OUR MISSION

To create a better AI-empowered future through innovation.

OUR VISION

To advance the interconnection of the physical and digital worlds with artificial intelligence, driving sustainable productivity growth and seamless interactive experiences.

We aim to:

- advance the state of the art in AI research
- develop scalable and affordable AI software platforms that benefit businesses, people and society
- attract and nurture top talents, shaping the future together

WHO WE ARE

We are a leading AI software company serving a broad range of industries, and the largest in Asia in terms of revenue in 2020, according to Frost & Sullivan. We have built market leadership by helping customers drive productivity, creativity and efficiency with our AI software platforms. As of June 30, 2021, our software platforms had been used by a total of over 2,400 customers, including over 250 Fortune 500 and other publicly-listed companies, 119 cities and over 30 automobile companies, while empowering over 450 million mobile phones and over 200 mobile apps, five of which are super apps with over 500 million monthly active users each.

Our business is underpinned by our original and cutting-edge research, recognized by over 70 first-prize awards in global academic competitions, more than 600 top-tier academic paper publications and over 8,000 AI patents and patent applications. We have built a first-of-its-kind universal AI infrastructure to achieve mass production of a diverse and growing portfolio of AI models with rich functionality and superior accuracy. We develop scalable AI software platforms to facilitate the rapid deployment of AI models and applications in numerous scenarios. Fueled by technological excellence and scale effects, we have achieved leading market positions in smart business, smart city, smart life and smart auto, serving a wide spectrum of industries across commercial space management, residential property management, urban management, manufacturing, infrastructure, transportation, mobile devices and applications, healthcare and automobiles, according to Frost & Sullivan.

Our culture is deep-rooted in academic excellence. In 2014, Professor Tang Xiao'ou, who founded the CUHK Multimedia Lab in Hong Kong in 2001, and other core members of the lab jointly started our company. As of June 30, 2021, 40 professors led our research efforts, and approximately

two-thirds of our over 5,000 employees were scientists and engineers. This vast intellectual capital lays the foundation for a comprehensive and integrated innovation system from AI research to production, covering key fields across perception intelligence, decision intelligence, AI-enabled content generation and AI-enabled content enhancement, as well as key capabilities in AI chips, sensors and computing infrastructure. Our systematic research efforts in these interdependent AI areas allow us to offer and continuously improve industry-leading, full-stack AI capabilities, cementing our commercialization success.

AI Models are the Building Blocks for AI Software, Underpinning Digital Transformation

According to Frost & Sullivan, AI software is expected to be one of the fastest-growing business areas in this decade. The global AI software market size is expected to reach USD121.8 billion in 2025, growing at a CAGR of 31.9% from 2020. AI software will continue to be seamlessly integrated into various industries and create massive business value. Global AI-enabled business opportunities are expected to reach USD10.0 trillion in 2025, growing at a CAGR of 27.2% from 2020 and accounting for 8.6% of estimated global nominal GDP in 2025.

The value of AI software lies in its key role in digital transformation, profoundly reshaping industries, communities and everyday lives by connecting the physical and the digital worlds. This revolutionary process is also catalyzed by the prevalence of IoT devices, such as automobiles, smartphones and sensors in physical spaces. According to Frost & Sullivan, there will be over 63 billion IoT devices in use globally by 2025. The data constantly generated and transmitted from such devices serves as the key bridge between the two realms.

However, the huge quantity of data, most of which is unstructured, such as in the form of images, videos, 3D point clouds and speech, poses the most important challenge in the digital era. The difficulties mainly lie in effectively extracting useful information from the data and leveraging it to make predictions and guide decisions. AI software products capable of transforming unstructured data into valuable information and insights are developed to meet this challenge.

As the core building blocks of AI software, AI models are algorithms which can take unstructured data as an input and transform it into informative output through their "intelligence", namely their capabilities to perceive the world, transcribe and organize information, enhance or generate content, or make decisions. AI models are produced by a training process that typically consumes a large amount of computing power and data. An AI application, which is developed to increase efficiency, improve productivity or enhance life experience, is a software product that integrates a group of AI models.

As digital transformation accelerates, AI models are being widely deployed at customer locations, over the cloud and on an increasingly large number of devices, across multiple industry verticals. In this new era, AI models are the "new electricity" that powers digital transformation, and demand for AI models will be ubiquitous. Hence, the ability to produce high-performance AI models with high accuracy, high speed and low power consumption at scale and in a cost-effective way is crucial and represents a major technology entry barrier in the AI industry.

Based on our innovations and technology breakthroughs, we have built a first-of-its-kind AI infrastructure capable of mass production of high-performance AI models. We have also enabled rapid and code-free deployment of AI models and applications in numerous scenarios through our software platforms. The rapid increase in the volume of available training data generated by automobiles, mobile phones and sensors across industries allows us to quickly increase the competency, accuracy and quantity of our AI models. As our AI models become more sophisticated and accurate in processing real-world data and driving various AI applications, they become the building blocks to advance digital transformation across industries.

Centralized Mass Production of AI Models with our Proprietary AI Infrastructure – SenseCore

We believe our centralized mass production of AI models is the approach of choice to improve the availability and productivity of AI models. This strategy has effectively addressed the following challenges that have constrained the deployment of AI applications at large scale:

- ***Most industrial-grade applications require high performance AI models that are expensive to produce:*** The process of designing and training state-of-the-art, high-performance AI models that are competitive in industrial-grade applications is expensive and relies on deep technical know-how, as it requires (a) massive data aggregated from numerous scenarios, (b) complex design of models and training algorithms, and (c) extensive computation supported by large-scale computing infrastructure with a sophisticated software framework and hardware systems. With data volumes increasing rapidly and algorithms becoming more complex, the computing power required to train state-of-the-art large AI models has increased cumulatively by one million times in the past ten years, according to Frost & Sullivan. For example, the training of the well-known GPT-3 language model developed by OpenAI consumed 570 GB of text data and 355 GPU-years, and cost approximately USD12 million, according to Frost & Sullivan.

- ***Low development efficiency in meeting market demand for large quantities of AI models:*** As digital transformation accelerates in all industries, there has been a sharp increase of demand in the scale and diversity of AI applications, which requires a large number of AI models. However, the research-to-product cycle for building AI models is complicated and costly, featuring fragmented processes as well as lack of standardization across different industries. Because production of each model requires extensive computing and manpower, it becomes increasingly labor and resource intensive.

- ***"No data for training?" — The long-tail problem is common for many industries:*** In real-world AI applications, long-tail scenarios have low frequency of occurrence but in aggregate account for the majority of all scenarios. Urban management, for example, has many long-tail scenarios, such as certain traffic accidents, road cave-in and outbreak of fire. Due to the low-frequency nature of the long-tail scenarios, there is insufficient data available to train high-performance AI models, and, as a result, in many industries, significant numbers of long-tail scenarios have not been satisfactorily dealt with.

Facing these constraints and challenges, many AI companies can only develop narrowly focused AI models in a costly and time-consuming way, covering only a limited number of scenarios. The key to the large-scale industrial application of AI is to achieve industrial-grade AI

model production which refers to cross-industry, large-scale, high-efficiency and low-cost production of high-performance AI models. Industrial-grade AI model production requires comprehensive technical strengths and large investment.

Our proprietary AI infrastructure, SenseCore, makes industrial-grade AI model production feasible, achieving economies of scale and solidifying our technology leadership. SenseCore is built on three pillars: (i) large-scale supercomputing power; (ii) massive data processing and desensitization; and (iii) shared platforms and production tools for developers.

SenseCore offers a smooth, standardized and end-to-end automatic production flow of AI models. In addition to using SenseCore for our own AI model production, we also provide its capabilities to customers, enabling them to produce AI models specific to their business needs with minimal expertise, effort and investment. We believe SenseCore distinguishes us through the following features:

- ***Training of large, state-of-the-art base models***: Large AI models with significant numbers of parameters, trained using massive and diverse data, can achieve a richer and more general understanding of the world. We refer to them as base models. For example, SenseCore allows our experts to design and train base models with over 30 billion parameters, currently representing the world's largest in the field of computer vision, according to Frost & Sullivan. Base models ensure high accuracy and demonstrate significant advantages in handling complex and corner cases in diversified scenarios.

- ***Low-cost production of scenario-specific models efficiently addressing "long-tail" problems***: SenseCore allows developers to leverage base models to produce scenario-specific models through a further round of training with a small amount of scenario-specific data. Scenario-specific models are widely used in real-world applications, as they are faster and smaller in size, achieving a balance between high accuracy and low power consumption. The approach of deriving scenario-specific models from base models brings three advantages, namely, (i) quick, low-cost production of scenario-specific models with much less scenario-specific training data and minimal computing power; (ii) effective handling of long-tail scenarios with little training data; and (iii) the performance of all scenario-specific models benefiting from the improvement of base models, generating economies of scale for model improvement.

- ***Industry-leading automatic machine learning (AutoML)***: SenseCore offers a comprehensive set of software tools to achieve fully automated model production with minimal human intervention and supervision. We are one of the pioneers in AutoML techniques. Our development of AutoML techniques and platforms effectively frees our experts from the tedious model design process, thus allowing them to focus more on fundamental algorithm innovations and product design. It also lowers the technical entry barrier and allows developers with limited machine learning expertise to train high-performance models.

- ***Industry-leading privacy computing and data desensitization***: SenseCore integrates cutting-edge privacy computing technology to allow model training with customers' data stored at the customer side without transmission of raw data samples, via the combination of a series of encryption computing technologies. This ensures data security, data privacy

and regulatory compliance throughout the production process. SenseCore also provides data desensitization and encryption tools, including data masking to hide personal information and blur out characters, numbers and faces. These tools add an extra layer of privacy and security protection to all data processed.

- ***Cross-chip, cross-device, and cross-cloud-platform adaptability***: SenseCore incorporates industry-leading model compression into the model production pipeline. Such techniques transform a large trained model into a lighter-weight one that runs faster on chips and requires significantly less memory capacity, while maintaining comparable accuracy. SenseCore incorporates a cross-platform model deployment tool to adapt the compressed models to more than 100 types of chips on the market, making our AI models easily deployable across diverse devices and cloud platforms.

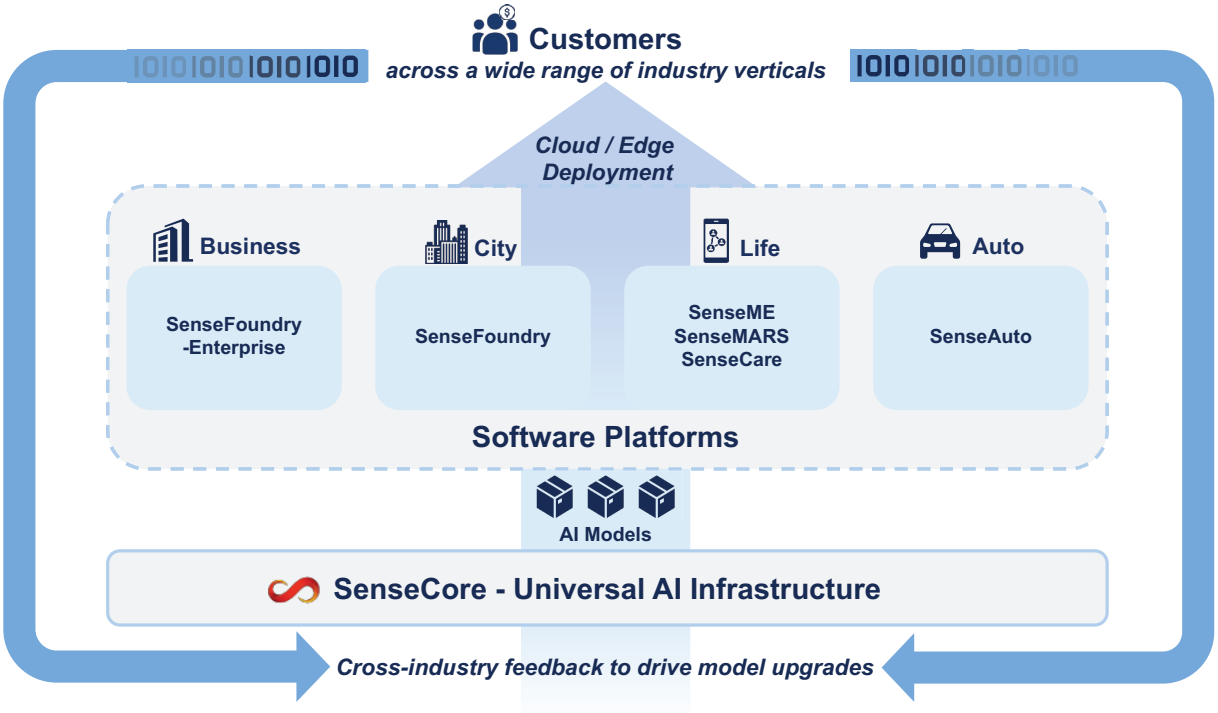
- ***Comprehensive portfolio of AI applications across industry verticals***: While many AI companies focus on individual industries and provide solutions to narrowly defined scenarios, we have broadened our offerings with our mass production capabilities covering AI models and applications capable of perception intelligence, decision intelligence, AI-enabled content generation and AI-enabled content enhancement. Such comprehensive coverage enables us to deliver full-suite offerings of diversified AI applications across a wide range of industry verticals.

By using SenseCore to power all AI workloads, our researchers and engineers can develop AI models in hours rather than in weeks. As we continuously enhance SenseCore's capabilities and capacity, our R&D staff developed an aggregate of 1,152, 9,673 and 8,377 commercial AI models in 2019, 2020 and the first half of 2021, respectively, representing an annual average of 0.44, 3.45 and 5.24 AI models per person in the same periods, respectively. As of June 30, 2021, we had developed over 22,000 commercialized AI models to power varied applications across industry verticals.

Rapid Deployment and Commercialization of AI Models through Software Platforms

To achieve economies of scale and shorten time-to-market in AI model deployment and commercialization, we develop and offer standard software platforms with modular flexibility to customers empowered by SenseCore. Our software platforms can be seamlessly integrated with customers' devices or IT infrastructure, and our AI models can be deployed both on edge devices and on the cloud through our software platforms. When we upgrade the existing models and introduce new models to empower AI applications, customers can preview and integrate the models and applications through our software platforms to enjoy a standard and code-free experience.

Our software platforms empower hundreds of millions of devices, perceiving and transcribing information, enabling automated decisions and processes and generating or enhancing virtual content to connect the physical and the digital worlds. The following diagram illustrates the rapid deployment and commercialization of AI models through our software platforms:



SenseFoundry-Enterprise for Smart Business

We work with enterprises to build future-oriented enterprise management operation systems to digitalize and automate their workflow processes in order to streamline tasks and enhance user experiences. SenseFoundry-Enterprise is used to create interconnected, efficient and scalable operations that drive better business outcomes for customers. It is a one-stop software platform embedded with more than 9,300 AI models and enables applications which meet various industry needs for real-world data perception and process automation across industries. SenseFoundry-Enterprise enables customers to build AI-integrated workflows and operations in a code-free, modular, flexible and scalable manner. SenseFoundry-Enterprise has been widely adopted across industrial verticals, including commercial space management, residential property management, manufacturing, infrastructure, transportation and financial services.

SenseFoundry for Smart City

We work with city administrators to build future-oriented urban management platforms. Integrated with the IT infrastructure of cities, our SenseFoundry software platform, powered by more than 14,000 AI models, transcribes raw and real-time city data into insights, alerts and actions. SenseFoundry is used to monitor the conditions of public facilities such as fire hydrants, manhole covers, power poles and road signs. It is also used to track incidents, such as traffic accidents, fire

and smoke, emergency exit obstructions, exposed garbage, road damage and unauthorized parking. It also tracks the impact of natural disasters such as flooding and typhoons and the progress of damage control measures. SenseFoundry is also equipped with an online incremental training engine derived from SenseCore, through which it provides AI-as-a-Service to cities. SenseFoundry facilitates the transformation of urban administration from human-intensive to human-computer interactive, from empirical judgment-based to data-driven, and from passive response to early detection. SenseFoundry has become the operating system for digital city operations and improved the safety, efficiency, convenience and environmental quality of cities. As of June 30, 2021, it had been deployed in 119 cities in China and overseas.

SenseME, SenseMARS and SenseCare for Smart Life

We work with IoT device, semiconductor, mobile app and gaming companies to jointly build a multi-layer infrastructure to empower IoT devices and the Metaverse, enriching user experiences.

With a full stack of offerings including SDKs, AI sensors and ISP chips, our SenseME software platform, powered by over 3,500 AI models, enables a broad range of IoT devices to facilitate perception intelligence and content enhancement. Our AI sensor offerings, with AI models embedded into CMOS image sensors, improve user experience by enhancing visual signal quality and real-world image perception, minimizing device power consumption and enhancing data security.

Metaverse refers to the convergence of physical, augmented and virtual reality in a shared digital world. Our SenseMARS software platform supports the development of Metaverse to create exciting new life experiences. SenseMARS is powered by over 3,500 AI models, supporting perception intelligence and the Mixed and Augmented Reality System (MARS).

SenseME and SenseMARS create the interface connecting the physical and digital worlds by empowering more than 200 types of mobile phones, AR and VR glasses, smart screens and consumer drones. As of June 30, 2021, SenseME and SenseMARS had empowered over 450 million mobile phones and over 200 mobile apps, five of which are super apps with over 500 million monthly active users each.

Our AI software platform for smart healthcare, SenseCare, provides AI tools in diagnosis, treatment planning and rehabilitation. We have obtained three NMPA certifications and two CE marks for five SenseCare modules.

SenseAuto for Smart Auto

Our SenseAuto software platform, powered by around 1,400 AI models, provides automobile companies with ADAS systems, smart cabin systems as well as AI-as-a-Service which enables them to develop and enhance their autonomous driving capabilities. In addition, we have launched SenseAuto Robobus, an L4 autonomous driving product for bus operating companies. We also developed SenseAuto Connect, our V2X product, that enables smart interactions among vehicles and their surroundings such as roads, traffic lights and roadside units.

Since 2017, we have been a strategic partner with Honda to provide it with our autonomous driving-related AI technologies. As of June 30, 2021, we had collaborated with over 30 automobile companies, including leading domestic and global brands, and had been selected as the supplier for more than 20 million automobiles across over 50 vehicle models in the next several years. We were recognized by CB Insights Research as The Most Valuable Private Auto Tech Company in 2021.

AI-as-a-Service to More Industry Verticals through AIDCs

We provide SenseCore's capabilities as a versatile AI-as-a-Service offering to customers through our software platforms, enabling them to produce AI models tailored to their business needs with minimal effort, expertise and investment. SenseCore interoperates with customers' IT infrastructure via a set of standard interfaces and allows users to utilize their own data for continuous model training and upgrades. For many customers, compared with building in-house AI infrastructure which may take years and a tremendous amount of investment, using SenseCore through our AI-as-a-Service offering to develop AI models is much more cost-effective and can substantially reduce the time to market.

To further enhance SenseCore's production capabilities and expand our AI-as-a-Service offering to more industry verticals, we are constructing a large-scale AI computing and empowerment data center (AIDC) in Lingang, Shanghai, which is expected to be launched in early 2022 to support cloud-based, full-stack AI model production and deployment services. Our Shanghai Lingang AIDC is an open, large-scale, low-carbon and energy-efficient advanced computing infrastructure with a designed computing capacity of 3.74 exaFLOPs, which will bring our total computing capacity to 4.91 exaFLOPs. Our AI-as-a-Service offering supported by AIDCs allows users to (i) flexibly subscribe for pre-trained AI models to deploy AI applications and (ii) utilize their own data to produce and deploy new AI models, through cloud computing services with a complete set of tools and APIs. Our AIDCs also allow customers to collaborate with our experts via cloud to co-design and develop customized AI models and applications in a cost-effective way. We believe that our AIDCs will not only accelerate our innovations and enhance our competitiveness, but also cultivate an open and rapidly growing ecosystem that further strengthens the connections with our customers and the community. We expect it to make the production of AI models and the development of AI capabilities more efficient and affordable across industries, thus extending the boundary of AI industrialization.

Platform-based Approach Drives Sustainable Revenue Growth

As we expand to more scenarios in more industry verticals, we produce AI models in greater quantity and quality that meet customer needs. When we first expand to new scenarios for a specific industry vertical, we usually work with launch customers to develop an in-depth understanding of industry verticals and customers' specific needs. Launch customers are generally market leaders, with deep industry knowledge and abundant scenario data to support model production. We use SenseCore to quickly and cost-effectively configure our products for customers by assembling existing models in our model library and training new models for missing features. Such products can be made available to other customers through our software platforms.

We take a platform-based approach when engaging with customers by selling our software platforms to integrate with customers' devices or IT infrastructure. Customers can access a shared and ever-growing pool of AI models and applications, and preview and integrate AI models code-free. The delivered software platform includes selected AI models and applications, and may also be provided with AI software-embedded hardware integrated with AI chips or AI sensors to effectively run our AI models.

Pricing of our software platforms is primarily based on (i) the number and complexity of AI models provided, (ii) the number and types of IoT devices supported, (iii) the hardware and computing resources to run the AI models, and (iv) services for deployment and maintenance. Through our software platforms, we also provide SenseCore's capabilities as a versatile AI-as-a-Service offering to customers for customized model production. As customers expand the scale and diversity of AI applications, they are expected to purchase additional product and service offerings from us, which will generate additional and potential recurring revenue for us.

We have achieved strong growth since our inception in 2014. Our revenues grew from RMB1,853.4 million in 2018 to RMB3,026.6 million in 2019 and further to RMB3,446.2 million in 2020, and from RMB861.2 million in the first half of 2020 to RMB1,651.8 million in the first half of 2021. Our gross profit margin grew from 56.5% in 2018 to 56.8% in 2019 and further to 70.6% in 2020, and from 72.1% in the first half of 2020 to 73.0% in the first half of 2021. Our research and development expenses in 2018, 2019, 2020 and the first half of 2021 were RMB848.7 million, RMB1,916.0 million, RMB2,453.9 million and RMB1,771.7 million, respectively. Our net losses in 2018, 2019, 2020 and the first half of 2021 were RMB3,432.7 million, RMB4,967.7 million, RMB12,158.3 million and RMB3,712.9 million, respectively. Our historical net losses were also largely attributable to the fair value losses of our preferred shares.

Eliminating the impact of items that our management does not consider to be indicative of our operating performance, we had adjusted net losses of RMB220.5 million, RMB1,037.1 million, RMB878.4 million and RMB726.2 million in 2018, 2019, 2020 and the first half of 2021, respectively.

OUR STRENGTHS

Technology Pioneer and Industry Leader in AI

We are the largest AI software company in Asia in terms of revenue in 2020, according to Frost & Sullivan. Our industry leadership is built on our pioneering research, advanced AI infrastructure and platform approach for commercializing AI technology.

We pioneer and lead research in AI

- In 2015, our founders won the first place in large scale video object detection in the ImageNet Large Scale Visual Recognition Challenge to recognize 1,000 object categories covering many long-tail scenarios, with the world's largest AI model at that time.

- We built the world's largest computer vision model, with over 30 billion parameters, as of June 30, 2021.

- Our researchers broke the record of training AlexNet on ImageNet by reducing the training time to 90 seconds in 2019, a significant improvement over the previous record of four minutes.

- We ranked number one in terms of the number of research papers published in the top three Computer Vision conferences, namely, CVPR, ICCV and ECCV, during the period from 2015 to June 30, 2021.

- We had won over 70 first-prize awards in global competitions in AI as of June 30, 2021.

We have built state-of-the-art AI infrastructure

- Our proprietary AI infrastructure, SenseCore, supports industrial-grade production of AI models and is our key differentiator and the cornerstone of our business scalability.

- As of June 30, 2021, we had built 23 AI supercomputing clusters strategically located in our major geographic markets, with over 20,000 GPUs sustaining an aggregate computing capacity of 1.17 exaFLOPs to support SenseCore's model production.

- We are building our Shanghai Lingang AIDC with a designed computing capacity of 3.74 exaFLOPs, which is expected to become one of the largest supercomputers in Asia upon launch in early 2022.

- We have developed our specialized AI chip, STPU, which effectively adapts to our AI models, significantly accelerates AI inference operations and reduces the cost for AI deployment.

- We have developed AI technology for next-generation AI CMOS image sensors in collaboration with a world-leading semiconductor company.

We lead in commercializing AI technology

- We were the first company to provide face payment technology integrated to subways' ticketing systems in megacities with populations of over ten million to support contactless swift subway entry.

- Our SenseFoundry was one of the first AI-empowered human-computer interactive digital operating platforms to support city management in 11 megacities with populations of over ten million.

- Through SenseMARS, we were the first AI company to apply interactive AR and MR effects on mobile apps, which product has become one of the biggest Metaverse enabling platforms.

- We were the first AI company in Asia to collaborate with a global top-five automobile brand to co-develop advanced autonomous driving solutions and were recognized by CB Insights Research as The Most Valuable Private Auto Tech Company in 2021.

Powerful AI Infrastructure

Our proprietary AI infrastructure, SenseCore, makes industrial-grade AI model production feasible, enabling economies of scale and solidifying our technology leadership. We believe that SenseCore is our key differentiator and the cornerstone of our business scalability. It features the following:

- Supporting the training of state-of-the-art base models for high performance and accuracy
- Low-cost production of scenario-specific models, effectively addressing "long-tail" problems, and achieving economies of scale for model improvement
- Industry-leading automatic machine learning (AutoML) for efficiency and easy use
- Industry-leading privacy computing and data desensitization for high privacy and data security
- Cross-chip, cross-device and cross-cloud-platform adaptability
- Comprehensive AI functions across industry verticals

SenseCore has allowed us to develop, deploy and commercialize more than 22,000 models in a wide range of industries. We also provide SenseCore's capabilities as a versatile AI-as-a-Service offering to customers, enabling them to produce AI models specific to their business needs with minimal effort, expertise and investment.

Comprehensive and Scalable Software Platforms

Our software platforms allow customers to access a shared and ever-growing pool of AI models, and customers can preview and integrate AI models code-free, enabling us to expand business across industries at scale. Our software platforms have the following advantages:

- ***Comprehensive coverage***: Our software platforms meet ever-evolving and growing industry demands with differentiated capabilities and functions.
- ***Scalability and seamless integration***: Our software platforms can be seamlessly integrated with customers' devices and IT infrastructure and allow simultaneous connection of millions of devices and support city-scale applications for megacities with populations of over ten million.

- ***Code-free model deployment***: Customers can deploy AI models code-free over-the-air into target scenarios with low cost, easy use and quick value creation.

- ***Cross-industry innovation***: By engaging with customers across industries, we have built an extensive and shared pool of AI models and in-depth industry knowledge and created more competitive cross-industry AI applications to better serve customers.

Successful Commercialization with a Broad Coverage of Industries and Regions

We have achieved successful commercialization of our products and services, and our strengths in AI technologies are highly recognized by our customers. We have established our technology and commercial advantages through the following initiatives:

- ***Early mover in many industry verticals***: We were one of the first companies to possess mature technology advantages and commence commercialization in various industry verticals. Our first-mover advantage has made us a leader in formulating AI industry standards and creating a wealth of intellectual property. We are among the companies with the largest portfolio of invention patents in the AI industry in Asia, according to Frost & Sullivan. As of June 30, 2021, we had 8,123 patents and patent applications, among which close to half were overseas IPs.

- ***International success***: We recognized the importance of international expansion and entered the overseas markets at very early stage. We currently focus on markets such as Northeast Asia, Southeast Asia and the Middle East, and have established regional headquarters across countries and regions. Our local teams are familiar with customer preference and have achieved swift localization of our product and service offerings, while developing local relationships and business partnerships.

- ***Recognition by leading companies***: We have gained market recognition through strategic partnerships with many leading domestic and global companies, who are attracted by our technology leadership and strong synergy with them. Our collaboration with such companies has increased our brand awareness in various industries and regions and boosted our customer acquisition capabilities.

- ***Diversified industry and region coverage***: Given that the business cycles and demand of our customers are unbalanced across industries and regions, our cross-industry and cross-region coverage allows us to be more resilient to uncertainties and sustain our growth under evolving macroeconomic conditions. Our broad coverage has also been a solid foundation for our business continuity and growth during the COVID-19 pandemic.

Through the above initiatives, we have had a successful track record of growing our customer base across industries and regions. Our AI software platforms had been deployed by more than 2,400 customers across industry verticals in over 15 countries and regions as of June 30, 2021.

Effective AI Talent Development

Talent is critical to our success. We have developed an effective system to discover, attract and cultivate world-class AI talent. Our industry leadership, cutting-edge AI infrastructure and strong

commitment to state-of-the-art AI research allow us to attract and develop top AI talent. Our talent development approach has the following three key strengths:

- ***Early access to talent pool***: Through extensive and tight-knit research collaborations with 52 top-tier universities and 15 joint labs globally, we are able to identify promising AI scientists early on, ensuring a continuous supply of young talents with great potential. We train and support students in partnered universities by working with their professors to co-design industry-related AI research topics and sharing access to our AI infrastructure to support their research efforts.

- ***Shared AI infrastructure that accelerates research outcomes***: Our powerful AI infrastructure provides our R&D teams and institutional partners with advanced research resources and thus a more fulfilling research experience, allowing them to not only develop market-recognized products but also achieve high-quality research outputs efficiently. The number of research papers published annually by our company has increased by more than five times from 29 in 2015 to 181 in 2020.

- ***Strong support in research talent development***: We select top-tier university students to join our internship programs. In the past six years, we have trained thousands of students through these programs, with over 500 of them eventually joining us as employees.

As of June 30, 2021, we had 40 professors leading our research efforts and 3,593 R&D staff members, including more than 250 PhDs and PhD candidates. We have built one of the largest and most capable research teams in Asia to drive state-of-the-art AI research.

Visionary Management Team with a Young and Deep Talent Pool

SenseTime was founded by a team of AI scientists and practitioners, including Prof. Tang, Dr. Xu Li, Dr. Wang and Mr. Xu Bing, who are highly regarded in the AI industry. Over the years, they have attracted top scientists, engineers and business talents and led our evolution from a research-focused group into a leading AI company with commercial success.

Our Chairman and CEO, Dr. Xu Li, is a distinguished innovator and business leader with strong academic and industry recognition. He was featured in Fortune's Global List of "40 under 40" in 2018 and the winner of the EY World Entrepreneur of The Year Award in 2019. The management team combines top AI scientists and seasoned business professionals, with an average of more than 20 years of work experience. They are joined by over 5,000 employees of an average age of 31, forming an energetic team with a firm and long-term commitment to the mission of creating a better AI-empowered future through innovation.

A Vibrant AI Ecosystem

We have been developing a broadly-based ecosystem through joint efforts with the AI industry to advance common initiatives and access resources critical to our sustainable growth:

- ***SenseCore open-source community***: We play an active role in open-source AI, which connects us to a wide range of academic researchers and industry players. OpenMMLab,

OpenDILab and OpenPPL are our major open-source algorithm platforms for perception intelligence, decision intelligence and high-performance inference engines, respectively, making public 10 code repositories and over 1,500 AI models. Launched in 2018, OpenMMLab has gained wide recognition from both industry and academia, receiving over 38,000 stars on GitHub. Industry participants and academic institutes from more than 100 countries or regions have contributed to our open-source community, including Tsinghua University, Carnegie Mellon University and Microsoft Research Asia.

- ***Academic alliance***: We initiated the Global AI Academic Alliance (GAIAA) in 2018, which currently includes members of 18 top universities worldwide such as SJTU, Fudan University, Tsinghua University, CUHK, HKU, HKUST and NTU to (i) promote global research collaboration, (ii) incubate and support start-ups, (iii) promote development of industry standards and (iv) empower and develop research talents.

- ***Industrial collaboration***: We initiated the AI Computing Power Industry Alliance (AICPIA) in 2021, together with a group of research institutions and semiconductor companies, with the objective of promoting the development and sharing of AI computing power. Since 2019, we have been the founding Chair of the China Augmented Reality Core Technology Industry Alliance (CARA) joined by leading companies and universities including OPPO, Xiaomi and JD.com, to promote the development of an AR and MR technology sharing platform.

- ***Capital partnerships***: Our reputable global investors help us extend industry outreach and create synergy with their portfolio companies. We have also selectively invested in companies that complement and expand our technology capabilities. We have established an AI industry fund to further expand our contribution to the development of the AI industry.

High Standards on Data Security, Privacy and Ethics for Sustainable AI

We believe that AI should be developed in a human-centric, controllable and sustainable way, and have held ourselves to the highest standards on data security, privacy and ethics for sustainable AI. See "— Responsible and Sustainable AI." We have been actively involved in the development of national and international industry standards on data security, privacy protection, ethical AI and sustainable AI. As of June 30, 2021, we had participated in the formulation of more than 80 national or international industry standards. We work closely with multiple domestic and multilateral institutions on the sustainable and ethical development of AI.

- We were the only AI company in Asia to have our Code of Ethics for AI Sustainable Development selected by the United Nations as one of the key publication references in the United Nations Resource Guide on AI Strategies published in June 2021.

- We were the first AI company to receive all three ISO/IEC certifications for Privacy Information Management System, Information Security Management and Personally Identifiable Information Protection.

- We have been the Chair of the IEEE Mobile Device AR Standard Working Group since 2020 and have co-led the development of the IEEE Standard for Biometric Liveness Detection since August 2020.

- We have been a member of the AI National Standardization Administration Committee of China (國家人工智能標准化技術委員會) since March 2020 and the Chair of the National Standards Working Group for Face Recognition (人臉識別國家標准工作組組長) since November 2019.

- For sustainable AI development, we engage in the promotion of AI education for the younger generation. We published our first AI textbook for senior high school AI classes in 2018 and AI textbooks for primary school and junior high school students in 2019. Our AI textbooks and AI courses have been adopted in more than 2,700 schools in China as of June 30, 2021.

OUR STRATEGIES

We are committed to the long-term goal of creating a better AI-empowered future through innovation. We focus on the following key strategies:

Expand AI Research Talent Pool and Research Focus Areas

We believe that state-of-the-art original research is the foundation of our company, which allows us to attract top talent, reinforces our brand and industry reputation with customers and brings us long-term competitive advantages and business growth. AI technology is progressing rapidly, and we will continuously invest in original research to maintain our leading position.

- ***Talent pool expansion***: We will expand our AI research talent pool by attracting more top AI scientists and engineers. Our broad expertise in AI technologies, deep industry knowledge and rich scenarios create a favorable environment for cultivating multi-skilled AI talent. We will continue to invest in programs and projects to train our talent across existing and new AI technology areas. Our collaboration with universities and labs provides both a source of potential new employee talent, while also broadening the scope of our research through joint initiatives. In order to strengthen collaboration and expand joint research projects, we will also appoint our scientists and engineers to help partnered universities in the design of their AI curriculum. We believe we benefit from helping educate the next generation of AI experts and discover future areas for AI research.

- ***Cross-domain integrated innovation***: We believe fundamental breakthroughs of future AI will come from cross-domain integrated innovations. We will strengthen our cross-domain AI research initiatives, which integrate cross-domain knowledge from various industries and have the potential to produce more significant and disruptive innovations. We have established special R&D groups focusing on various strategic cross-domain fields, including autonomous driving + traffic management, Smart City + Metaverse and smart healthcare + new drug development. In addition to strengthening AI algorithm research, we will further enhance other core elements including computing systems and AI chip and sensor design, and integrate these elements to strengthen our comprehensive technical capabilities.

Invest in SenseCore AI Infrastructure and Model Development

We will continue to enhance the fundamental capabilities of our SenseCore AI infrastructure, to achieve our goal of ensuring SenseCore is the most advanced platform for developing, training and deploying AI models for our customers, as well as partnering with the industry and academia.

- ***Universal infrastructure***: We intend to further expand the computing capacity of our AIDCs to allow more customers to utilize our AI infrastructure, AI resources and AI models on our cloud-based platform. We will continue to invest in building AIDCs in major regional markets to expand our AI-as-a-Service business to more geographies.

- ***Reduce AI model production cost and grow AI model pool***: By continuing to invest in SenseCore, we will be able to produce larger quantities of more advanced AI models at lower cost. We intend to grow the number of our commercialized AI models from 22,000 to millions, making it possible to cover most real-world scenarios for extensive applications.

- ***Build universal AI models***: We will continue to build powerful base models with more generalized capabilities to handle multitasks across scenarios and devices. They rely on integrated cross-domain data, large-scale supercomputing and advanced algorithm design in their production, enable more disruptive applications and unlock new monetization potential.

Expand Use Cases and Verticals

We believe AI will transform all aspects of society, for industries, communities and consumers, profoundly affecting people's lives. We will continue to expand the capabilities of our existing software platforms as well as develop products suitable for new industry verticals. SenseCore allows us to leverage existing models and develop and train new models to rapidly and cost effectively create new products for new markets.

- ***Expand use cases and features in existing verticals***: We will continue to improve our AI software platforms, including new features and capabilities. This will allow us to gain new customers in existing industry verticals, while also allowing us to increase revenues from existing customers through upgrades and other enhancements.

- ***Further develop and commercialize Metaverse-related offerings***: Metaverse is expected to be the interface connecting the physical and digital worlds where new forms of social activities, entertainment and economic activities will take place and generate substantial value. We intend to enhance and enrich the functionalities of our AI, AR and MR capabilities of SenseMARS and grow the customer base and developer ecosystem to strengthen our leadership in Metaverse-related offerings.

- ***Further develop and commercialize SenseAuto***: We believe our investment in the development of autonomous driving technologies will create long-term monetization opportunities. We will continue to promote the adoption of SenseAuto by improving its capabilities and expanding our strategic partnerships with automobile companies and city transportation and other relevant departments.

Extend Our Reach: Devices, Service Offerings and Geographies

We will continue to extend the deployment of our AI models to grow our revenues.

- ***Deploy our models to more sensors, chips, devices and cloud platforms***: We have long sought to make our AI models compatible with more sensors, chips, devices and cloud platforms. We will continue to enhance our AI models to deliver superior performance on most mainstream chips and platforms. We will also provide our own AI chips and sensors tailored to our AI models to optimize the overall performance and cost.

- ***AIaaS cloud offering***: We will continue to promote AIDC cloud services to more industries and customers. Our powerful, high capacity AIDCs will allow us to provide AIaaS to empower customers across industries. We plan to further open up SenseCore's capabilities to both academia and industry to drive future AI productivity upon launch of our Shanghai Lingang AIDC.

- ***Expand international coverage***: We aim to strategically expand into more overseas markets with strong demand for AI and digital transformation through localization of our infrastructure, team and products.

Invest in Sustainable Technology

We are committed to achieving a sustainable world, with both our AI infrastructure and the products we provide to customers. We intend to leverage AI to promote carbon neutral transformation. We have made efforts in promoting carbon neutral goals by (i) building low-energy and carbon-saving AIDCs, (ii) optimizing the efficiency for model training, (iii) developing AI sensors, AI chips and AI models with low energy consumption and (iv) leveraging AI in Smart City for environmental monitoring and traffic optimization. We will continue to make investments to utilize AI across industries for carbon-neutral goals, saving operational costs and providing energy-saving AI products and services to our customers.

OUR SOFTWARE PLATFORMS

Overview

The prevalence of IoT devices and ongoing digital transformation enabled by the development of IT infrastructure have brought the physical world and the digital world closer to each other. However, traditional IT systems are inadequate in effectively extracting useful information from massive data in the physical world to make predictions and guide decisions. In addition, more advanced technologies are needed for creating a Metaverse and bringing digital content into the physical world for people to have immersive and interactive experiences. AI technologies have become essential to drive this transformation.

To achieve economies of scale and shorten the time to market required for AI model deployment and commercialization, we have developed and offered our standard software platforms

with modular flexibility to our customers. Our major software platforms are SenseFoundry-Enterprise for Smart Business, SenseFoundry for Smart City, SenseME, SenseMARS and SenseCare for Smart Life, and SenseAuto for Smart Auto. Our software platforms are equipped with AI models supporting the following key capabilities:

- ***Perception intelligence***: AI models transcribe unstructured data, such as images, videos, handwriting and voice from IoT devices into structured data, such as identified objects, confirmed identities and readable contents.

- ***Decision intelligence***: Based on the structured data analyzed and streamlined through the perception intelligence process, AI models capable of decision intelligence make further use of such data for AI-enabled decision making, process automation and resource allocation. For example, AI models achieve automatic traffic signal control through analysis of traffic data captured through perception intelligence. They also accomplish task dispatching for complex workstreams through analysis of current work process to find the best way to achieve production efficiency. For autonomous driving, our AI models enable timely response to anomalies and incidents, ensuring proper handling of emergencies with high safety standards.

- ***AI-enabled content generation***: AI models realize content generation including 3D reconstruction of physical spaces, avatars and software agents to enable the creation of the Metaverse. Through superimposition of such created content into the Metaverse with mixed reality (MR) and augmented reality (AR) technologies, we create brand-new user interactive experiences.

- ***AI-enabled content enhancement***: AI models extend the human vision system. To enhance image and video quality and enrich content details, our AI models achieve (i) multi-spectrum imaging, (ii) image and video enhancement under a wide range of light conditions, (iii) high dynamic range imaging, (iv) slow motion capturing and (v) 3D depth effects on consumer IoT devices through maximizing sensor performance.

Our software platforms empower hundreds of millions of devices, perceiving and transcribing information, enabling automated decisions and processes, automatically generating virtual content in the Metaverse and presenting enhanced visual content.

Smart Business

Enterprises moving towards digitalization typically face the challenge of processing the massive amount of unstructured data generated by IoT devices in daily operations. Traditional IT systems, designed to handle different tasks separately, are inflexible and costly in addressing the fragmented demands arising from emerging scenarios. In addition, they are generally inadequate in perception and decision intelligence for long-tail scenarios, where data is often insufficient due to the low frequency of occurrences.

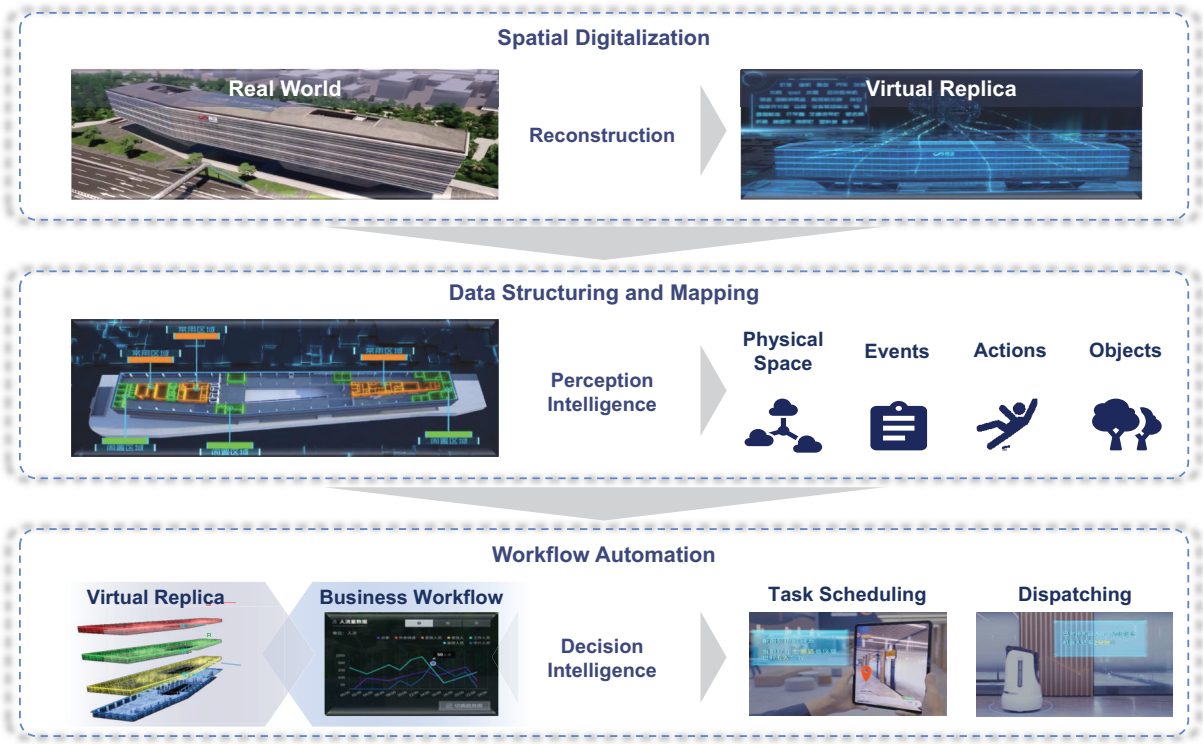
Overview of SenseFoundry-Enterprise

SenseFoundry-Enterprise is our software platform to facilitate and accelerate the digital transformation of our enterprise customers, addressing complex demands from different industry

verticals. It leverages our massive AI models trained on SenseCore to process huge amounts of data for deeper insights into business operations and provide better decision-making capabilities.

SenseFoundry-Enterprise facilitates enterprise digital transformation through the following steps:

Our Steps of Digital Transformation



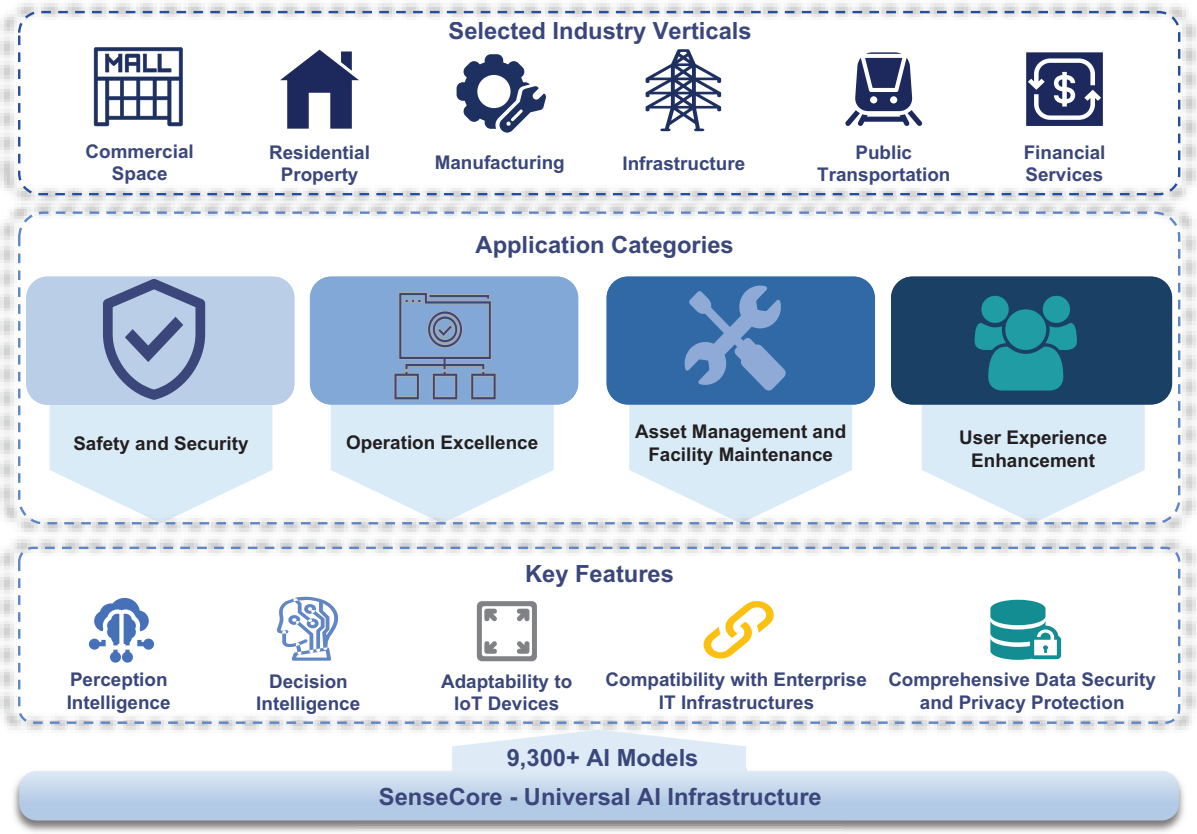
1. ***Spatial digitalization***: SenseFoundry-Enterprise creates virtual replicas, or digital twins, of the physical spaces and precisely projects objects and events in the digital space at corresponding positions. We use SenseMARS Reconstruction to facilitate this process of 3D reconstruction. See "— Smart Life — SenseMARS for Metaverse — Applications — SenseMARS Reconstruction – Digital Reconstruction of the Physical World" for details.

2. ***Data structuring and mapping***: SenseFoundry-Enterprise uses perception intelligence AI models to transcribe raw and unstructured data input from different IoT devices into structured data for further processing and maps the processed data into virtual replicas, connecting the physical and digital spaces.

3. ***Workflow automation***: Following the previous steps, SenseFoundry-Enterprise seamlessly integrates the virtual replicas and the structured data with the existing business workflow. It then generates business insights through our decision intelligence AI models to automate workflow for our customers, and further enhances the efficiency of operations through AI applications such as incident prediction, emergency alerting, automated task scheduling and re-scheduling, intelligent dispatching and status tracking.

The following diagram illustrates the key features, applications and representative industry verticals of our SenseFoundry-Enterprise platform:

SenseFoundry-Enterprise Platform for Smart Business



Key Features of SenseFoundry-Enterprise

Combining more than 9,300 AI models, SenseFoundry-Enterprise possesses the following comprehensive features:

- ***Perception intelligence:*** SenseFoundry-Enterprise transcribes raw data generated by different IoT devices into structured data for further processing through its perception intelligence capabilities. Our advanced perception intelligence allows us to conduct comprehensive analysis of "Who," "What," "When," "Where" and "How" under different enterprise scenarios:
  - Who — recognition of figures and objects;
  - What — detection of actions, events and anomalies;
  - When — sequencing of events based on timing;

- Where — creation of virtual replicas to precisely locate figures, objects and events; and

- How — analysis of correlation of actions and events.

- ***Decision intelligence:*** SenseFoundry-Enterprise enables workflow automation by leveraging various inferences and business insights generated from structured data, thereby optimizing resource allocation, automating task scheduling and facilitating business decision-making.

- ***Adaptability to IoT devices:*** SenseFoundry-Enterprise supports seamless integration with IoT devices to enable real-time intelligent analysis. As of June 30, 2021, the platform was compatible with over 500 types of IoT devices.

- ***Compatibility with enterprise IT infrastructure:*** SenseFoundry-Enterprise allows swift deployment on a wide range of computing devices, including edge devices, cloud servers and on-site servers. As of June 30, 2021, SenseFoundry-Enterprise supported more than 100 types of chips equipped with AI models across computing devices and computing platforms.

- ***Comprehensive data security and privacy protection:*** SenseFoundry-Enterprise employs a comprehensive data security strategy that protects the processed data from unauthorized access and misuse. We protect our customers from potential cyberattacks through a two-pronged approach: (i) the encryption of processed data; and (ii) data desensitization technologies, which hide personal information and blur out characters and numbers.

Commercialization

We provide our enterprise customers with SenseFoundry-Enterprise, with pre-installed AI models for enterprise AI applications. The AI models structuralize and analyze the data generated from IoT devices and empower enterprises with decision intelligence. We charge licensing fees, as well as software subscription fees to a lesser extent, for access to SenseFoundry-Enterprise and relevant AI applications. In addition, we generate revenue from sales of AI software-embedded hardware products which support the running of our software and related services. Our business growth is primarily driven by (i) expansion of our customer base across different industry verticals, (ii) providing more customer value through a growing number of AI models and applications and (iii) a wider range, and growing scale, of onsite deployment.

We had 539, 834 and 848 Smart Business customers in 2018, 2019 and 2020, respectively, representing a CAGR of 25.4%, and our customers increased by 19.4% from 532 to 635 in the six months ended June 30, 2020 and 2021. As of June 30, 2021, we had SenseFoundry-Enterprise deployed at approximately 6,000 customer sites, connecting more than 2.5 million IoT devices. As of the same date, we had a total of over 180 Fortune 500 company and other publicly-listed company customers in Smart Business. We continuously develop new AI models for AI applications in numerous industry verticals, which in turn helps expand our software platform capabilities and enables further business expansion.

Applications

Demands from enterprise customers vary across industries, but they also share many commonalities for daily operations and management. SenseFoundry-Enterprise meets these business needs in the improvement of overall safety and security, operation optimization, asset management and facility maintenance, as well as user experience enhancement.

Set forth below are the major applications and functions supported by SenseFoundry-Enterprise and the representative industry verticals where SenseFoundry-Enterprise has generated significant value for customers:

Commercial Space Management

Our customers in commercial space management own, operate or run business on a wide range of premises such as commercial complexes, shopping malls, office buildings, hotels, expo centers and business parks. SenseFoundry-Enterprise enables customers to process the vast amount of information generated in these premises through perception intelligence. Leveraging SenseFoundry-Enterprise's decision intelligence capabilities, customers are able to understand the evolving needs from their premises occupants in time and optimize their business operations accordingly. SenseFoundry-Enterprise also provides additional functions such as enhancing security for public facilities in commercial spaces and automating business operations to improve the interactive experience of end users. Examples of scenarios where we facilitate effective management of commercial premises through SenseFoundry-Enterprise include:

- ***Value for premises managers:*** Through spatial digitalization of commercial premises, we provide a visualized platform based on a virtual replica of the space for one-stop management of the commercial premises, including:

  - ***Management of office and retail units***: SenseFoundry-Enterprise supports analysis of commercial premises' operating status and forecasts on the potential non-renewal rate of office and retail units for rental, so premise managers can plan ahead accordingly.

  - ***Optimization of floor plan settings***: SenseFoundry-Enterprise conducts comprehensive analysis of crowd density and traffic flow in specific areas of the commercial premise to make recommendations on optimization of floor plan settings, including a proper mix and allocation of different retail units on the premises to achieve higher revenue generation and better allocation of resources.

- ***Value for retailer tenants:*** SenseFoundry-Enterprise supports analysis of traffic flow and average time of customer stay of specific retail units on the commercial premises to make recommendations about trending products, merchandise display and sales and marketing activities to the tenant. It generates comprehensive business insights for tenants to effectively enhance their customer catering and help generate higher revenue.

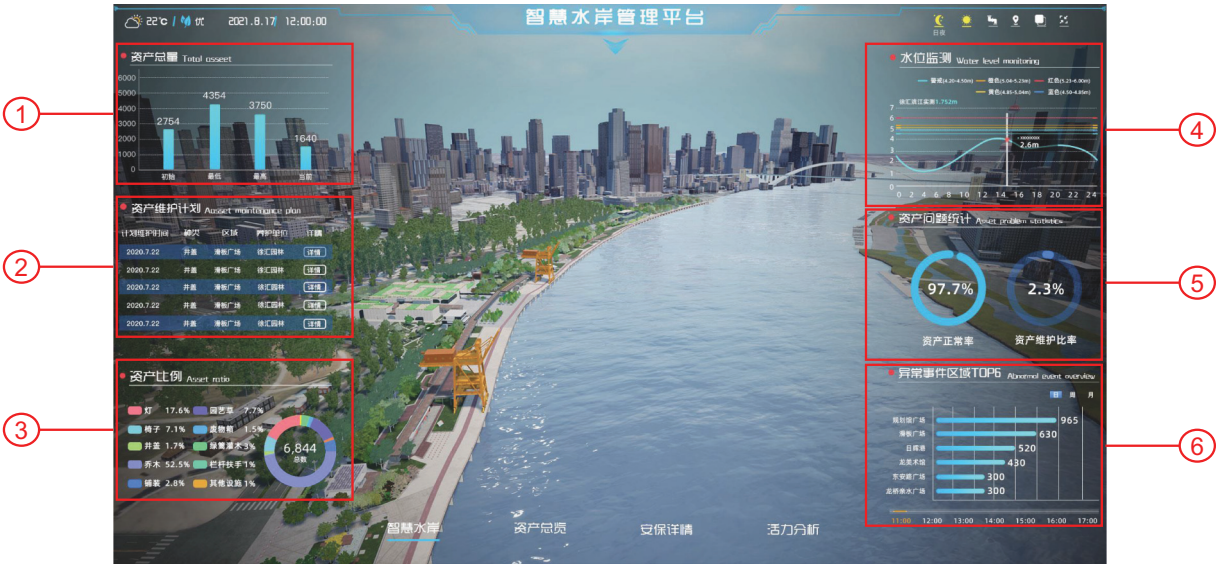
- ***Value for visitors, passengers and employees:*** SenseFoundry-Enterprise empowers indoor navigation and digital personal assistants on commercial premises such as banks and shopping malls through provision of personalized guidance services to consumers. SenseFoundry-Enterprise also supports smart security checks and ticketing in metro stations and amusement parks. We also enhance employee working experience on commercial premises by providing AI-empowered office products and services such as access control, conference room management, cloud-based printing systems and inventory management.

Use Case

A Comprehensive Business and Industrial Hub

Shanghai West Bund manages an open zone consisting of a comprehensive business and industrial hub, extending along a shoreline of 8.4 km. The hub management team faced the

difficulties of managing a wide and open area of public space with a variety of commercial and industrial formats and huge traffic flow with no entrance control. The customer had a large workforce for routine inspection and anomaly detection, but the response time was unduly long, and the customer was unable to achieve unified remote management of the entire hub, predict potential incidents and take preventive measures accordingly. We have digitalized the open space and our AI models enable ongoing maintenance of the more than 6,800 specific commercial assets in the hub area, such as trees, streetlamps, paths and facilities. It automatically triggers alerts upon detection of anomalies such as damages to the facilities and theft, dispatches staff and further tracks the process, which is empowered by our AI models with decision intelligence. As of June 30, 2021, SenseFoundry processed around 200 work orders per month, over 98% of which can be resolved within 20 minutes, providing high-value comprehensive management services to the customer and significantly enhancing resident and visitor safety and experience.



Notes:

(1) Total assets panel: tracks the change in the number of commercial assets under management

(2) Asset maintenance plan panel: indicates the commercial asset maintenance plan with regular updates

(3) Asset composition panel: displays the breakdown of various types of commercial assets

(4) Water level monitoring panel: monitors water level changes and automatically sends alerts when the water level reaches pre-defined thresholds

(5) Asset incidents panel: monitors the status of commercial assets and displays follow-up measures for incidents in real-time

(6) Anomalies hot spots panel: analyzes and displays hot spots with high incidences of anomalies

An Exposition Center

Hangzhou International Expo Center is a large multi-functional complex with a floor area of 850,000 square meters, accommodating convention, exhibition, hotel, catering, commercial and

office spaces. It holds around 110 exhibitions and over 400 conferences every year, with more than 700,000 annual visits and attracting close to 40,000 visitors a day in peak seasons. The complex multi-functional operations and the traffic flow brought by large amount of visitors created the need for a more intelligent and reliable approach to ensure the safety and greater efficiency of operations. We introduced SenseFoundry-Enterprise to the customer in 2018, equipped with our AI models to provide full coverage services. SenseFoundry-Enterprise provides the following services:

- ***Anomaly detection and alert***: SenseFoundry-Enterprise is equipped with AI models capable of safety and security assistance with full coverage of various incidents including fire and theft. As of June 30, 2021, 98% of the incidents detected by SenseFoundry-Enterprise had been properly dealt with within 30 minutes.

- ***Rental management***: SenseFoundry-Enterprise has reconstructed the expo center on cloud through its virtual replica, covering approximately 90,000 square meters of the exhibition area with more than 7,500 exhibition booths and more than 4,100 parking spots. Combined with VR view of the virtual expo center supported by AI-enabled content generation and enhancement, potential exhibitors are able to explore the expo center remotely and simulate their layout planning, creating business opportunities and saving costs for both exhibitors and the center and leading to a higher occupancy rate.

- ***Enhancing visitor experience***: We provide AR navigation and tour guide supported by AI-enabled content generation and enhancement to visitors, creating easy-to-use and user-interactive one-stop user friendly visiting experiences. SenseFoundry-Enterprise also supports smart vehicle parking, intelligent car positioning and car park navigation to enhance visitors' experience.

Residential Property Management

The residential property management industry traditionally requires substantial labor resources to provide routine property management services. Our SenseFoundry-Enterprise platform establishes full-cycle automated workflow from problem detection to problem solving, effectively shortening the overall service response time and creating value for customers. It facilitates residential property management primarily in the following areas:

- ***Convenient and safe access to the residential property***: SenseFoundry-Enterprise facilitates contactless and authorized access by the residents and vehicles and provides real-time updates of available parking slots.

- ***Anomaly detection***: SenseFoundry-Enterprise supports detection of anomalous situations such as recognizing open fire or smoke, falling objects and assaults. Once these anomalies are detected, SenseFoundry-Enterprise alerts property managers for prompt action.

- ***Maintenance of clean and orderly environment***: SenseFoundry-Enterprise enables automatic detection of garbage overfill and unauthorized parking, and promptly alerts the property managers for actions through real-time safeguarding of the community space.

We set forth below a screenshot of the operating dashboard empowered by SenseFoundry-Enterprise for residential property management. The software platform operates on a 24/7 basis, providing a full range of services to the property management teams and residents.

Notes:

(1) Basic information on the residential community

(2) Visitors and vehicles traffic statistics

(3) Digital twins of the community and facilities

(4) Facility conditions and real-time tracking of maintenance workstreams

(5) Security alerts along with automated work orders and follow-up evaluation of work efficiency

(6) Residential service tracker along with automated work orders and follow-up evaluation of work efficiency

Use Case

Residential Communities

Languang Justbon Services (Languang) is a property service provider that manages approximately 1,400 residential properties in more than 130 cities in China. The company was facing an increasing challenge of providing high-quality property services to the residents in a cost-effective way. Since the first successful deployment of SenseFoundry-Enterprise to its residential communities, we have enabled the digital transformation of more than 50 residential properties across four provinces managed by Languang. SenseFoundry-Enterprise is able to accurately detect 31

types of incidents and anomalies through its connection to more than 8,000 IoT devices, automatically send alerts and dispatch appropriate personnel for in-time response. We offer over-the-air AI model upgrades that can be synchronized across devices in all communities. More than 160,000 residents have registered on Languang's property management platform. More than 1,000 alerts are generated every day with a detection rate over 95%. This has substantially improved the service quality and security standards at the residential properties and is highly regarded by the customer, and became a differentiating factor of the customer's property management services compared to its peers. As a result, in 2020, Languang reduced its operational costs by 28.6% at the residential communities that had adopted our software platform, substantially improving operating efficiency.

Industrial Quality Control

Quality control is crucial for manufacturing industry. Most quality control inspections are still conducted through manual checks. SenseFoundry-Enterprise accurately identifies defects with higher efficiency and accuracy. Since quality control measures vary substantially across industry verticals, we have leveraged the mass production capabilities supported by SenseCore to produce scenario-specific AI models for each type of defects with limited samples. Integrated with the key steps of quality control, SenseFoundry-Enterprise helps manufacturers avoid disruptions and prevent losses by detecting defects in time, improving overall production efficiency.

Use Case

An Automobile Company

China FAW Group is a leading automobile company. In its metal stamping process, it is difficult for quality control inspectors to detect small defects that could be found in different metal parts. The traditional inspection process is time-consuming and lacks consistency. SenseFoundry-Enterprise enables our customer to automatically inspect over 34 types of defects within six to 12 seconds, with a detection rate of more than 99%. It is integrated with the existing production line and operates on a 24/7 basis with high stability. The real-time detection further helps the customer to identify deficiencies or malfunctions in assembly lines immediately, preventing potential disruption to production processes and defects in products.

A Sugar Production Factory

Hi Sugar Tech operates 10.6 million acres of sugarcane fields and 67 sugar factories. Traditionally, inspectors heavily relied on personal experience to detect impurities in sugarcane such as sugarcane skins, leaves and roots. To facilitate the automatic inspection, we standardize the quality control process by deploying SenseFoundry-Enterprise which can automatically detect various impurities, achieving a detection rate of more than 90%. SenseFoundry-Enterprise transforms the manual check process to automatic inspection and substantially improves detection efficiency by 67%.

Infrastructure Maintenance

Maintenance optimization is one of the key tasks for asset-heavy industries, including public utilities and infrastructure companies. Ineffective facility maintenance shortens the equipment lifespan and increases unplanned downtime and maintenance costs. SenseFoundry-Enterprise improves the efficiency and accuracy of inspection processes through empowering IoT devices installed around the target assets or on autonomous patrol devices, and helps our customers to save maintenance costs through AI models.

Use Case

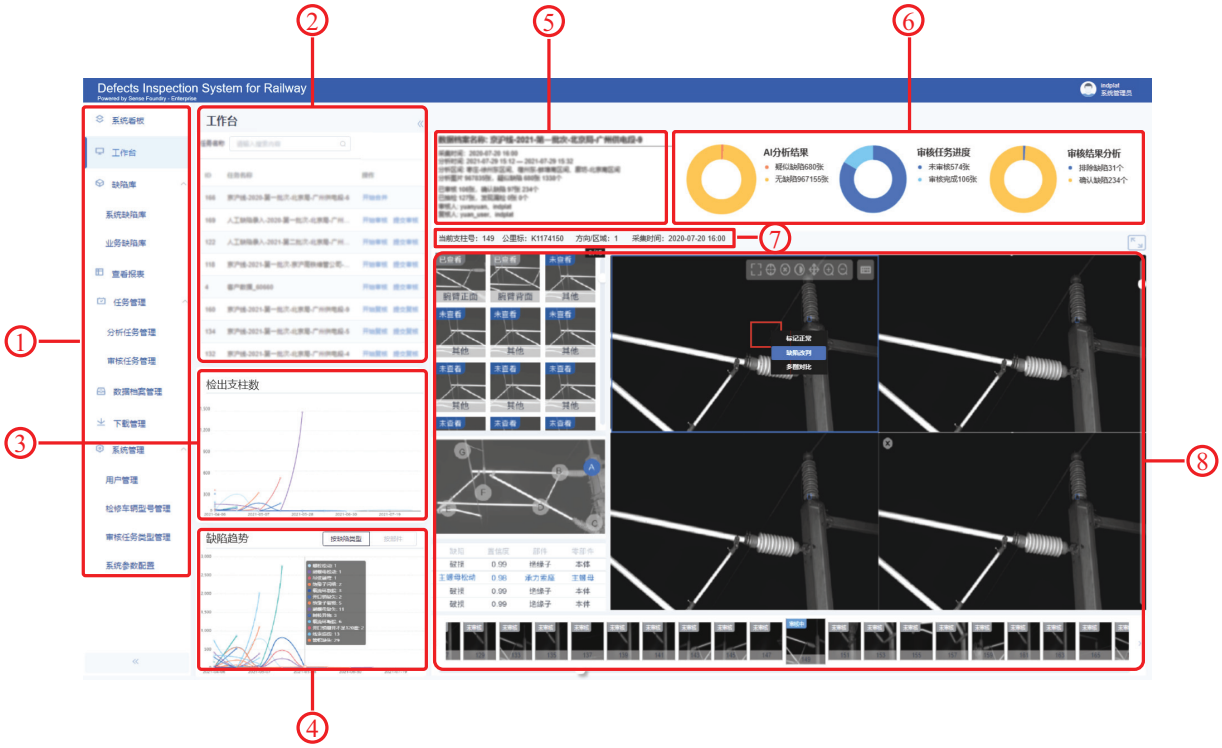
A High-speed Railway Maintenance Company

Overhead electricity power lines support high-speed railway networks. The maintenance of power lines is critical to the daily operation of high-speed trains and passenger safety. Beijing-Shanghai High-speed Railway operates and maintains a railway network of more than 1,000 km, which carried more than 130 million passengers in 2020.

High-definition cameras are installed on the customer inspection vehicle. The photos of the overhead contact system were taken at regular intervals as the vehicle moved along the railway. It generates millions of high-definition photos each quarter with location information encoded for review and analysis, saving massive manpower for the defect inspection.

SenseFoundry-Enterprise was deployed on the customer's data processing center. Once the high-definition photos are transmitted to the data center, our system will automatically detect 2,160 types of defects among 514 components including overhead equipment, supporting structure and suspension gear. As of June 30, 2021, SenseFoundry had automatically detected 26,914 defects.

Compared to the traditional approach that inspects an average of 2.5 km of power lines in one day, the new AI-powered method helped the customer inspect an average of 50 km power lines in the same period of time. To further optimize operational efficiency, the customer has since extended applications of our AI-powered inspection services throughout its railway network, with an aggregate length of more than 9,000 km inspected as of June 30, 2021.



Notes:

(1) System management panel which includes different functionalities and enables generation of inspection reports

(2) System workstation which lists outstanding tasks for follow-up

(3) The number of poles with defects detected

(4) Trend analysis on the defects detected

(5) Summary of the railway section conditions, AI analytical statistics and the latest status of inspection tasks

(6) Diagrams which show the amount of workload reduced by AI, the working progress of inspection tasks and the number of confirmed defects

(7) Summary of current detection tasks, such as dispatched vehicles and their direction and positions

(8) Display of current detection tasks, with indication of poles being inspected, photos shot and defects detected.

A Power Grid Company

Company K is China's largest power grid company, serving 26 provinces and more than one billion people. A key objective for Company K in digital transformation is to enhance maintenance efficiency and fully utilize its existing infrastructure, through approaches such as building edge data centers on existing substations. Our SenseFoundry-Enterprise platform has been deployed for anomaly detection and automatic operational management, such as trespass warnings and emergency alerts, to ensure more efficient implementation of safety procedures. In addition, we provide AI-as-a-Service to Company K and deploy our AI models and computing capabilities to its edge data centers to transform them into mini AIDCs, allowing Company K to provide AI-empowered cloud services to its customers. Recognizing the significant benefits, Company K expanded deployment of SenseFoundry-Enterprise to more than 200 substations within one year.

Smart City

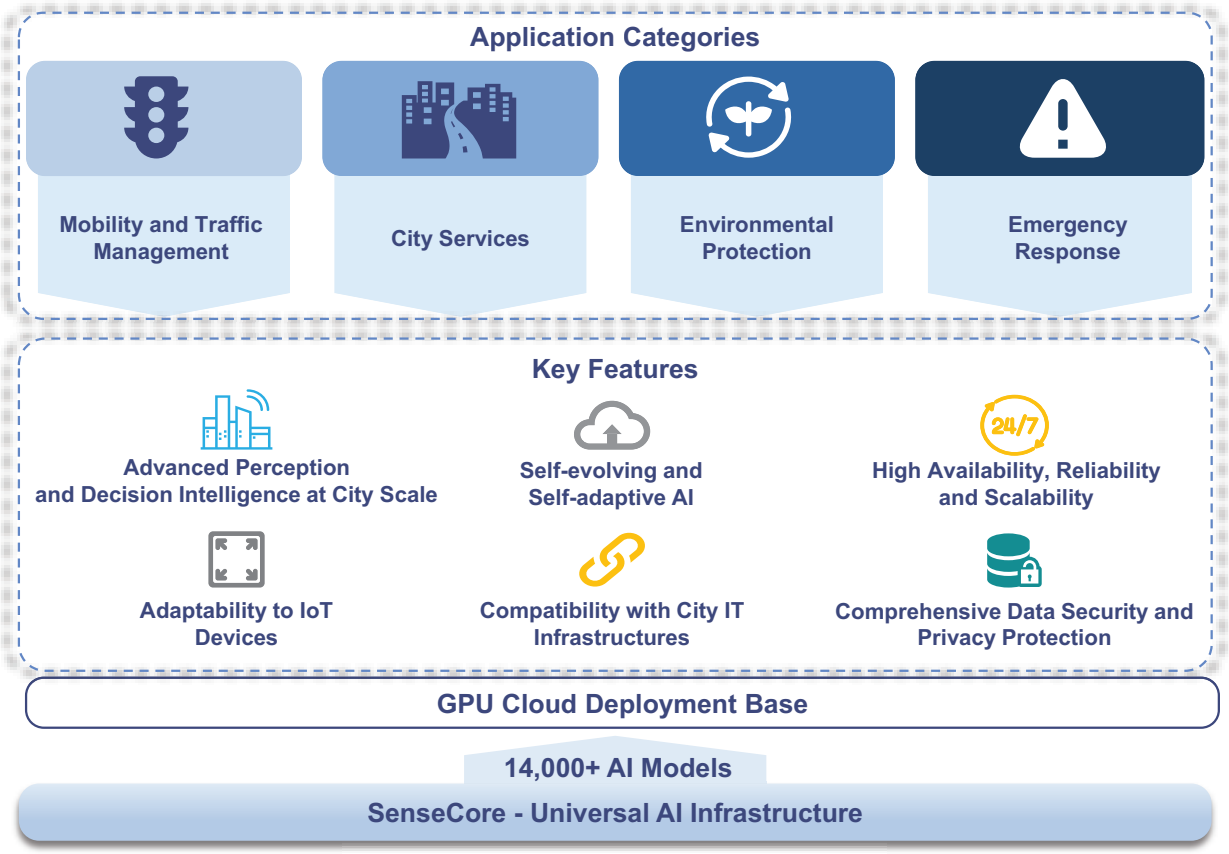
Urbanization and the increasing populations of major cities globally have changed the landscape of city management. City administrators are faced with challenges brought by large populations and limited resources and seek to meet residents' expectations for a high quality of life while maintaining public safety.

City administrators increasingly look for digital transformation of city management through AI technologies, especially to deal with the massive amount of data generated from city IoT devices covering interactions between people, city infrastructure and public space. There has been a strong demand for a unified one-stop AI software platform capable of comprehensive and digitalized analysis of objects, events and information in cities.

Overview of SenseFoundry

To empower city management, SenseFoundry, our software platform for city-scale applications, facilitates the digital transformation of the city through the same steps as SenseFoundry-Enterprise does for the digital transformation of enterprise customers. See "— Smart Business — Overview of SenseFoundry-Enterprise" for details. SenseFoundry is deployed on powerful cloud-based GPU servers tailored for AI applications.

SenseFoundry Platform for Smart City



Key Features of SenseFoundry

While sharing common features with SenseFoundry-Enterprise, SenseFoundry is tailored for city-scale to serve as a one-stop software platform for Smart City management, addressing the needs of customers in the public sector. SenseFoundry is seamlessly integrated with existing city IT infrastructure, providing the operational interface with real-world 3D urban models. Furthermore, combining more than 14,000 AI models, SenseFoundry features the following:

- ***Advanced perception intelligence and decision intelligence at city scale:*** SenseFoundry features parallel analysis of massive amounts of data from millions of IoT devices, and supports concurrent responses to tens of thousands of user operations within seconds. City administrators gain insights into the operational patterns of cities and identify bottlenecks in daily operations through SenseFoundry.

- ***Self-evolving and self-adaptive artificial intelligence:*** SenseFoundry is equipped with an online incremental training engine derived from SenseCore to provide AI-as-a-Service. By frequently feeding in the results of online data processed by original AI models and the information generated from city management operations, it is able to automatically upgrade the existing AI models and produce new models with higher accuracy. SenseFoundry is therefore capable of addressing use cases and scenarios with limited data while maintaining high accuracy, achieving self-evolvement and self-adaptability.

- ***High availability, reliability and scalability:*** SenseFoundry is deployed on cloud servers to achieve high availability, high reliability and high scalability. It facilitates city services on a 24/7 basis with constant scaling and upgrading. To further ensure the data security and service reliability, SenseFoundry supports multi-tier data replication to minimize the risk of data loss.

Commercialization

We primarily deliver SenseFoundry to our customers in public sectors and deploy the software platform on cloud. Integrated with the city IT infrastructure, SenseFoundry provides perception and decision intelligence to realize digital transformation of city management. We charge licensing fees, as well as software subscription fees to a lesser extent, for access to SenseFoundry and relevant AI applications. In addition, we generate revenue from sales of AI software-embedded hardware which support the running of our software and related services. Our business growth is primarily driven by (i) expanding our geographic reach and connecting more IoT devices and (ii) an increasing number of AI models providing enhanced functionalities and greater customer value.

The number of cities we served increased from 21 as of December 31, 2018 to 47 as of December 31, 2019, and further to 94 as of December 31, 2020 and 119 as of June 30, 2021. As of June 30, 2021, SenseFoundry connected over one million IoT devices.

Applications

SenseFoundry facilitates city management with applications such as mobility and traffic management, city services, environmental protection and emergency response.

Mobility and Traffic Management

SenseFoundry integrates decentralized traffic management systems into a one-stop system and empowers it with the ability to interconnect with IoT devices and interchange information real time, forming a more efficient, comprehensive and data-centric smart traffic management system. This enables traffic management with a bottom-up approach based on real-time data feedback and unified and intelligent decision-making, easing traffic congestion in cities.

Typical scenarios for mobility and traffic management include:

- ***Traffic violation detection:*** Automatically identifies, reports, and collects evidence on traffic violations, based on advanced perception intelligence, covering: (i) vehicles illegally carrying passengers and helmet-free riders; (ii) unauthorized parking; and (iii) overloading and other road violations by special vehicles.

- ***Highway anomaly warning:*** Performs real-time detection and alerts for anomalous highway incidents, such as pedestrian trespassing, congestion, unauthorized parking and smoke and fire.

- ***Traffic flow optimization***: Identifies traffic congestion, performs real-time diagnosis of anomalies and provides assistance for efficient traffic flow management by controlling traffic signals.

- ***Traffic condition information extraction***: Extracts and digitalizes traffic information such as traffic flow, queue length, vehicle distance and overflow time at intersections, and produces traffic condition evaluation through perception intelligence.

City Services

The traditional method of city services is less efficient and difficult to implement as it relies heavily on manpower for patrol and dispatch of personnel for execution, and often faces difficulties in obtaining evidence of violations. By providing city services systems with comprehensive perception and decision intelligence at the regional, city or provincial level, SenseFoundry helps reshape the process and application of city services, driving its improvement and transformation.

Typical scenarios for city services include:

- ***Public safety***: Perceives and analyzes the density, flow and any anomalies of crowds at attractions, tracks prowling behaviors near restricted areas and detects smoke and fire to enhance public safety and security management.

- ***Public facilities***: Identifies and reports any anomalies regarding public facilities, detects any emergency exit obstructions by vehicles and other large items and alerts the owner or administrative staff for appropriate handling of such incidents.

- ***Public health and social services***: Identifies and sends alerts for smoking, improper discharge of sewage and illegal roadside stalls, and facilitates management of other incidents, such as management of shared bikes in public areas.

Environmental Protection

Environmental protection is of utmost importance in ensuring the sustainable development of cities. SenseFoundry achieves automatic detection, warning, analysis and resource dispatch in fields such as public space sanitation and air pollution detection. It reshapes the overall process of pollution source tracing, pollution treatment, resource allocation and result evaluation for environmental protection management, and drives the digital transformation of environmental protection.

Typical scenarios for environmental protection include:

- ***City landscape oversight***: Supports governing, planning, policymaking, supervision and enforcement for city landscape oversight. It covers detection of any decrease in plantation areas and improper usage of land.

- ***City environmental protection***: Performs real-time analysis of roads and neighborhoods to identify waste disposal in public areas and alerts administrative staff of litterings for timely and appropriate handling to improve sanitation, detects and identifies construction vehicles and load spillage through automatic detection of any spillage of dirts, rocks, bricks and other waste, and sends alerts accordingly.

Emergency Response

We support the safety, health and emergency response objectives of relevant city departments with SenseFoundry. Through early warning, intelligent incident detection and automated incident handling procedures, it assists city administrators to identify, assess and handle emergencies more accurately, effectively and efficiently.

Typical scenarios for safety, health and emergency response include:

- ***Disaster detection***: Performs analysis on city landscape visual data, detects and provides early warnings of fire and smoke and detects stranded vehicles and predicts urban locations prone to waterlogging, such as low-lying areas, culverts, underpasses and road construction sites.

- ***Production safety***: Detects the storage and transmission of hazardous chemical substances, sends alerts for any potential safety issues and supervises the proper operating practices of construction site workers, such as wearing of helmets, gloves, masks, uniforms and reflective vests.

- ***Epidemic preventive measures***: Provides contactless temperature measurement and supervision of epidemic control practices such as mask wearing, social distancing and crowd gathering management.

Use Case

A First-tier City in East China

City A is one of the largest and most populated cities in China. City A's urban administration is a large, complex and diverse system. It daily supports a population of 30 million and serves more than 2.7 million businesses. City A adopts a grid management approach by dividing the city's urban areas into regional blocks of appropriate size with clear boundaries, known as grids. In each grid, the management of public facilities and discovery of incidents mainly rely on the continuous efforts of grid personnel to conduct patrols and inspections, which require significant manpower. There may also be a certain time lag in the manual discovery of incidents, and manual verification and confirmation is also required after handling. City A aims to achieve a comprehensive digital transformation.

City A uses SenseFoundry to utilize thousands of AI models to analyze the physical world data in real time, and translate data into insights, alerts and actions. SenseFoundry monitors the conditions of public facilities such as manhole covers, fire hydrants, power poles, telephone booths, road guardrails and road signs, and common problems of these public facilities are loss, damage, displacement, skewing, unevenness and looseness. Bike sharing services have been popular in City A in recent years, causing the issue of bicycle parking in city services. SenseFoundry assists with automatic detection of unauthorized bicycle parking and abandoned bicycles, with the case detection

and reporting efficiency improved from hours to minutes. 80% of the work to rearrange bicycles is dispatched automatically through SenseFoundry. Before deployment of SenseFoundry, the government needed to commit a huge amount of manpower to patrol the streets for maintenance. After one year of deployment of SenseFoundry, the manpower requirement was reduced significantly and bicycle parking violations were reduced by 35% from January 2020 to December 2020.

City A also uses SenseFoundry to track incidents, such as traffic accidents, fire and smoke, emergency exit obstructions, exposed garbage, road damage, road congestion, unauthorized parking, unlicensed road occupancy and explosions. SenseFoundry transforms the traditional grid management into an automated closed-loop process with four steps: (i) automatic discovery of incidents; (ii) automatic case filing and dispatch; (iii) case handling and execution; and (iv) automatic verification and case closure. SenseFoundry evolves into the underlying digital city operating system, and promotes the transformation of city services from human-intensive to human-computer interactive, from empirical judgment to data driven, and from passive response to early detection and action. SenseFoundry serves to improve the safety, efficiency, convenience and environmental quality of cities.

An International Metropolis

City B is an international metropolis that aimed to transform into a smart city. We provide support to city administrators by offering our SenseFoundry together with mini AIDC through our AI-as-a-Service. With self-evolving capabilities, SenseFoundry is able to train AI models locally with the input of just a small amount of data, meeting the requirements of the local government.

We developed 11 traffic management applications that are installed on SenseFoundry for City B. SenseFoundry can fully utilize and analyze limited data generated by IoT devices installed on law enforcement cars and enable end-to-end traffic violation management, making mobile traffic law enforcement possible. SenseFoundry achieved detection of not wearing safety belts with a precision rate of 94% and a recall rate of 94%, and detection of using mobile phone while driving with a precision rate of 86% to 96% and a recall rate of 93% to 94%, along with child on-board safety, license plate recognition, broken headlight, inspection vehicle recognition, vehicle maker and model recognition. It has increased the safety awareness of drivers to abide by traffic regulations and improved overall traffic management efficiency by reducing the occurrence of severe accidents.

A First-tier City in South China

City C has a total area of approximately 2,000 square kilometers and a population of more than 17 million. We provide traffic management and city service applications through SenseFoundry to City C. For example, moped management had long been a complex and manpower intensive issue for City C administrators with huge amount of mopeds in the entire city presenting difficulties in traffic violation detection and tracing for limited law enforcement personnel. Our traffic management application enables the traffic police to manage traffic violations effectively. Since deployment of SenseFoundry, around 50,000 cases of traffic violations by moped riders have been identified. The number of monthly traffic violations decreased by 56% from 1,800 in December 2020 to around 800

in January 2021, and the rate of moped riders and passengers wearing helmets substantially increased from 44% to 94% during the same period, as SenseFoundry has enhanced the efficiency of the enforcement of the city code to create a safer and more orderly traffic environment.

Smart Life

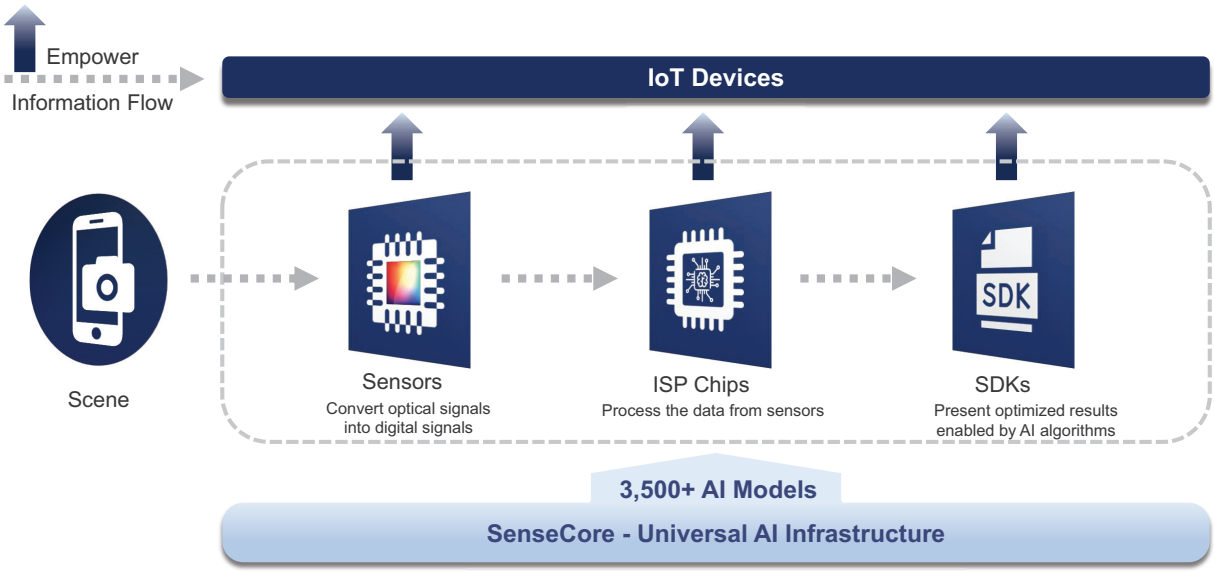
In today's digital era, people's lives are being enriched by a wide range of smart IoT devices and built-in software applications. Intelligent upgrades of applications and devices are required to further unlock the potential of the digital era. Our Smart Life software platform offerings comprise AI software, sensors and ISP chips that make people's lives more colorful and convenient. Our core capabilities lie in AI models which can be embedded in multiple IoT devices. With our industry-leading AI capabilities, our SenseME, SenseMARS and SenseCare software platforms have become indispensable in driving a number of new and rapidly growing verticals such as IoT devices, Metaverse and smart healthcare.

SenseME for IoT Devices

With a full stack of offerings in SDKs, AI sensors and ISP chips, our SenseME software platform, powered by over 3,500 AI models, enables a broad range of IoT devices to facilitate perception intelligence and content enhancement. In the past, sensors, ISP chips and SDKs were sourced by IoT manufacturers from separate suppliers and integrated on the devices. We provide full-stack offering by embedding AI models into CMOS image sensors and ISP chips which are compatible with most IoT devices, with low requirements on space, cost, bandwidth and power consumption. Sensors acquire signal inputs from the physical scene, and then further provide input for ISP chips. The output of the ISP chips is further processed by our SDKs to provide perception intelligence and content enhancement for end users.

The following diagram illustrates our offerings supported by SenseME:

SenseME Platform for IoT Devices



Empowered by SenseME, AI sensors improve user experience by enhancing real world image perception, improving image and video quality and enriching the content details, while minimizing device power consumption and strengthening data security. Our AI models empower AI sensors to achieve (i) multi-spectrum imaging, (ii) image and video enhancement under a wide range of light conditions, (iii) high dynamic range imaging, (iv) slow motion capturing, and (v) 3D depth effects on consumer IoT devices. We further design our AI ISP chips to process output from AI sensors and maximize sensor performance.

Key Features and Applications

Perception Intelligence

SenseME provides perception intelligence to IoT devices through our SDKs and AI sensors. AI sensors feature the following advantages compared to normal SDK offerings:

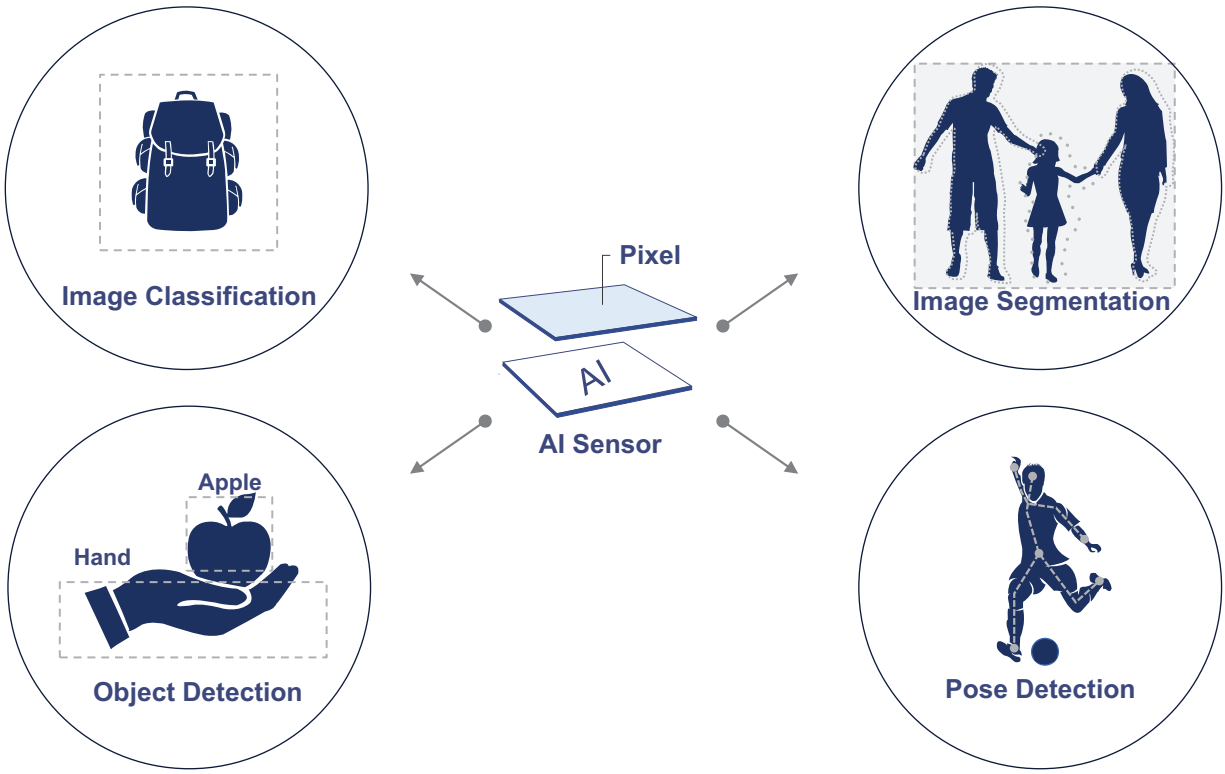
- ***Better user experience:*** AI sensors are capable of real-time perception intelligence including image classification, image segmentation, object detection and pose detection based on high-speed data processing with low latency.

- ***Lightweight deployment:*** AI sensors are compatible with a broad range of IoT devices, and require relatively low space usage, cost and bandwidth. AI sensors achieve high-speed data processing at the sensor end with no need to transmit raw data to the cloud. AI sensors extract critical information from images and videos and transmit such extracted information as metadata for further processing, substantially reducing the bandwidth required and therefore providing affordable and economic deployment to IoT devices.

- ***Low power consumption:*** Through lightweight deployment, AI sensors require low computing power and limited data transmission which reduce power consumption, extending battery usage time for better user experience.

- ***Enhanced data security:*** By transmitting metadata only without personal information, AI sensors provide enhanced data security and minimize the risk of personal information leakage.

The following diagram illustrates several prominent AI applications achieved through deployment of AI sensors:



Visual Content Enhancement

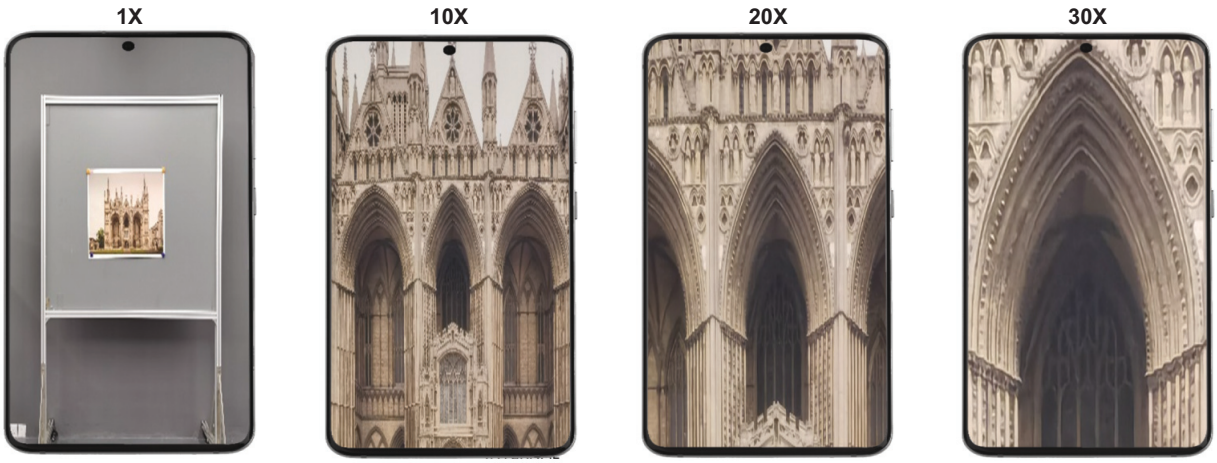
SenseME augments image and video quality and extends the human vision system through SDKs, AI sensors and AI ISP chips.

AI sensors capture high-quality images and videos under extreme conditions, such as poor light conditions and high-speed movement, through dynamic range control, de-noising and color fusion. Compared with traditional image processing technologies, data-driven AI models achieve superior performance in enhancing the image and video quality under various conditions.

The following pictures illustrate (i) the effects of our content enhancement capabilities for pictures taken under poor light conditions, supported by SenseME (picture 2); and (ii) the bokeh

effects supported by SenseME to provide aesthetic quality images with blur produced in out-of-focus parts (picture 4):

The following pictures illustrate the effects of our super resolution capabilities restoring the details of images, supported by SenseME. The detailed texture of the architecture is clearly visible after digital zooming in by 10, 20 and 30 times:



AI ISP chips work seamlessly with sensors to further enhance image and video quality in real-time, especially in dealing with those in large scale, under extreme conditions including poor light or low power conditions and high-dynamic range and high-velocity motion scenarios. AI sensors designed with rich color channels and new sensing patterns require new types of ISP chips to be capable of multi-format data processing, while traditional ISPs cannot fully utilize AI sensor outputs as they only accept standard data format and thus have not been able to preserve critical information. We expect our AI ISP chips to leverage our AI models and chip design capabilities to enhance image quality and work with new types of sensors such as depth sensors, multispectral sensors, and dynamic vision sensors.

Commercialization

We commercialize our SenseME offerings through different deployment methods:

- ***SDKs to mobile phone and other IoT device companies:*** We typically charge customers license fee for the use of our SDKs on mobile phones and other IoT devices. Mobile phone companies leverage our software to achieve superior photography performance and enrich their product functions. We are one of the leading mobile phone AI software providers, and our customers cover all top five Android brands globally. Our SDKs had been installed on more than 450 million mobile phones across over 200 models as of June 30, 2021. Our customers also include smart TV, smart projector and tablet companies.

- ***IP license for AI sensors:*** We charge an IP license fee for AI sensors. Such license fee comprises an upfront R&D service fee and ongoing fees based on a percentage of the AI sensors' revenue. The IP for the first AI sensor was already delivered in 2021.

- ***AI ISP chips to mobile phone and other IoT device companies:*** We expect to launch our AI ISP chips by the end of 2021 with target customers primarily being mobile phone and other IoT device companies.

Use Case

A Leading Mobile Phone Company

We formed a strategic partnership with Company L in 2017, providing a full stack of SDKs to enable various breakthrough features and increase the cost-efficiency of their products:

- ***Single-camera bokeh effect***: Dual cameras are traditionally required to realize bokeh effect. Our application was the first in the industry to achieve bokeh effect with a single camera, substantially enhancing user experience on a wider range of mobile phone models. Such application was introduced on products of Company L in 2016. Single-camera bokeh effect eventually became the industry norm.

- ***3D applications***: Our AI-empowered 3D applications fully realize the capabilities of 3D cameras, featuring 3D face beautification, AR ruler for size and spatial measuring and gesture control for interactive games. In 2018, Company L adopted 3D cameras, powered by our 3D applications, for the first time as a cutting-edge highlight of its flagship phones.

- ***AR platform***: In 2018, we started to provide our AR platform to Company L to support AR-related applications, such as AR photo with virtual figures, outdoor AR navigation and virtual furniture placement.

- ***Video highlight***: We provide a video highlight application with the capabilities of intelligent video analysis to Company L, which was presented as a key feature on its

flagship phone launch event in 2019. Video highlight generates themed video footage in high quality by automatically extracting and reorganizing highlights from a user's video album.

A Leading Mobile Phone Company

We provide Company M with multiple SDKs to enhance user experience:

- ***Smart album***: We provided Company M with the first-of-its-kind AI-empowered smart album in the market in 2016, which has since been installed on more than 150 million mobile phones. With image categorization capable of automatic identification of objects or persons shown in the photos, users can manage their phone album in a convenient and user-friendly way.

- ***Super resolution***: We launched the first deep learning-based super resolution application in 2014, which restores the details of images. Company M adopts our super resolution application on all its phone models.

- ***Super night photography***: We collaborated with Company M to develop the super night photography application, which is capable of capturing high-quality videos under poor light conditions.

SenseMARS for Metaverse

Metaverse refers to the convergence of physical, augmented and virtual reality in a shared digital space. Empowered by perception intelligence, AR and MR technologies enable human-computer interaction and AI-enabled content generation which are considered as the foundation for the Metaverse. The Metaverse has the potential to become the universal platform for digital social interaction in the future. We have been developing Metaverse-related technologies that can be implemented on the cloud and a range of IoT devices, which are expected to become the ubiquitous interfaces for Metaverse and are critical for the creation of a truly immersive Metaverse experience.

Our SenseMARS platform supports an immersive and interactive Metaverse experience through three core elements, SenseMARS Reconstruction, SenseMARS Avatar and SenseMARS Agent. SenseMARS Reconstruction builds a digital world replica of the physical world through 3D reconstruction technologies. SenseMARS Avatar creates digital identities and provides an interface for people to enter the digital world. SenseMARS Agent generates software agents to interact with people in the digital world. The combination of the three elements enables the creation of a digital world on the cloud, achieving a seamless integration of the physical and digital worlds for people to interact with each other in the form of avatars and other software agents.

The following picture illustrates a typical scene on the Metaverse:

Notes:

(1) Avatars or software agents

(2) 3D Reconstruction of the physical world

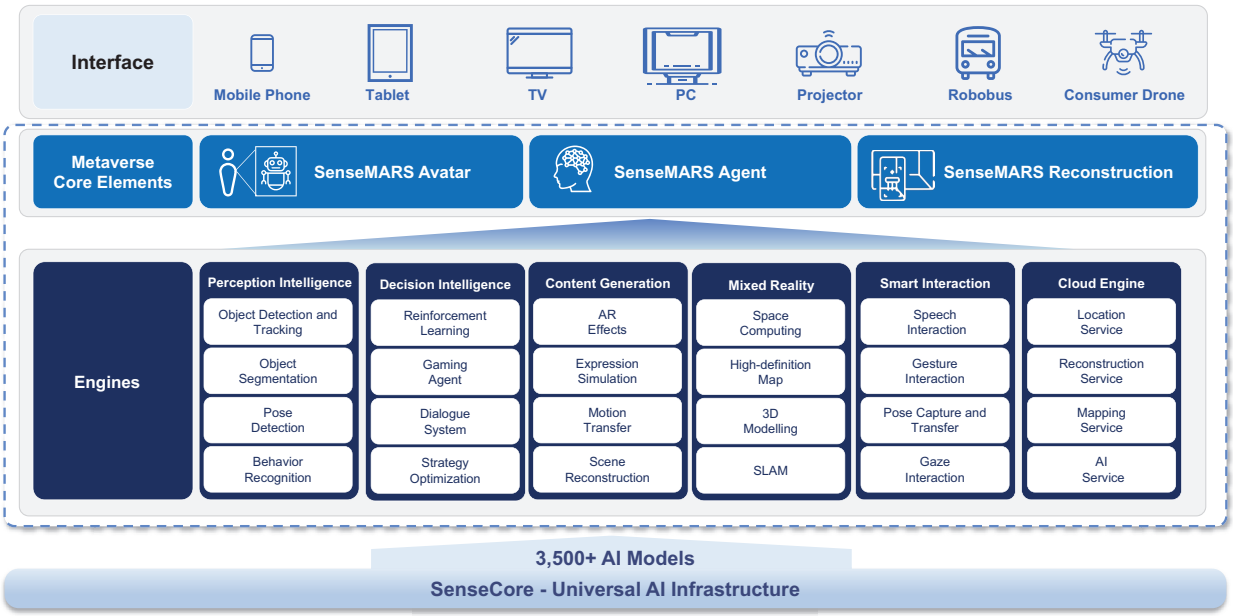
Overview of SenseMARS

Our SenseMARS software platform serves as the key enabling technology platform for the Metaverse to create new interactive experiences. We work with mobile phone, semiconductor, mobile app and online gaming companies to jointly build a multi-layer infrastructure to enable the Metaverse and enhance Metaverse user experiences.

SenseMARS is equipped with core functionalities, including perception intelligence, decision intelligence, AI-enabled content generation including AR and MR and smart interaction through software agents, and other infrastructure including cloud engine, providing support for Metaverse applications. SenseMARS is compatible with (i) different applications such as mobile apps, mini programs and H5 and (ii) various IoT devices, including more than 200 types of mobile phones, tablets, AR and VR glasses, smart TVs and consumer drones. As of June 30, 2021, SenseMARS provided a total of more than 3,500 AI models.

The following diagram illustrates the structure of the SenseMARS software platform:

SenseMARS Platform Enabling Metaverse



We are the founding Chair of the China Augmented Reality Core Technology Industry Alliance (中國增強現實核心技術產業聯盟), comprising over 300 members including Xiaomi, OPPO and JD.com. We initiated development of the first standard proposal of AR technology on mobile devices in the industry, the Standard for Augmented Reality on Mobile Devices, which was officially approved in 2020. We are currently also the Chair of Augmented Reality on the Mobile Devices Working Group for the Institute of Electrical and Electronics Engineers (IEEE) Standards.

Commercialization

We provide the SenseMARS platform to three types of customers:

- ***IoT device companies***: SenseMARS empowers IoT devices for consumers to interact in the Metaverse. We typically charge customers a license fee for the use of our SDKs.

- ***Mobile app and content providers***: SenseMARS enables over 200 apps, five of which are super apps with over 500 million monthly active users each, to create a digital world and generate avatars for users. We charge such customers a license fee for use of our SDKs.

- ***Commercial properties, such as stores, museums and airports***: We provide SenseMARS to commercial property customers to reconstruct the physical structure of their properties and builds a virtual replica. This brings new interactive experiences to visitors, such as AR navigation, AR marketing and AR games. It also generates software agents or digital humans capable of interacting with users. In addition to the SDKs which we charge license fee for, we also charge our customers fees for use of our AI-enabled content generation services on the cloud.

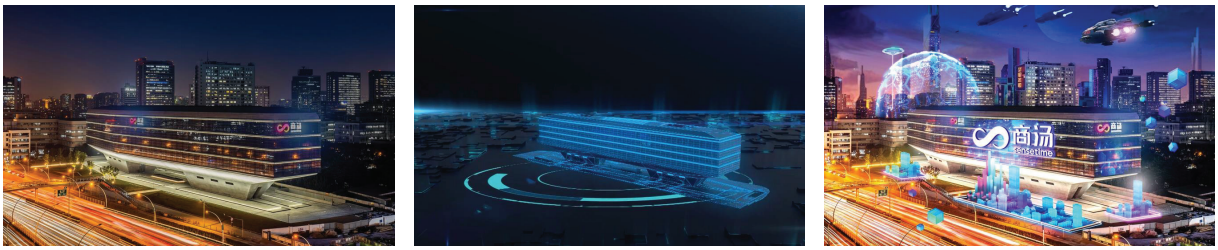
Applications

Our SenseMARS platform supports an immersive and interactive Metaverse experience through three core elements, SenseMARS Reconstruction, SenseMARS Avatar and SenseMARS Agent.

SenseMARS Reconstruction-Digital Reconstruction of the Physical World

A fully immersive Metaverse experience requires the seamless integration of the digital and physical worlds. SenseMARS enables users to efficiently reconstruct high-precision 3D models of the physical world using consumer devices such as mobile phones, sport cameras and drones. SenseMARS also enables spatial mapping and localization with accuracy to the centimeter-level, allowing visual content to be superimposed into the physical world through AR glasses, mobile phones and smart TVs.

The following diagram illustrates the digital reconstruction and MR effect of a physical place:



Physical World　　3D Reconstruction　　Mixed Reality in Metaverse

SenseMARS Reconstruction covers a wide span of scenarios, and is capable of reconstruction of objects and spaces, ranging from small objects to shopping malls, transportation hubs and cities. Set forth below are some of its recent applications:

- We provide SenseMARS Reconstruction services to the Palace Museum to digitally reconstruct its precious collections and present them through AR in the Palace Museum calendars (故宮日曆).

- We are building the Three-Body Immersive Experience Space (三體沉浸式體驗館) with SenseMARS. The Three-Body Problem is one of the most popular science fictions from China.

- We provide SenseMARS Reconstruction and interactive MR applications to the Shanghai Expo Exhibition & Convention Center and Bangkok Suvarnabhumi Airport.

- We built a virtual experience space for BilibiliWorld 2021, where users can interact with virtual streamers.

- We facilitate immersive AR guided tours of the West Lake area of Hangzhou.

- We are the official provider of intelligent vision technologies, including AI and MR applications empowered by SenseMARS, to the Asian Games 2022.

The following diagram illustrates our digital reconstruction and MR applications:

SenseMARS Avatar

An Avatar represents the digital identity of an individual in the Metaverse. Facilitated by SenseMARS Avatar, lively personalized Avatar figures with different styles can be automatically generated from photos. With accurate pose and micro expression recognition, SenseMARS Avatar enables users to generate their own Avatars easily with IoT devices such as mobile phones, supporting functions that previously required professional motion capture devices. SenseMARS Avatar empowers IoT devices to provide accessible interfaces for everyone to enter the Metaverse with their own character through mobile apps. For example, it has supported various mobile apps to generate Avatars of streamers for virtual live-broadcasting.

The following pictures illustrate Avatar generation from photos:

SenseMARS Agent

SenseMARS Agent enables intelligent human-machine interactions with perception intelligence and decision intelligence covering natural language processing and speech, hand gesture, pose and gaze. For example, SenseMARS Digital Human, a human-like software agent, interacts with users naturally and vividly through dialog, expressions and gestures. When trained with domain-specific knowledge, SenseMARS Digital Human can serve in various scenarios including shopping malls, exhibitions, tourist attractions and banks.

The following pictures present various SenseMARS Digital Humans and their applications in different business scenarios:

Digital Humans Generated by SenseMARS

SenseMARS Agent is also provided to gaming companies to serve as AI-enabled non-player characters or virtual players competing in online games of different genres.

Use Case

An International Mobile App Company

Company N has a number of popular mobile apps in social networking, e-commerce, photo sharing and online games. Company N has adopted SenseMARS to enhance user experiences, including the following:

- ***AR effect***: One of Company N's apps for live-streaming launched an AR effect application in early 2016. Supported by the superior performance of our AI models with high accuracy, adaptability and computational efficiency, AR effects including 2D/3D AR sticker, face beautification and background decoration are achieved to create differentiated user experiences in innovative ways.

- ***SenseMARS Avatar***: One of Company N's apps for the Metaverse adopted the SenseMARS Avatar in 2018 and gained immediate popularity among its users. We help generate fully controllable Avatars with personal characteristics for users in the digital world, where users can socialize or play games together using their Avatars.

A Video Platform Company

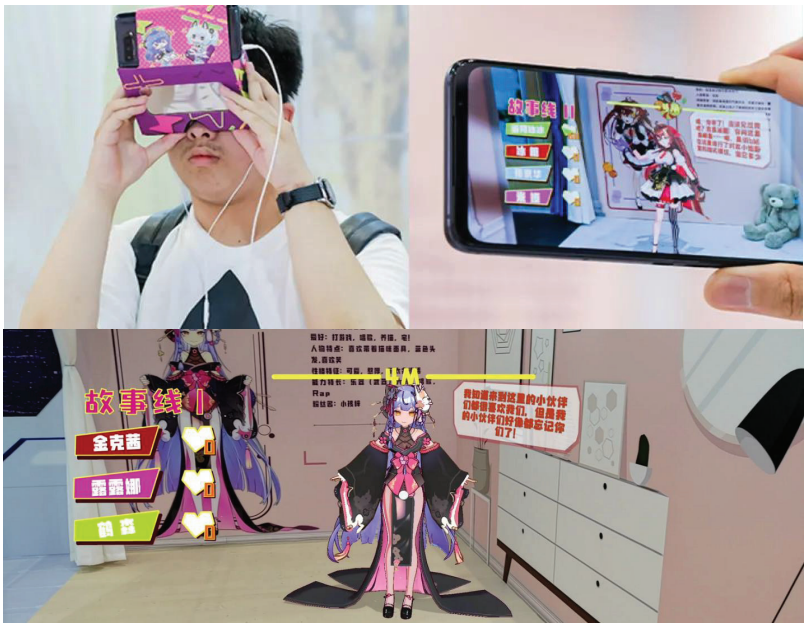
Bilibili runs a leading video community for the young generation in China with monthly active users of more than 200 million. SenseMARS helps Bilibili to provide novel user experiences.

- ***AR effect***: We have supported superimposing AR contents on live videos, beautifying the appearance of streamers and facilitating streamers' interactions with the audience through AR effects.

- ***SenseMARS Avatar***: SenseMARS generates an Avatar with personal characteristics for each streamer so that people can roam in the Metaverse with their Avatars and interact with the audience. SenseMARS Avatars can also participate in virtual live-broadcasting.

- ***SenseMARS Digital Human and SenseMARS Reconstruction***: Empowered by SenseMARS Digital Human and SenseMARS Reconstruction, a digital world can be reconstructed for a comic show, where the users can interact with the virtual streamers, bringing immersive user experiences.

The following pictures illustrate the application of our products provided to Bilibili:



Shopping Malls

Company O is one of the largest property developers based in Hong Kong. It has deployed SenseMARS in the mobile apps of its shopping complexes in Chengdu and Changsha to enhance shopping experiences. SenseMARS enables centimeter-level indoor positioning through 3D reconstruction of a high-definition map of the shopping malls to bring convenient and engaging shopping experiences:

- ***AR navigation and AR guided tour***: SenseMARS supports precise navigation through perception intelligence, such as finding a parking spot or store. SenseMARS also superimposes virtual marketing content such as store information and coupons on shoppers' mobile phones.

- ***AR games and AR photo***: SenseMARS also provides AR games and AR photo applications, with which visitors can play games in augmented reality settings and take photos with virtual contents superimposed with real scenes.

SenseCare for Smart Healthcare

Our AI software platform for smart healthcare, SenseCare, provides AI tools in diagnosis, treatment planning and rehabilitation. SenseCare is embedded with AI models supporting anomaly detection, recognition and automatic diagnostic analysis for the medical imaging of a variety of organs, servicing key clinical departments.

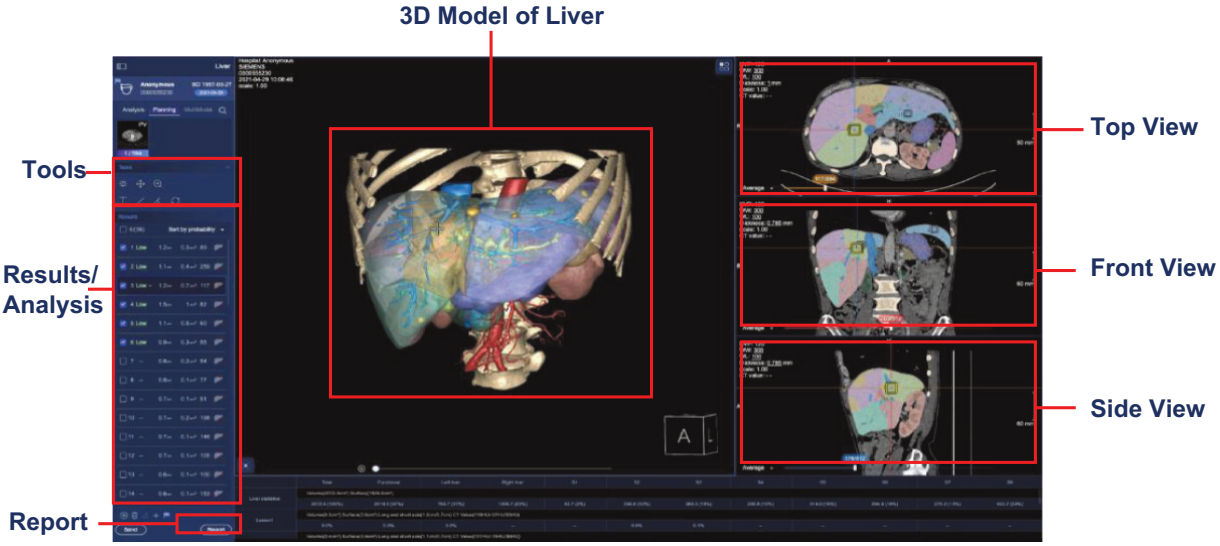
Key Features of SenseCare

- ***Comprehensive diagnosis offerings***: Our products support diagnosis of conditions covering 13 body parts and organs, such as heart, liver, lungs, stomach, intestine and cervix. Our products serve key clinical departments including radiology, pathology, radiotherapy, surgery and orthopedics.

- ***Treatment planning and rehabilitation***: We offer 3D surgery planning and rehabilitation services to medical professionals and patients, respectively.

- ***Flexible deployment supported by high concurrency rendering***: SenseCare can be deployed on the premises or cloud. Moreover, our proprietary high concurrency rendering technology allows concurrent access by doctors to SenseCare from terminals across hospitals and other medical institutions.

The picture below illustrates the diagnosis interface of a liver screening supported by SenseCare's multiphase imaging and automatic 3D reconstruction capabilities:



Commercialization

We obtained NMPA certification for three modules of SenseCare, including the Digital Pathology Image Processing System. We have also obtained CE marks for another two modules, SenseCare-Lung Pro and SenseCare-Chest DR Pro, respectively.

We charge licensing fees for SenseCare and also provide R&D services to some of our customers. SenseCare has been adopted by hospitals and other medical institutions in China and overseas. As of June 30, 2021, we had partnered with 16 Class III Grade A hospitals in China.

We provide our AI-as-a-Service to local Health Commissions for the regional hospital network. It will serve as a centralized smart health hub that connects hospitals and clinics, helping customers to construct a regional medical collaborative platform, optimizing the allocation of medical resources.

Use Case

Hospital A

Hospital A is one of the largest private hospitals in Macau. We provide Hospital A with SenseCare for intelligent daily diagnosis assistance and image analysis of cardiac CTA, Lung CT, carotid CTA and chest X-ray. SenseCare has significantly improved diagnosis efficiency and patient experience through its automatic diagnosis and 3D reconstruction functions.

Smart Auto

SenseAuto is our intelligent automotive application platform with the goal to enable our customers to capture new business opportunities created by the trend towards intelligent automobiles. It comprises five products, namely, SenseAuto Pilot, SenseAuto Cabin, SenseAuto Empower, SenseAuto Robobus and SenseAuto Connect.

We started to develop SenseAuto in 2016. We have been a strategic partner with Honda to provide it with our autonomous driving-related AI technologies since 2017. We have been developing L4 autonomous driving technologies, extending our strength in perception intelligence to full-stack capabilities including sensor fusion covering AI dash-cams, LiDAR and millimeter-wave radars, predictions on vehicle and pedestrian behaviors, driving decisions, planning and control, city-scale 3D map reconstruction and high-precision positioning. As of June 30, 2021, we had won 18 championships in autonomous driving-related international competitions.

To support advanced autonomous driving functions, it is critical to monitor the level of vigilance and detect the drowsiness of drivers in a timely manner. A Driver Monitoring System (DMS) will be a key feature for automobile companies to meet regulatory requirements. Our ADAS in SenseAuto Pilot and DMS in SenseAuto Cabin are jointly designed to ensure the safety of drivers and passengers. With autonomous driving, people will have more time for work and entertainment activities in the cabin, with the cabin effectively becoming an extension of their living space. Many technologies and products developed from our other business lines for other scenarios, such as smartphones and mobile apps, have been utilized in our smart cabin systems, demonstrating the synergies across our business lines.

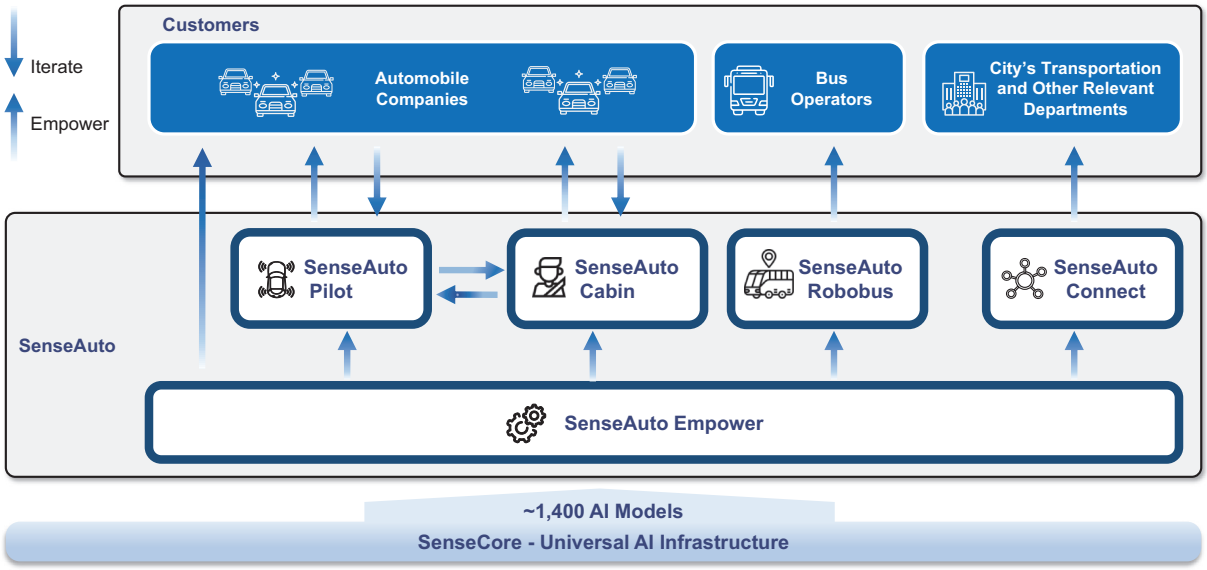
With our R&D efforts targeting leading automobile companies from day one, our technologies have been developed for mass production in a wide range of car models. Our technologies have been optimized for use on the major operating systems and chips so that our products can fulfill the requirements of different automobile companies. Our development strictly follows industry-renowned quality management systems for mass production. For example, we have been certificated by Automotive Software Performance Improvement and Capability dEtermination (ASPICE) L2 and Automotive Safety Integrity Level (ASIL)-B. We have also built a comprehensive supply chain system with more than 50 partners.

We provide SenseAuto Empower, our AI-as-a-Service product to automobile companies, providing an integrated offering comprising around 1,400 AI models and also AI computing power on the cloud. It is designed to support sophisticated automobile companies' in-house AI development initiatives, which could be deployed efficiently on over 30 types of chips installed on various car models.

We have launched our SenseAuto Robobus product to the bus operators, empowered by our autonomous driving and AR capabilities. We have further developed our SenseAuto Connect to provide AI-empowered V2X.

The following diagram illustrates our offerings through the SenseAuto software platform:

SenseAuto Platform for Smart Auto



Products

SenseAuto Pilot

We have developed SenseAuto Pilot, which covers our products and initiatives for advanced driver assistance systems (ADAS). We have been developing perception intelligence technologies that perform well with long-distance and multi-view sensing and in a wide range of driving conditions including challenging scenarios, such as bad weather, special car models and poor road conditions. We have developed a uniform perception intelligence platform for visual perception, LiDAR perception and multi-sensor fusion that supports our ADAS product, L4 autonomous driving initiatives and our SenseAuto Connect product.

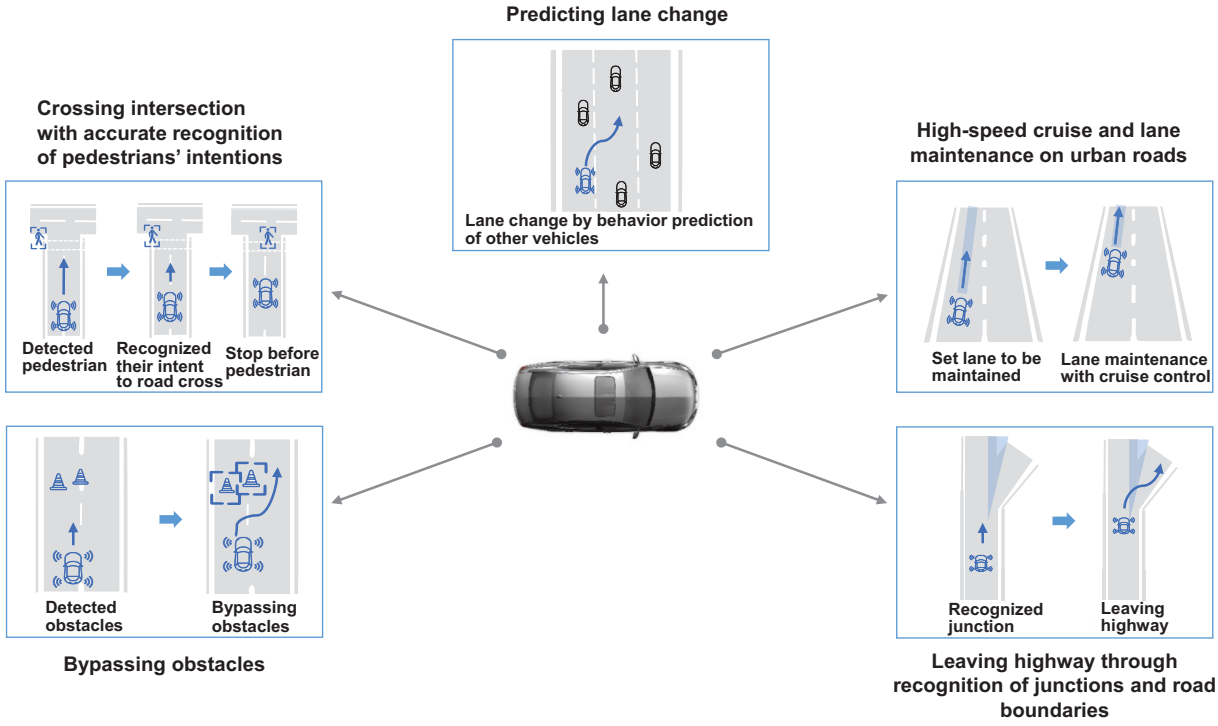
SenseAuto Pilot provides a cost-efficient vision-based system and multi-sensor fusion system options for both premium and mass market segments:

- ***Cost-efficient vision-based system***: SenseAuto Pilot provides a cost-efficient vision-based system that is capable of detecting vehicles at 200 meters and pedestrians at 150 meters. We utilize Digital Video Recorder (DVR), a common form of equipment founded in most car models as the perception camera to provide high-precision ADAS functions, demonstrating the high scalability of our vision-based system. Compatible with various car models, SenseAuto Pilot has been provided to a wide range of automobile companies.

- ***Multi-sensor fusion system***: We also provide a multi-sensor fusion system featuring a wider range of view and high accuracy for car models. We embed our perception

intelligence models into sensors including LiDAR, which can be easily integrated into automobiles with different hardware platforms. SenseAuto Pilot provides comprehensive functions such as Adaptive Cruise Control (ACC), Lane Centering Control (LCC), Traffic Jam Assist (TJA) and Navigation on Pilot (NoP).

The following diagram illustrates the typical scenarios perceived by SenseAuto Pilot:



We are developing L2+ ADAS products for traditional and new energy automobile companies. We expect the car models pre-installed with our L2+ ADAS products to be mass produced in 2022. Aggregating our experience gained from development of L2+ ADAS products, we are also conducting research projects on advanced L4 autonomous driving technologies, which in turn provide insights for us to strengthen our L2+ ADAS products. We will continue to upgrade our ADAS products to support automobile companies with the introduction of higher-level autonomous driving functions in the coming years.

SenseAuto Cabin

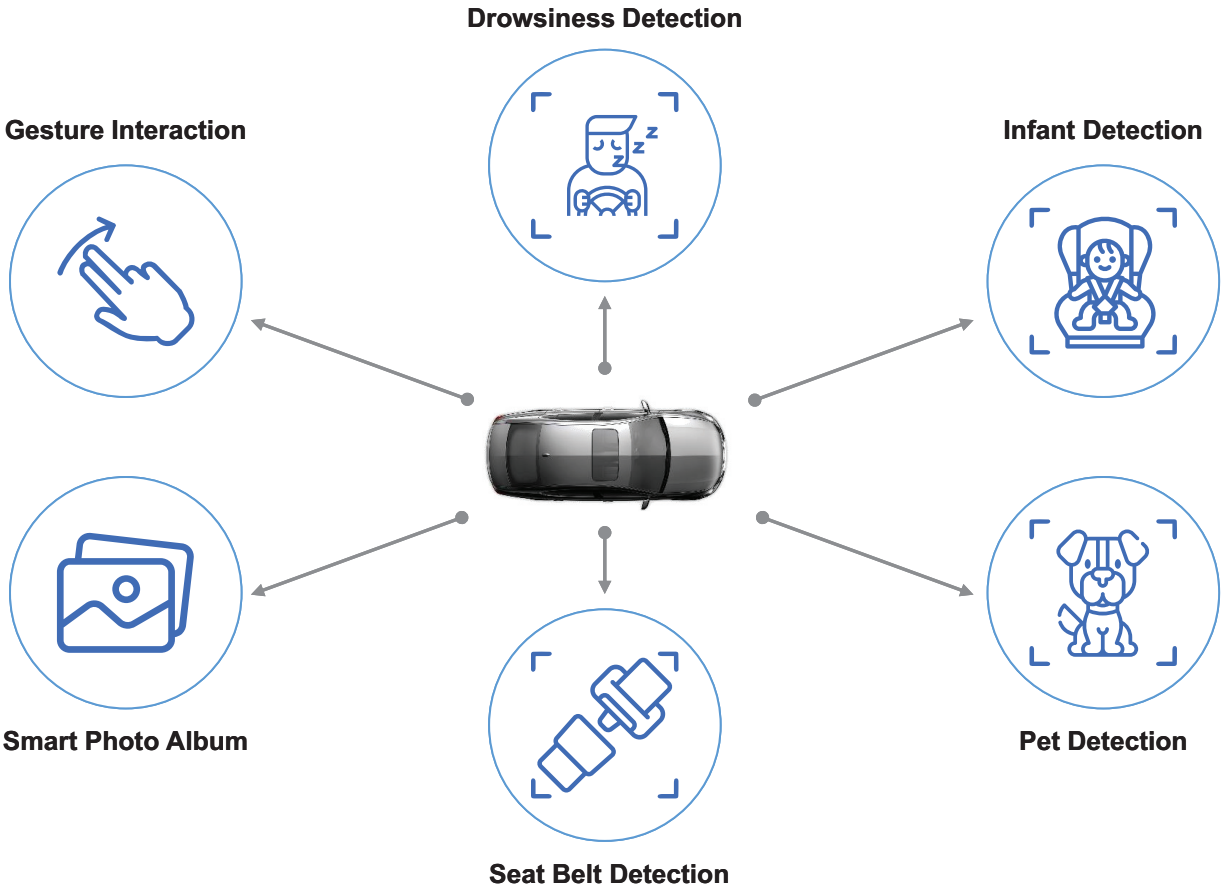
SenseAuto Cabin comprises our driver monitoring system (DMS), occupant monitoring system (OMS) and in-vehicle infotainment (IVI) system, making in-vehicle travel smarter, safer and more comfortable for both drivers and passengers.

- ***DMS***: Our DMS capabilities include driver identity recognition, drowsiness detection, distraction detection, absence detection and anomaly detection, which enhances driving safety. Our DMS also provides critical support to the SenseAuto Pilot product as it facilitates the must-have safety protection for L2+ autonomous driving. Our DMS has been deployed in various car models, catering to both premium and mass markets.

- ***OMS***: Our OMS detects unauthorized passengers and unattended objects in the cabin, and offers detection of infants/children, pets, lost items, safety belts and safety seats, which enhances the safety of passengers. Our OMS for infant/children detection was installed in mass produced car models in 2020, being the first of its kind available in China.

- ***IVI***: We have embedded our SenseMARS offerings into our proprietary IVI system to provide innovative features including in-cabin augmented image quality, AR high-precision navigation and special effects for beauty cameras, smart albums and software agent assistance functions. For example, our IVI beauty camera for passengers was installed in the mass produced GAC Trumpchi in 2021, and was the first of its kind in China. It leverages established technology in our existing product offerings to mobile phones.

The following diagram illustrates the capabilities of our SenseAuto Cabin product:



SenseAuto Empower

In the era of intelligent automobiles, automobile companies have diverse demands for improving user experience through their own product design, and to swiftly respond to customers' expectations for new features, diagnosis of safety problems and timely updates of AI models with data feedback to address corner cases. We provide the SenseAuto Empower product as a critical AI

development infrastructure to sophisticated automobile companies with an understanding of AI technologies and capabilities to support in-house AI development by themselves, which includes AI models tailored for automobile industry needs and our computing power support through the cloud.

With data-driven improvements on automobile AI technologies and continuous upgrade and utilization of AI technologies, we provide SenseAuto Empower as our customized in-house AI development support product for the automobile industry, through which we provide AI-as-a-Service. SenseAuto Empower, powered by around 1,400 AI models, helps automobile companies to effectively diagnose problems, upgrade products and adapt to vehicles with different hardware settings. It makes our SenseAuto Pilot and SenseAuto Cabin products more competitive since they are constantly being updated by our automobile company customers, and SenseAuto Empower provides an option for such customers to design their own desired upgrades. SenseAuto Empower also provides R&D services to automobile companies for AI technologies. We have provided AI-as-a-Service to automobile companies and led joint R&D initiatives through SenseAuto Empower with prominent automobile companies.

We also provide critical computing power supported by AIDC to automobile companies as intelligent automobiles requires huge computing power and storage, which is costly and complex for the automobile companies to build by themselves. SenseAuto Empower provides powerful capabilities of data processing, monitoring, analysis, compliance and simulation, model training and inference for automobile companies. The data processed by SenseAuto Empower is automatically desensitized through cleansing, encryption and anonymization with strict standards on security and privacy. Enabled by SenseAuto Empower, automobile companies can efficiently manage and process massive data as well as evaluate and iterate AI models for their own needs.

SenseAuto Robobus

We have launched SenseAuto Robobus, an L4 autonomous driving product, for autonomous shuttle services for bus operating companies. We have strategically selected autonomous driving bus for shuttle services as our major autonomous driving product at this stage, since it has a wide range of scenarios in business parks, tourist attractions and designated autonomous driving pilot zones. We have developed a full-stack of L4 autonomous driving technologies from multi-mode sensor fusion, planning and control to city-scale high-definition maps and conducted extensive trials for safe and reliable autonomous driving.

We have also leveraged our Metaverse-related capabilities empowered by SenseMARS and developed tailor-made interactive car windows for our SenseAuto Robobus. In the cabin, the generated virtual content and the surrounding physical world are superimposed on the smart car windows which also serve as the display screens for dynamic AR effects. For buses operated in tourist attractions and for city tour routes, the smart car windows with our Metaverse-enabling technologies support introduction of the development of the city, history of attractions and culture sites to be automatically displayed and updated to passengers simultaneously in accordance with the specific location of the bus, creating an immersive experience. We launched our SenseAuto Robobus during the World Artificial Intelligence Conference (WAIC) 2021 and provided a shuttle service

with immersive sightseeing experience for visitors as a showcase. Our SenseAuto Robobus was selected as one of the top ten exhibits of WAIC 2021.

The following picture depicts our SenseAuto Robobus and its in-cabin settings:

SenseAuto Connect

SenseAuto Connect is a platform which enables smart interactions of both vehicles and their surroundings, including roadside units and other vehicles using cloud and edge computing to facilitate efficient city traffic management. In addition to receiving signals from vehicles, it also empowers roadside units with full-stack intelligent sensing ability through sensors such as LiDAR and mmWave radar. It also acts as a hub for Vehicle to Everything (V2X) applications.

SenseAuto Connect provides city transportation and other relevant departments with powerful tools for data analytics including multi-model perception, data transmission, information aggregation and simulation. With SenseAuto Connect, effective decision-making can be made for traffic management services, improving efficiency and safety.

Commercialization

We started our SenseAuto offerings through providing R&D services and AI-as-a-Service to automobile companies with our SenseAuto Empower product. We have launched our SenseAuto Pilot and SenseAuto Cabin products to be pre-installed on various car models. We have generated revenue from our SenseAuto Robobus and expect to generate revenue from our SenseAuto Connect products in the coming years.

- ***Automobile companies:*** We empower automobile companies with AI capabilities through our SenseAuto Pilot, SenseAuto Cabin and SenseAuto Empower service offerings. For SenseAuto Pilot and SenseAuto Cabin, we typically charge our customers engineering fees for initial deployment, and license fees based on actual car shipments with our software. For SenseAuto Empower, we typically charge R&D service fees for research projects and initiatives and subscription fees for our provision of AI-as-a-Service.

- ***Bus operators:*** We generate revenue from sales of our SenseAuto Robobus to bus operators for shuttle services.

- ***Public sector customers:*** We will provide public sector customers with our SenseAuto Connect software offerings in late 2021. We intend to charge a license fee which varies based on the number of AI applications provided through our software.

As of June 30, 2021, we had collaborated with over 30 automobile companies, and been selected as the supplier of SenseAuto products for more than 20 million automobiles across over 50 car models in the next several years.

Use Case

A Leading Chinese Automobile Company

Company P ships more than one million automobiles every year. Prioritizing its strategy in intelligent automobile upgrade, Company P has reserved our SenseAuto Cabin product for approximately 1.2 million automobiles. We provided integrated systems with AI software, cameras and domain controllers, which support all the visual perception functions in the cabin. The cost for integration of the system has been greatly reduced and the time for deployment of AI functions into new car models has been shortened through our SenseAuto products. We also provide Company P with SenseAuto Empower which supports upgrades through software over-the-air to constantly improve user experience. The first set of car models pre-installed with our SmartAuto Cabin product was launched in April 2021.

- ***SenseAuto Cabin DMS***: Our DMS provides multiple intelligent functions, including identity recognition, emotion recognition, drowsiness detection, distraction detection and gaze tracking to empower automobiles. It enables automatic adjustment of seats and rearview mirrors according to previous settings of the driver. It warns drivers of dangerous behaviors such as fatigue, distraction and incoming phone calls during the course of driving. It provides a better and safer driving experience.

- ***SenseAuto Cabin OMS***: Our OMS intelligently perceives occupants and objects in the cabin, enabling personalized services for drivers and passengers. When an infant/child is left in the cabin, the OMS system automatically alerts parents. It also sends a reminder once lost items are detected.

- ***SenseAuto Cabin IVI***: With accurate gaze detection and gesture recognition, our IVI provides contactless interaction functions, such as control of radios with gestures. It enables new in-vehicle infotainment activities and improves driving safety.

A Smart Electric Car Company

Hozon is a smart electric car company in China with rapid growth in recent years. We have empowered Hozon to develop its intelligent automobiles that are well-received by the market. Hozon has launched car models equipped with our SenseAuto products in 2020.

- ***SenseAuto Pilot***: Our ADAS system provided to Hozon provides multiple functions, including LDW (lane departure warning), FCW (forward collision warning), PCW (pedestrian collision warning), SGW (stop and go warning), HBA (high beam assist), TSR (traffic sign recognition) and TLR (traffic light recognition).

- ***SenseAuto Cabin DMS***: Our DMS is capable of driver identification, drowsiness detection, emotion recognition and gaze tracking. We also provide robot assistant services designed for intelligent interaction. Through emotion recognition, the robot assistant automatically initiates communication with the driver and provides tailored assistance.

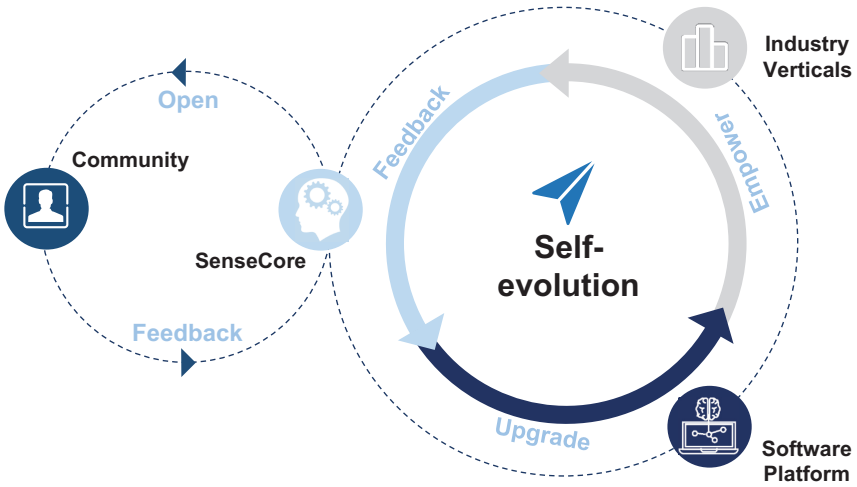
OUR UNIVERSAL AI INFRASTRUCTURE

SenseCore is the universal AI infrastructure underlying our software platforms. It produces large, high-performance AI models with low cost and high efficiency. The AI models produced on SenseCore encompass capabilities in perception intelligence, decision intelligence, AI-enabled content generation and AI-enabled content enhancement, and are integrated into our products and software platforms to support customers across industry verticals.

SenseCore leverages cutting-edge technologies on AI algorithms, AI systems, AI chips and AI sensors. It equips our researchers and engineers with deep learning platforms for end-to-end automated model production. In the past three years, our model production capacity has increased by over 300 times, largely due to innovations on these platforms and tools as well as the increase in computing power.

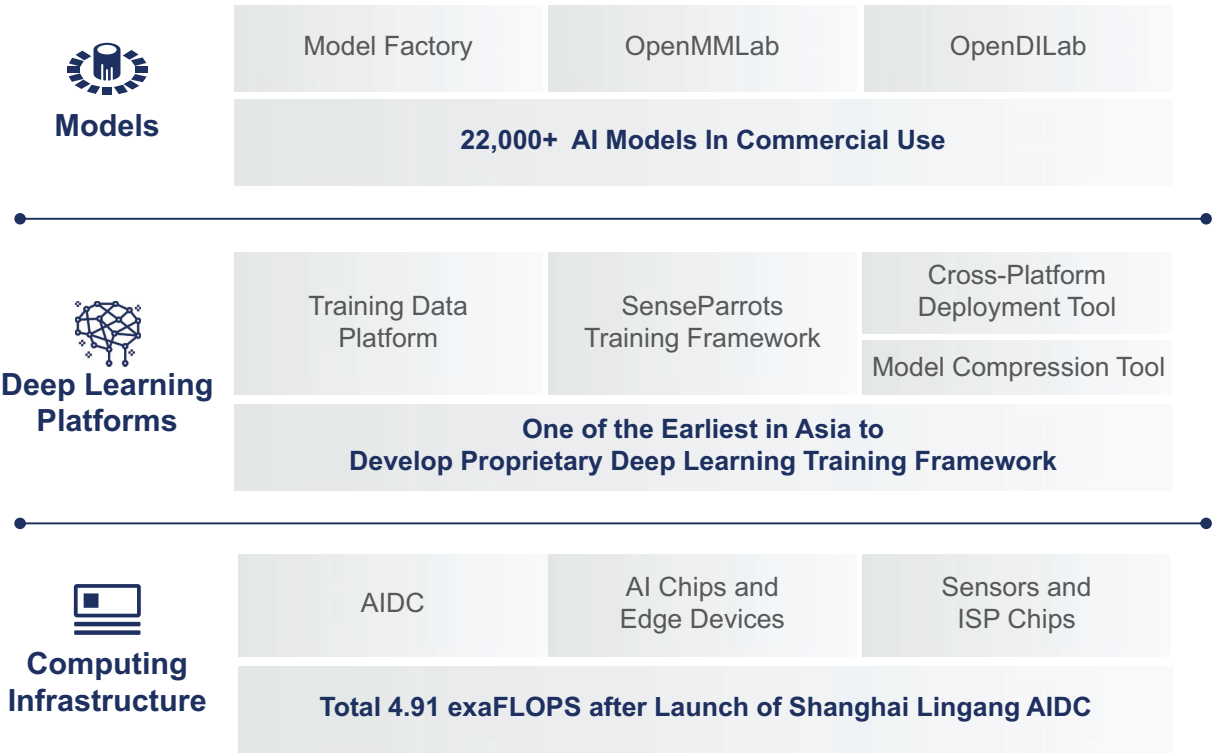
SenseCore provides powerful AI models that are extensible and adaptable to a wide range of scenarios. SenseCore allows us to offer customized production, training, deployment and iteration of AI models on demand, serving customers with greater flexibility and shortening our time-to-market.

Each time SenseCore is updated or upgraded with technology breakthroughs, our software platforms for different industry verticals will be upgraded concurrently, with substantial improvement on functionalities and performance. The industry verticals we cover on top of SenseCore will, in turn, provide abundant scenarios and feedback to foster the evolution of SenseCore. This flywheel effect as shown in the diagram below places us in a favorable position compared to other AI companies working on industry verticals separately:



SenseCore comprises three layers: models, deep learning platforms and computing infrastructure, as shown in the diagram below:

SenseCore: Universal AI Infrastructure



Models

The models layer provides industry-oriented AI models for our software platforms through the industrial-grade model factory. To develop our AI ecosystem, we also open up our perception intelligence models through OpenMMLab and our decision intelligence models through OpenDILab. SenseCore is constantly upgraded by incorporating feedback from the industry verticals and the academic community.

Model Factory

Industrial applications require AI models tailored to specific scenarios. The primary goal of our model factory is to produce scenario-specific models with superior performance in an efficient way to meet the large number of "long-tail" demands arising from a wide range of industrial scenarios.

However, producing a high-performance AI model with a traditional approach is very costly and time-consuming, as it demands large volumes of annotated training data, lengthy and resource-consuming training processes and complex scene-specific procedures. We tackle this key challenge

with a two-stage approach based on SenseCore, thus making large-scale model production feasible. The first stage is to train a large base model with massive training data, which has superior performance and generalizes into many scenarios. The second stage is to derive a light-weight scenario-specific model by adapting from the base model. The models resulting from this stage are substantially faster and smaller, and thus much more suitable for deployment on edge devices. The advantages of this two-stage approach are the following:

- ***Addressing "long-tail" scenarios***: This is critical for the scalability of our business. Our base models, which aggregate generalized knowledge from massive amounts of training data from multiple scenarios, have demonstrated remarkably improved performance in handling corner cases and complex cases. With base models, scenario-specific models can be generated with much less training data, so that long-tail scenarios can be effectively tackled with significantly reduced effort, and the scope of AI applications can be broadened.

- ***Maximizing data usage***: Compared with training a new model from scratch for each scenario, our two-stage approach significantly reduces the need for data.

- ***Achieving economies of scale***: Our investment in R&D and computing power is focused on the development of base models; once the base models are improved, the performance of all the scenario-specific models can be improved accordingly, hence reducing costs. Our model factory automatically recommends existing scenario-specific models for new scenarios, further reducing costs substantially.

Training a base model is essential and challenging. The challenges include the aggregation of a very large volume of annotated training data from many scenarios, the complexity of model architecture design and a requirement for massive computing resources. SenseCore, through the integration of computing infrastructure, a versatile training data platform and our proprietary training framework SenseParrots, allows us to meet such challenges effectively.

Our ability to produce AI models at scale has allowed us to build an extensive library of commercialized models to power our software platforms. As of June 30, 2021, we had accumulated over 22,000 AI models. This model library is being expanded and enhanced on an ongoing basis.

Our scenario-specific models can be automatically tailored to specific requirements on hardware settings and requirements on runtime efficiency, which helps our customers to choose and deploy scenario-specific models based on their needs. As big data analytics are performed on this large and growing collection of models, we can often find models from the library that are likely to be relevant and easily adaptable to new scenarios with system recommendations.

OpenMMLab

The open-source ecosystem has been a driving force behind the advances of AI technologies. Open source is an important part of our efforts to grow our ecosystem. In 2018, we launched OpenMMLab, an open-source initiative that aims to cover perception intelligence algorithms. With

three years' development, OpenMMLab has grown into one of the most comprehensive open-source algorithm systems for perception intelligence globally. It comprises 10 code repositories, providing more than 210 algorithms and 1,500 AI models. As of June 30, 2021, the code repositories of OpenMMLab have received more than 38,000 stars in aggregate on GitHub and attracted users from over 100 countries and regions. A number of well-known corporations and research institutes build their codebases thereon. The success of OpenMMLab reinforces our position as a leading force to drive the advances of perception intelligence algorithms.

OpenMMLab, together with a thriving community around it, has formed an ecosystem with world-wide impact. This ecosystem strengthens our connection with both our industrial partners and academia. More importantly, OpenMMLab enables us to not only share our capabilities, but also learn from the open-source community, thus accelerating our technological progress.

OpenDILab

Decision intelligence is regarded as a significant path towards the next level of AI technologies. In 2021, we released OpenDILab, an open-source platform for decision intelligence, jointly with Shanghai Artificial Intelligence Innovation Center. OpenDILab provides both a comprehensive collection of algorithms and industry-level scalability. Compared with existing frameworks in this area, OpenDILab is distinguished in multiple aspects including seamless integration of training and deployment, a standardized framework for both environment provision and algorithm execution, and compatibility with most academic and industrial data models.

As of June 30, 2021, OpenDILab had released more than 20 generic families of decision AI algorithms, such as multi-agent reinforcement learning. On the OpenDILab platform, we are making available several industrial-grade applications, including an advanced decision system for autonomous driving, decision intelligence systems for complex games and a city-level traffic signal control system.

Deep Learning Platforms

Our proprietary deep learning platforms comprise the training data platform, our SenseParrots training framework, the model compression tool, and the cross-platform deployment tool, which integrate seamlessly to deliver highly efficient data training performance. They enable powerful AI model training, lead to high efficiency in model production including both the training and deployment processes, and expand the coverage of AI models across platforms with different types of chips.

Training Data Platform

Training industrial-grade models typically requires substantially larger and more diverse datasets with high-quality annotations, compared to academic settings. However, sourcing, managing and transferring training data at this scale is challenging and costly. We have built an industrial-grade training data platform to support this process. It provides full-fledged services that cover all stages throughout the lifecycle of a training dataset.

Compared to traditional data management systems, our training data platform, which is tailored to the demands of AI research and development, provides a number of distinct capabilities:

- ***Semi-automated data annotation***: Our training data platform facilitates the annotation of images, videos and 3D point clouds with intelligent tools based on AI models, which reforms a traditional manual annotation procedure into a more efficient and guided process, where the annotators are guided to focus on the parts that truly need human input while the system can automatically supplement the remaining parts with AI. The cost of annotation for some tasks is reduced by 90% compared to manual annotation.

- ***Training data generation***: To supplement the data from the real world, we also explore other ways to generate and derive data through simulation and rendering, such as simulation of traffic conditions to generate traffic data.

- ***Efficient data storage and access***: Our training data platform is built on top of a storage system that is optimized to store a massive quantity of training data while allowing million-level concurrent visits per second.

- ***Versatile data retrieval***: An important way to reduce the cost of data acquisition is to retrieve data relevant to specific scenarios and acquire new data when existing data becomes insufficient. We have developed an AI-oriented data retrieval capability, through which our platform allows retrieval of datasets across domains based on queries of various forms such as keywords and reference images.

- ***Seamless integration***: Our training data platform is seamlessly integrated with other stages of the model production workflow. With a standard exchange format, it can combine data from multiple sources into large-scale coherent datasets, ready for training. It also provides user-friendly web UI and a set of standardized APIs for integration into an automatic or semi-automatic workflow.

- ***Privacy computing support***: We integrate cutting-edge privacy computing technology to allow model training with customers' data stored at the customer side without transmission of raw data samples, through the combination of a series of encryption computing technologies. This ensures data security, data privacy and regulatory compliance throughout the production process.

- ***Data desensitization and privacy protection***: Data security and privacy protection is a fundamental requirement of our training data platform. We strive to adhere to the highest standard of information security and data privacy. Specifically, we safeguard our data through systematic access control and data encryption and protect data privacy through automatic desensitization. For instance, we mask personal and sensitive information and ensure that our data is used for training purposes without personal information attached.

Overall, our proprietary training data platform effectively improves the efficiency of data acquisition, annotation and access, enabling a large number of models to be trained on top concurrently, and at the same time enforces data security and privacy protection at the highest standard.

SenseParrots Training Framework

Deep learning frameworks are the cornerstone of AI research and development. The capability of a deep learning framework has a great impact on the efficiency of model production. SenseParrots is our proprietary deep learning framework, which lies at the heart of SenseCore, serving as the core training engine of AI models.

According to Frost & Sullivan, SenseParrots, which was launched in 2015, was one of the earliest self-developed deep learning frameworks in China. Constantly evolving since its launch, SenseParrots has become a sophisticated training framework that achieves high levels of versatility, efficiency and productivity with the following distinctive features:

- ***Highly efficient training of AI models with dynamic computing paths***: Training of certain advanced AI models relies on dynamic change of the underlying computing paths in the training process, facilitating more efficient and optimized training of AI models compared to a fixed structure approach. However, training a model with dynamic paths is much more challenging than one with a fixed structure. SenseParrots resolves this challenge with its built-in just-in-time compiler, which allows fast compilation of computing paths in real time.

- ***Large-scale parallel training***: To train large base models within a reasonable timeframe, the training framework needs to coordinate multiple servers with hundreds of GPUs or more. It requires highly frequent synchronization and high throughput communication among GPUs. With advanced optimization of memory, communication and synchronization, SenseParrots can scale a training task to thousands of GPUs. It achieves a high parallel efficiency at 91.5% on 1,024 GPUs, while the efficiency of a mainstream training framework is around 25%. We have trained an AI model for visual recognition that contains over 30 billion parameters, which is the largest in the computer vision industry based on public information, according to Frost & Sullivan.

- ***Inherent support of multiple AI training chips***: In recent years, new training chips, which are designed to provide special advantages in specific domains, have emerged as alternatives to mainstream GPUs. SenseParrots is devised to support multiple kinds of AI training chips coherently.

- ***Seamless integration with the model production pipeline***: The model production process consists of multiple stages, including data preparation, model training and deployment. SenseParrots can directly operate on the datasets from our training data platform, and the trained models derived therefrom can be directly fed into the model deployment tools. Such a streamlined pipeline significantly improves the efficiency of model production.

Overall, SenseParrots provides a solid foundation to support fast innovations on models and algorithms, thus **[REDACTED]** us in a favorable position compared to those competitors that rely on open-source frameworks.

Model Compression Tool

Runtime efficiency, memory footprint and power consumption are crucial factors in the fitness of a model to a certain device and user experience of applications. To attain high accuracies, we

train large, scenario-specific models on GPUs. However, such models are usually not suitable for direct deployment, especially in the context of mobile devices, due to their excessive demand on memory and computing power.

To ensure the fitness to devices with stringent computing environments, we have developed model compression techniques, such as quantization, pruning and distillation, and have incorporated these into the model production pipeline. Such techniques can transform a trained model into a light-weight one that runs faster on edge devices and consumes less memory, while maintaining comparable accuracy.

Cross-Platform Deployment Tool

The success of our business relies on the capability of deploying AI models to a large number of scenarios in multiple industry verticals, and responding to customer needs in a timely manner. Taking the super resolution photography product as an example, it took ten people three months to deploy the super resolution models on one mobile phone model in 2018. With our deployment tool, a team of a similar size now supports almost 100 phone models from different manufacturers and with different computing platforms and sensors. It takes a single engineer one week to support three to four mobile phone models simultaneously. This has been critical for scaling up our business in the mobile phone vertical. Such significant improvement in efficiency results from the automatic multi-platform model deployment tool provided by SenseCore. It supports more than 100 chips in the market, and also provides unified deployment of cloud services.

Computing Infrastructure

The computing infrastructure of SenseCore comprises AIDC, AI chips and edge devices, sensors and ISP chips. We have made continuous efforts in the development of this infrastructure to provide computation resources and large-scale data management for training powerful AI models at low cost. The size, complexity and diversity of AI models continue to increase, and the usage of AI software is rapidly expanding. The computing resources required to support training state-of-the-art large AI models have increased by one million times over the past ten years, according to Frost & Sullivan. The development of new chips and sensors expands the range and capabilities of AI embedded in hardware.

AIDC

As of June 30, 2021, we have built 23 supercomputing clusters with over 20,000 GPUs, sustaining an aggregate computing capacity of 1.17 exaFLOPS. Our AIDC empowers our research and development through its capabilities of supporting large-scale data processing and high-performance computing. We have developed a system software stack as the foundation to support AI workloads, with the following key capabilities:

- ***High-performance computing***: Both training and inference are computationally intensive tasks. To fully unleash the power of computing chips and enable efficient execution of

such tasks, we have developed a high-performance computing engine, which comprises a rich collection of highly optimized computing routines, often referred to as "operators" in the context of AI computing, a compiler and a runtime environment. Compared to the computing engines provided by chip vendors, our computing engine improves end-to-end runtime efficiency significantly, through optimized operators and a whole-graph optimization technique that can cover not only neural network computing but also the pre-processing and post-processing stages.

- ***Highly efficient distributed scheduling***: Our AIDC is equipped with a distributed task scheduling system, which allows tens of thousands of computing tasks to be dynamically scheduled on thousands of GPUs. This system schedules over 20 million tasks per year and thus ensures that research and development activities can be carried out timely and efficiently. With the support of a wide range of scheduling policies, our scheduling system maintains a high utilization rate of the computing power, thus significantly reducing the average cost needed to train a model.

- ***High-speed data input/output (IO)***: When training a model over a dataset, each data sample will be loaded and processed for multiple times, at a high frequency and in a random order. Our AIDC typically runs a large number of training tasks simultaneously, resulting in a huge pressure on the data IO system. The storage and IO system not only stores a large volume of training data but also allows fast random access to them. It delivers a very high IO throughput, allowing training tasks to load over two million images per second, which ensures that training tasks can run at full speed without waiting for data.

- ***Hardware/software co-design***: Training base models with billions of parameters have very large demands for computing power and memory capacity, which results in a need for high-performance computation on GPUs. Such GPUs communicate with each other and frequently fetch data from the distributed storage system. Connecting multiple servers while coordinating all the aforementioned operations is a considerable undertaking and results in significant loss of runtime performance. We adopt the hardware/software co-design approach, configuring hardware settings according to our understanding of AI workload, while designing the software stack accordingly and conducting cross-layer optimization. With this design, our AIDC enables massive model production in a highly efficient manner, producing tens of thousands of models per year.

- ***High-standard system security***: We consider security as a top-priority of our computing infrastructure and design its architecture with system security enforced at multiple levels. For example, we have a comprehensive set of guidelines to categorize our data by security levels and grant access permissions accordingly. Our storage system is equipped with a sophisticated access control system. Sensitive data is stored and transferred in an encrypted form. Computing resources assigned to different authorized groups are appropriately isolated. A security team is working diligently to monitor the operations of our AI data centers and takes actions when potential risks arise.

Our computing capacity is expected to reach 4.91 exaFLOPS upon the launch of Shanghai Lingang AIDC with a designed computing capacity of 3.74 exaFLOPS. This will further enhance our AI-as-a-Service offerings and our leadership position in China's AI industry. We will make these computing resources available as a cloud-based computing infrastructure service for customers to deploy our software at large scale as well as to support the training needs of customers building

in-house AI capabilities. We will lower the entry barrier for large-scale AI applications in various industries.

AI Chips and Edge Devices

AI chips and edge devices are important hardware infrastructure of SenseCore to support AI applications. In order to efficiently utilize the computation power of AI chips and reduce power consumption, increasing numbers of AI chips will be co-designed with AI models and AI software in the future. Such joint optimization has the potential to substantially reduce cost and improve efficiency.

We started development of our first specialized AI chip, STPU, in 2018 to support SenseFoundry-Enterprise and SenseFoundry, and it was successfully rolled out in January 2020. As of June 30, 2021, we had mass produced a total of 11,000 STPU chips. STPU is optimized for our AI models and tailored to intelligent video analysis, which significantly accelerates inference. With STPU, the hardware cost of SenseFoundry and SenseFoundry-Enterprise has been reduced by 75%, with the number of processed video streams being increased by three times. STPU enables our customers to build more cost-effective AI integrated products and services. AI engine, which is an accelerator for AI computation, is the core IP of STPU. It has superior performance for AI models, as its architecture reflects our deep understanding of AI algorithms and AI systems, and its performance has been verified with our tens of thousands of AI models. SenseCore provides complete software systems for STPU, including the operating system, the compiler tool chain and the development platform.

We have also developed multiple types of intelligent processing cards with STPU. They are adaptable to both edge and cloud services. Each single card can process eight to 200 video streams simultaneously, depending on the scenarios.

We also launched the development of AI training chips to prepare for the next major breakthroughs in AI. As the complexity of AI models increases, AI chips tailored to the development of such models will show significant benefits compared to general-purpose GPUs. We consider AI chips as an important capability in the future AI industry, based on our capabilities of co-designing AI chips, AI models and the SenseParrots training framework.

Sensors and ISP Chips

SenseCore also has the capability of deploying AI models to sensors, which is important for AI to cover more scenarios. We are developing ISP chips to further enhance the capabilities of AI-enabled CMOS image sensors. See "— Smart Life — SenseME for IoT Devices" for details.

OUR RESEARCH AND DEVELOPMENT

Our leading position in the industry originates from our success in technology innovation supported by our strong research and development capabilities. We have invested significant R&D

resources in our AI infrastructure SenseCore, fundamental technologies, software platforms and the AI ecosystem with a long-term commitment. Our R&D staff members collaborate closely to deliver high-quality products and services for customers, innovate sustainably and continually expand the technology boundaries. As of June 30, 2021, 40 professors led our research efforts, and approximately two thirds of our 3,593 R&D members held or were pursuing master's or higher degrees, including more than 250 PhDs and PhD candidates. Our research and development expenses amounted to RMB848.7 million, RMB1,916.0 million, RMB2,453.9 million and RMB1,771.7 million in 2018, 2019, 2020 and the six months ended June 30, 2021, respectively. Our prolific and original research and development achievements have cemented our position as the leader in the AI field.

Fundamental Research

Our research covers perception intelligence, decision intelligence, AI-enabled content generation and AI-enabled content enhancement. Deep learning and reinforcement learning are the fundamental technologies supporting these areas. We are the pioneer of research and technologies in multiple areas, which has enabled us to be an early mover in several industry verticals. As of June 30, 2021, we had won over 70 first-prize awards in global competitions.

- We were the first to surpass human eyes' performance on face recognition in 2014, which was an important milestone for industrial applications of AI. In 2020, we won five champions in Face Recognition Vendor Test (FRVT), one of the most recognized competitions in face recognition, awarded by the National Institute of Standards and Technology (NIST) USA.

- We developed as the base model a neural network with 1,207 layers, which was the deepest neural network in 2015. It was one of the earliest methods of training that was applied to very large models. The models were typically around one hundred or fewer layers at that time. With powerful base models, we have achieved superior performance in addressing long-tail recognition problems in Smart Business, Smart City and autonomous driving. We won the ImageNet challenge organized by Stanford University and Google, which included 1,000 object categories and was an influential challenge for visual perception during 2010-2017. We also won the COCO challenge organized by Microsoft, Google and Facebook, which included 1.5 million object instances:

  - ImageNet Large Scale Visual Recognition Challenge
    - Champion in Object Detection from Video in 2015
    - Champion in Object Detection, Object Detection from Video and Scene Classification in 2016
  - Microsoft Common Objects in Context (COCO)
    - Champion in Image Classification in 2017
    - Champion in Object Detection in 2018
    - Champion in Detection and Panoptic in 2019

- Starting our research in 2016, we were among the first to develop industrial-grade AutoML technology. In 2018, we authored one of the first two papers on AutoML ever published at CVPR.

- We invented the first super resolution technology with deep learning in 2014. Our super resolution photography products have been widely used by top mobile phone manufacturers. We won eight champions in NTIRE, the most important challenge for enhancing image and video quality, such as:

  — New Trends in Image Restoration and Enhancement Workshop and Challenges (NTIRE)

    ○ Two champions in the Video Deblurring Challenge, 2019

    ○ Three champions in the Video Super-Resolution Challenge, 2019 and 2021

    ○ Champion in Spectral Reconstruction from an RGB Image, 2020

    ○ Two champions in the Quality Enhancement of Heavily Compressed Videos Challenge, 2021

- We were among the first companies in Asia to develop L4 autonomous driving technologies with top global OEMs. We won 18 champions in global competitions related to autonomous driving, such as:

  — The KITTI Vision Benchmark Suite by Karlsruhe Institute of Technology and Toyota Technological Institute at Chicago (KITTI), which is the large vision benchmark for autonomous driving

    ○ Champion in Pedestrian and Vehicle Detection in 2016

    ○ Champion in the KITTI Stereo 2015 Benchmark in 2017

    ○ Champion in the Moderate Level of KITTI 3D Object Detection in 2019

  — Cityscapes, which is one of the largest well-recognized benchmarks for image segmentation in autonomously driving

    ○ Champion in the Pixel-level Semantic Labeling Task in 2016

- We are a pioneer in applying deep learning to action recognition. We developed temporal segmental networks (TSN), which substantially extends the capability of handling long videos and has been widely used in industrial settings. Action recognition plays a

significant role in Smart Business and Smart City. We won the action recognition competition ActivityNet several times:

- ActivityNet, the most influential benchmark for action recognition and with 200 event categories
  - Champion in Untrimmed Classification Challenge in 2016
  - Champion in Activitynet-2020 Kinetics-700 Challenge in 2020
  - Champion in Temporal Localization Challenge in 2021

- We enable traffic optimization with AI supported by our advanced tracking technologies. We won five champion challenges in object tracking, including:
  - Multiple Object Tracking (MOT) Challenge, the top benchmark for object tracking
    - Champion in the Multiple Objects Tracking Benchmark in 2016

- We have been the pioneers of applying AR effect to Internet live broadcasting and video generation since 2016. Our design of facial key points for generating AR effects has become one of the industry standards in this vertical. We were first to successfully implement six degrees of freedom object tracking on a large scale, which is a core technology in AR, in H5 and applet for commercial usage in 2020. It is crucial for our AR technology to be used on a broad range of mobile phones.
  - We won the best paper award in ISMAR 2020, a top conference on AR and MR, and ours was the first paper from Asia to achieve this.

We have published over 600 papers in leading academic conferences and journals, among which over 500 papers were published at the world's three most influential computer vision conferences, namely, CVPR, ICCV and ECCV. According to Frost & Sullivan, we ranked number one in terms of the number of papers published in CVPR, ICCV and ECCV during January 1, 2015 to June 30, 2021.

Development

We have built an experienced product development and deployment team across domestic and overseas markets. Our team supports large-scale deployment, rapid iteration and continuous maintenance of products with strict guidelines. In addition, our user experience design (UED) team focuses on innovations of the design of AI products, including user experience research, interaction design and visual design. As of June 30, 2021, over 800 patents on product design had been granted.

We consider technological capabilities as a key part of our core competencies. Over the years, we have developed a number of key technology capabilities across multiple domains, including heterogeneous parallel computing, cross-platform compilation, large-scale parallel training, massive data storage, distributed scheduling, large scale vector search, IoT connectivity and management, security and cloud. Set forth below are the key highlights of our prominent advanced technology capabilities:

- ***AI chip-accelerated distributed vector search engine***: This is a core engine in SenseFoundry for city-grade information matching, and supports vector search on a database with 100 billion features. It integrates (i) distributed database technologies and (ii) deep learning-based vector compression and fast search. It achieves the requirements of high availability, high scalability and high concurrency, which are often required in real world applications.

- ***"Compile once and run anywhere" runtime framework***: This framework enables efficient deployment of AI models on different types of cloud, edge and end devices. We achieve this through a cross-platform runtime framework that integrates AI model inference with business logic in specific scenarios.

- ***Large-scale IoT connectivity and management***: Such capability is essential for all the software platforms to connect with a large amount of IoT devices. Our IoT connectivity engine is optimized for AI applications of sensors. It is compatible with network cameras, smart devices and roadside units, and supports data access, transmission and storage with millions of devices.

- ***Product security***: We have built a professional security management team with rich experience in data compliance, classified protection of cybersecurity, development of security platforms and penetration testing. A security management system has been built to set control points for security compliance throughout the life cycle of products.

Initiatives for Next Breakthroughs

We are exploring new areas which may lead to the next generation of AI technologies. For example, as AI models are becoming larger and more complex, GPUs may be inadequate to train some advanced models. We tackle this challenge by leveraging our comprehensive AI chips, AI software platforms and AI models design and development capabilities. Other initiatives include AI-enabled content generation, next generation of AI sensors and improving the operation and power efficiency of AIDC with decision intelligence.

R&D Collaboration

We have conducted R&D collaboration with academic institutes for sustainable technology innovations, which attracts and cultivates AI talent, supporting our fast growth. We established Qing Yuan Research Institute with SJTU in 2020, which is planned to have 20 senior research faculty members within five years focusing on basic theoretical research and technological innovation of AI. We have established an AI joint lab with a renowned university in Southeast Asia to provide strong R&D support for expansion of our business in the area. It is planned to have 125 members of

research staff including PhDs, research fellows and professors in five years. We are the founding member of the Global Artificial Intelligence Academic Alliance, which has 18 global universities as members. We share our SenseCore with our collaborating universities and professors, who also contribute to OpenMMLab and OpenDILab. Such collaborations also provide our academic partners with opportunities of finding inspiring research topics stemming from industrial applications. As of June 30, 2021, we had close collaboration with 52 universities, established 15 joint laboratories and carried out 257 joint research projects.

We have a long-term internship program focusing on cultivation of future AI talent. In the past six years, we trained over 3,500 students in this program. Many of them have subsequently joined us right away or after pursuing advanced degrees at top universities across the globe.

INTELLECTUAL PROPERTY

Our intellectual property is critical to our innovation which underpins our success. We seek to protect our intellectual property through a combination of patents, copyrights, trademarks, domain names, trade secrets, confidentiality agreements and other measures.

As of June 30, 2021, we had an extensive portfolio of 8,123 intellectual property rights, including 4,169 patent assets in China and 3,954 overseas patent assets. We are among the companies with the largest portfolio of invention patents in the AI industry in Asia as of June 30, 2021, according to Frost & Sullivan. As of June 30, 2021, out of our patent assets, among which 1,324 were granted patents and 6,799 were patent applications pending approval, and 7,134 were inventions. Our overseas patent assets, including 256 granted patents, span across 20 countries and regions, primarily in East Asia, the United States and Southeast Asia. We have also applied for 971 PCT international patents.

As a long-term leader of AI technology innovation, we have established our extensive patent portfolio covering all key aspects of our businesses. Our patents for fundamental and core technologies primarily include: (i) 389 patent assets for SenseCore AI infrastructure; (ii) 4,072 patent assets for perception and decision intelligence; (iii) 458 patent assets for AI-enabled content enhancement; (iv) 1,463 patent assets for AI-enabled content generation; (v) 89 patent assets for AI chips and sensors; (vi) 475 patent assets for medical image analysis; and (vii) 1,100 patent assets for smart automobile technology.

As of June 30, 2021, we also had 4,178 registered trademarks and trademark applications, 497 registered software copyrights, 57 registered copyrights and 591 registered domain names.

See "Appendix IV — Statutory and General Information — Further Information about our Business — Intellectual Property Rights."

We have designed and adopted comprehensive measures to protect our intellectual property. We enter into employment agreements with confidentiality, non-compete covenants and intellectual

property ownership clauses with our employees, certain consultants and advisors. They acknowledge that the intellectual property developed by them in connection with their employment with us, including our in-house developed content, is our property.

During the Track Record Period and as of the Latest Practicable Date, we had not been subject to any material disputes or claims for infringement of third parties' trademarks, licenses and other intellectual property rights. However, unauthorized use of our intellectual properties by third parties and expenses incurred to protect our intellectual property rights may materially and adversely affect our business and operations. See "Risk Factors — Risks Relating to Our Business and Industry — Unauthorized use of our intellectual properties by third parties may harm our brands and reputation and materially and adversely affect our business, and we may incur substantial expenses to protect our intellectual property rights" and "Risk Factors — Risks Relating to Our Business and Industry — We may be subject to intellectual property infringement claims, which could be time-consuming or costly to defend and may result in diversion of our financial and management resources."

DATA PRIVACY AND PERSONAL INFORMATION PROTECTION

We attach the greatest importance to data security and protection. We have adopted our standard protective measures including confidentiality categorization, access control, data encryption and desensitization to prevent unauthorized access, leakage, improper use or modification of, damage to or loss of data and personal information.

Our Data Security and Personal Information Protection Management Committee oversees our data security and personal information protection efforts. We have built up a comprehensive personal information management system and formulated a series of technical standards and specifications to ensure data and personal information security throughout their life cycle.

We set forth below the key principles of our data and personal information protection measures:

- ***Authorized access and use of data***

Our customers entrust us to process their data for certain of our business cooperation. We request our customers to confirm that they have acquired such data from legitimate sources and obtained the rights to use such data, with their end users' consent for the purposes specified in our agreements. We only use data for purposes explicitly authorized by our customers, such as identity verification, record-keeping and statistics, and do not use data for purposes without prior approval and consent. We continuously monitor our data processing collaboration with third parties, and regularly review the content of such collaborations, the scope of the collaboration agreements and the execution of such agreements to ensure compliance with relevant laws and regulations.

- ***Independent database and secure server system***

We have our own database and do not share customer or end user personal information with other third parties. Our server systems are protected with heightened levels of security. We regularly conduct user account auditing and monitoring of our server operations. Once we discover security issues with certain server systems, we will promptly upgrade such systems to ensure the security of our server systems and applications. We have enhanced encryption strength of sensitive personal information in our systems to ensure data confidentiality. We have a comprehensive personal information security and management system, covering security management of our data, source code, personal information, third-party personnel, cybersecurity incidents and infrastructure.

- ***Comprehensive data and personal information security and management policies***

We have implemented comprehensive employee confidentiality policies, data use approval procedures and data tracking mechanisms to ensure the security of our database. We have formulated corresponding workplace procedures based on relevant rules and regulations. As a data processor, we have implemented multiple data protection and cybersecurity measures to ensure our proper handling of sensitive data, including our data desensitization technology used for all data training activities. Through continuous investment in technology advancement, we have improved our overall security capabilities. Meanwhile, we have obtained multiple certifications, including the information security management system certification (ISO/IEC 27001:2013), the personally identifiable information protection management system certification (ISO/IEC 29151:2017) and the privacy information management system certification (ISO/IEC 27701:2019), and our key products have passed multi-level protection of information security evaluation. Moreover, our product design puts great emphasis on data security, and our products must pass data privacy evaluations and security tests before launching or delivery to customers.

- ***Regular audit and contingency plan***

We conduct a special audit of our data security compliance status each year. We have formulated a cybersecurity contingency plan and conduct training and safety drills every year in preparation for any emergency cybersecurity incidents. In the event that our security measures are compromised, we will report to the competent authority in accordance with relevant laws and regulations, and promptly inform impacted users.

RESPONSIBLE AND SUSTAINABLE AI

We are committed to the principles of responsible AI, and strive to address potential challenges to the sustainable development of global society, economy and technology.

Adherence to Principles of Responsible AI

We published our white paper Responsible AI that Promotes Sustainable Development of Humanity on Code of Ethics for Sustainable AI Development in June 2020 laying down the foundation for our AI ethics discourse, which has been included in the Resource Guide on Artificial

Intelligence Strategies released by the United Nations Department of Economic and Social Affairs. In 2021, we further crystalized our core ethical principles of responsible AI ("AI Ethics Principles"):

- ***The Principle of Sustainability***: We are committed to promoting AI ethics governance to ensure that AI will enhance sustainable economic, cultural and environmental development across society. Under the Principle of Sustainability, we endorse open and inclusive collaboration, promote AI's important role in environmental protection and peaceful development, advocate for social awareness of AI ethics, and actively explore the application of innovative and sustainable AI governance models.

- ***The Principle of Human-Centric Approach***: We believe the benefits brought by AI technology must be eventually shared with everyone, and not just a selected few. We strive to pursue inclusive digital ethics built on a value system that conforms to moral consensuses across different cultures. We respect and accommodate for diversities across nations and regions, and endeavor to minimize bias arising from differences in culture, ethnic origins, jurisdictions or other attributes. Under the Principle of Human-Centric Approach, we place strong emphasis on human rights, privacy protection and unbiased application of technology.

- ***The Principle of Controllable Technology***: We believe AI technology should remain under human oversight and control. We recognize the importance of raising people's awareness of the benefits as well as the potential risks of AI technology. Key attributes such as legality, verifiability, certification, creditability, responsibility and reliability must be closely scrutinized before the adoption of any AI technology. Under the Principle of Controllable Technology, we abide by applicable laws and regulations in relevant jurisdictions, and strive to build trust through our commitment to apply our AI technologies audibly, openly and transparently.

Guided by these three principles, we apply our leading AI technology to tackle global challenges such as the COVID-19 pandemic and climate change, as well as to promote innovation, collaboration, environmental-friendliness and openness in the long run.

AI Ethics Initiatives

By adhering to the three AI Ethics Principles, we have devoted our active efforts in relation to AI ethics in the following aspects:

Organizational Structure and Governance

Our AI Ethics Council leads responsible and sustainable AI initiatives. Our AI Ethics Council comprises six members, including two external advisors, who are academic experts in the field of AI ethics, and four senior management members. Our AI Ethics Council is responsible for determining and implementing our AI ethics-related principles, strategy and policies. It mobilizes internal resources and engages with external key stakeholders to review and advise our AI ethics practices, to ensure that values such as professionalism, neutrality and objectivity are observed in our operations.

Inhouse Efforts

In adherence to the three AI Ethics Principles, we have implemented a number of initiatives in aspects of our operations, including risk controls, research and training.

AI Ethical Risk Control Scheme

We have set up our AI ethics review process to review and monitor potential ethical risks across the lifecycles of our products and services, starting from project approval, product release, to continuous monitoring of the operation, and the subsequent release of such products and services. Our ethics review process evaluates projects and services based on standards which conform to our aforementioned three AI Ethics Principles. During the evaluation process, we may elect to turn down new product proposals, terminate on-going product development projects or discontinue existing products which fail to meet our principles and standards. We also put much emphasis on data privacy protection by conducting comprehensive review of all our products and services. For details of our review process on data privacy protection measures, see "— Data Privacy and Personal Information Protection." We have also engaged external consultants to advise on our review process and risk management model to ensure ethical compliance of our products and services.

Our Global AI Ethics Research Achievements

Our research in AI ethics covers a broad range of subjects, including but not limited to AI ethics and law, AI governance and sustainable AI. We believe such research efforts solidify the foundation of, as well as enable the industrial integration and implementation of, our AI ethical principles. As of June 30, 2021, our research has been included in various international and domestic reports, including the Policy Guidance in AI for Children published by United Nations International Children's Emergency Fund.

In addition, we have established a Global AI Ethics Case Database since 2019 to keep track of the ever-evolving developments and ethical challenges in the AI industry around the world. Our Database has collected hundreds of case studies on both positive and negative real-life applications of AI, ranging from city governance, AI education and AI healthcare to autonomous driving. We use our AI Ethics Case Database as a key reference point when developing our white papers on AI ethics governance policies for different regions around the world.

Training and Promotion of AI Ethics

We organize periodic training on AI ethics for our employees. We design and continuously update our own ethics training curriculums and materials. We believe regular training can enhance our employees' ethical awareness in their daily work, which is crucial in ensuring the AI ethical compliance of the Group.

Collaborations

We collaborate with third-party institutions and think tanks, which allows us to keep abreast of the latest developments in the field, and to maintain neutrality and objectivity in the implementation of our AI ethics practice. It also reinforces our status as the industry leader in the AI ecosystem, and further enhances our influence in the advocacy for responsible and sustainable AI.

External Research and Collaboration

To advance our principle of human-centric approach in the area of AI governance, we serve as the vice chair-member at the Institute for AI International Governance of Tsinghua University, a leading Chinese academic institution in the field of AI governance, represented by renowned scholars from China and abroad. We collaborated with these scholars to promote research in innovative and sustainable governance models, such as agile governance.

We advocate our principle of controllable technology in the area of AI law and compliance, and have jointly established the Research Center for Computational Law and Artificial Intelligence Ethics with Shanghai Jiao Tong University to conduct research in areas such as data safety, privacy protection and unbiased algorithms. We have also collaborated with other institutes to conduct research on the interpretability of AI algorithms.

To further promote global development on our principle of sustainability, we have collaborated closely with the United Nations and other international organizations. In the Resource Guide on Artificial Intelligence (AI) Strategies released by the United Nations in June 2021, our white paper Code of Ethics for Sustainable AI Development was designated as one of the key reference publications from the private sector.

Initiatives on Setting AI Ethical Standards

We serve as the Vice Chair of the AI Reliable National Standards Working Group. We led the drafting of 13 national or organizational AI ethical standards initiated by the AI Reliable National Standards Working Group. These standards include Artificial intelligence — Risk assessment model, Artificial Intelligence — Evaluation Guidelines for Ethical Risk and others. We also serve as the Vice Chair-member of the Shanghai Artificial Intelligence Standardization Technical Committee, allowing us to be closely involved in setting industry standards in multiple areas such as responsible AI, AI ethics and data security.

ENVIRONMENTAL, SOCIAL AND GOVERNANCE MATTERS

Making a positive environmental, social and governance (ESG) impact on our communities is an integral part of our business and has been our core value since inception. Leveraging our AI technology and platform, we commit to creating sustainable value for our partners, customers, investors, employees and society, hence building a healthy, vibrant and sustainable ecosystem.

Nurturing Next Generation AI Talents

Since publishing the first edition of our AI textbook in collaboration with East China Normal University in 2018, we have been actively supporting AI education in China's public schools. We have designed a comprehensive AI curriculum supplemented by a full set of teaching materials, including textbooks, a software platform for interactive student-teacher experiments and other teaching tools.

As of June 30, 2021, through our collaborations with local schools and education authorities, we have brought AI courses to more than 2,700 primary and secondary schools in more than 30 cities. We have also provided training to over 7,200 teachers on up-to-date AI-related subjects.

We have been providing free online and offline AI courses, covering various topics on real-life applications of AI. Through these courses, we believe academic communities can be further integrated to participate in the latest developments of businesses and industries, hence expediting the conversion of AI technologies to applications across diverse industries.

Fighting COVID-19

During the COVID-19 pandemic, we promptly upgraded our SenseCare-Lung Pro software in response and provided the product for free to hospitals and medical institutions to help improve the efficiency and accuracy of COVID-19 diagnoses based on CT images. We also provided free AI computing resources for virus analysis and vaccine research. We have developed contactless temperature measurement products that can be used both indoors and outdoors to help with pandemic control.

Since early 2020, we have donated over 300,000 masks and other protective equipment to hospitals, universities and other institutions in need around the world.

Caring for the Disadvantaged

We are dedicated to making AI available and useful for disadvantaged groups. For example, we introduced a smart portable and wearable device for the visually impaired, so as to enable them to live more independently. Our device is able to detect barriers and obstacles and send alerts to the user, so that the visually impaired can maneuver around obstacles in time. We have been cooperating with several local governments and charities to provide AI-empowered brain computer interface technology, which is aimed at improving the living standard for individuals with prostheses.

Environmental Protection

We are committed to achieving carbon neutrality through our energy-saving and sustainable development initiatives. We adopt an intelligent energy platform to achieve the most efficient use of

energy within our owned office building. We also develop AI algorithms, sensors and chips with the goal of minimizing power consumption of AI software and products. Our Shanghai Lingang AIDC will aggregate computing needs from small- and medium-sized enterprises, and increase the overall computing efficiency for society. We have also invested in various energy optimization offerings such as PUE factor calculation and photovoltaics to further reduce our carbon footprint.

Caring for our People

Our employees are crucial to our success. We identify talent at the early stage of their careers, and invest heavily in training and retaining them. We provide adequate resources to help them succeed, including easy access to our supercomputing clusters, internal open-source program, sharing of industry-related insights and knowledge and regular training seminars.

We encourage a healthy work-life balance for all of our employees. We believe in "working smart" and have therefore invested heavily in automating part of the work process to enhance efficiency. We promote a healthy lifestyle by providing employees with access to welfare services such as fitness facilities, nursing lounges and health consulting services. We also conduct periodical employee feedback surveys and implement changes accordingly.

SALES AND MARKETING

Sales

We primarily adopt a direct sales model, and have built a professional sales team with an average of ten years' work experience and in-depth industry insights and experience in their respective industry verticals. The extensive experience of the sales team has been essential for the successful adoption and implementation of AI software in a wide variety of industries across different geographies.

We have made significant investments in our sales and marketing efforts globally. As of June 30, 2021, our sales team comprised more than 900 employees. We have an established physical presence across various countries and regions, including Mainland China, Hong Kong, Macau, Japan, South Korea, Singapore, Malaysia, Saudi Arabia and the UAE. We use regional hubs such as Singapore to cover neighboring countries. We have also established sales offices in major cities in mainland China, including Shanghai, Beijing, Shenzhen, Chengdu, Hangzhou, Nanjing, Xi'an, Qingdao, Sanya and Nanping. Through these sales offices, we have extended our reach to almost all provinces in Mainland China.

Our sales team is typically organized by industry verticals, and has deep knowledge of the industries and customers it covers. Leveraging its deep industry experiences, our sales team identifies market trends and customers' demands thoroughly and simultaneously works closely with our R&D team to ensure that they can accurately address customer pain points and deliver products and services to the customers' satisfaction in a timely manner. We often cooperate with a launch

customer when we enter a new industry, and this type of close collaboration allows us to accumulate industry expertise and demonstrate our technological capabilities and full-stack software platforms and applications, which could later serve as showcases for other potential customers and thereby further penetrate the industry vertical.

Certain members of our sales team are responsible for serving our key customers, and such arrangement allows us to maintain close relationships with such customers, understand and anticipate their needs and identify new business opportunities. This arrangement enables us to continuously enrich our offerings, improve our capabilities and promote wider adoption of our products, thus generating more revenues, promoting our ecosystem and driving sustainable growth of our business.

To encourage and incentivize our sales team, we have designed a compensation structure that includes a fixed component as well as a performance-based component. We set specific performance targets for each team member. We evaluate such employee's performance twice a year and pay out performance-based compensation accordingly.

Marketing and Branding

As we build a global brand associated with technology-driven innovation, we have employed a comprehensive marketing and branding strategy by utilizing various channels to reach potential customers, including in-person and online events, content marketing, partner marketing, developer outreach, search engine optimization, social media and public relations.

We hosted and participated in various offline events, such as industry conferences, product launch events and developer forums to showcase customer success stories and developer breakthroughs and to deepen industry connections, including the World Artificial Intelligence Conference in Shanghai, ConnecTechAsia in Singapore and the AI Everything Summit in Dubai. Such high-profile events allow us to demonstrate how AI applications can empower public and private sectors. Through establishing exhibition booths at these regional and global events, our potential customers around the world may experience how we digitalize cities and businesses with AI technology.

We have also established a number of AI Experience Centers worldwide, where customers and partners learn about a wide range of AI use cases and interact with AI technology in an immersive environment. In July 2021, we unveiled our AI Innovation Hub in Singapore, one of the firsts in Southeast Asia, to exemplify our technological capabilities and partner ecosystem in the region.

In addition, we further enhance awareness of our brand and promote our new and existing products and services through online channels. Examples of such efforts include regular sharing on our social media platforms and interacting with developers through code-sharing platforms.

Market Entry Strategy

We enter new markets through establishing engagements with global early adopters, or launch customers, across a range of industries. Such strategy allows us to leverage their leading position to better penetrate into new industry verticals. We also closely cooperate or enter into long-term R&D collaborations with our launch customers to explore different AI use cases, develop tailored products and showcase AI-empowered applications. As such, we have effectively expanded our offerings in different industry verticals. Simultaneously, our launch customers' local and global positioning allows us to expand into the different geographical markets they operate in.

Upon implementation of products to similar customers, we also leverage synergies across markets to iteratively upgrade and refine our products, thereby creating affordable standardized products to accelerate the commercialization of AI technology.

CUSTOMERS

We have a broad and diverse customer base, which has expanded rapidly over the Track Record Period. We have built an experienced team that is knowledgeable about both the technology advancements as well as the pain points faced by participants in the relevant industry verticals, allowing us to provide our software platforms that directly address customer needs. Our customers include enterprises across different industry verticals, city administrators and public sector entities. For information as to customers for each of our software platforms, see "— Our Software Platforms."

We generally enter into written agreements with our customers, the major terms and conditions of which are set out below:

- ***Service scope***: We provide licenses of use rights to our software, maintenance and upgrade service related to our software and/or hardware products embedded with our software and from R&D services.

- ***Pricing***: Our pricing is primarily determined by functions of products, scope of services, costs of procuring hardware and components and value created for our customers. In addition, we take into consideration the technological sophistication and advantages of our products, prices of our competitors' offerings and overall market demand.

- ***Ownership***: All intellectual property rights of the software, products, services and technical materials provided by us under the agreement belong to us and will not change due to the transfer of product ownership. For agreements involving new R&D requirements, the ownership of intellectual property rights for such R&D results is based on commercial negotiations. No party shall conduct any reverse engineering, decompiling, disassembly or use other methods to obtain the source code and underlying algorithms of the software, hardware and related technologies provided by any other party.

- ***Data use***: When necessary, our customers may authorize us to process their data for the purposes agreed upon with them. In circumstances where the data is from or generated by

our customers' users, we obtain consent from our customers for the purposes specified in our cooperation agreements. We typically undertake to comply with all applicable laws and regulations in connection with the collection of our customers' data, including but not limited to any laws in respect of intellectual property rights, privacy, data protection and image rights. For details, see "— Data Privacy and Personal Information Protection."

- ***Compliance***: Customers certify that all products or services will be used in compliance with all applicable laws and regulations.

- ***Confidentiality***: Each party shall maintain confidentiality of information obtained in relation to the relevant agreement and its contractual terms, and not use information obtained for other purposes.

The majority of our customers are end users of our products and services, while some of our customers are system integrators. Some end users in Smart City engage system integrators when selecting suppliers or service providers. Such system integrators help end users by directly negotiating with a large number of suppliers or service providers, although in most cases the end users will also need to approve and confirm the suppliers selection, especially for core suppliers, including AI software platform providers. Usually before a city administrator launches a project for a city management system, it lays out the goals it plans to achieve and the budget for the project and engages a system integrator which will provide various types of assistance in project implementation, such as advising on financing plans, selecting suppliers, managing construction and integrating the work products of different suppliers. In 2018, 2019, 2020 and the six months ended June 30, 2021, we had a total of 732, 1,165, 1,225 and 853 customers, respectively, among which 29.1%, 34.7%, 33.1% and 24.7% were system integrators, respectively.

Although a portion of our customers are system integrators, not end users, we do not believe our business model is a distributorship model. As stated above, system integrators are not distributors that we engage to broaden our sales channels; rather, they are agents selected by our end users, such as government agencies and businesses, to implement their projects, and the ultimate decisions as to which service provider to choose are primarily made by the end users. Regardless of whether our contracts were entered into directly with our end users or with system integrators, there is no material disparity in contract terms and the scope of our services. When we enter into a contract with a system integrator, we recognize such system integrator, instead of the relevant end user, as our customer. As such, we do not believe system integrators to be our distributors, and do not believe their involvement as our direct customers raises any concern in relation to inventory risk, cannibalization or recoverability of accounts receivables.

We have a diverse customer base and we do not rely on customers from specific industry verticals. Revenue generated from our largest customer for the years ended December 31, 2018, 2019, 2020 and the six months ended June 30, 2021 accounted for 8.7%, 7.7%, 11.9% and 22.9%, respectively, of our total revenues during those periods. Revenue generated from our five largest customers for the years ended December 31, 2018, 2019, 2020 and the six months ended June 30, 2021 accounted for 28.4%, 26.3%, 31.4% and 59.3%, respectively, of our total revenues during those periods.

Customer	Type of products/services provided	Year of commencement of business relationship	Revenue contribution *(RMB million)*	Percentage of our total revenue
2018				
Customer A	AI software platform and related services Advanced AI software	2018	160.7	8.7%
Customer B	Research and development services	2017	129.2	7.0%
Customer C	AI software-embedded hardware	2015	93.4	5.0%
Customer D	AI software-embedded hardware	2018	71.7	3.9%
Customer E	AI software platform and related services	2018	69.7	3.8%
Total			**524.7**	**28.4%**
2019				
Customer F	AI software-embedded hardware Advanced AI software	2019	233.8	7.7%
Customer G	AI software platform and related services	2019	209.6	6.9%
Customer E	Advanced AI software AI software-embedded hardware	2018	150.3	5.0%
Customer B	Research and development services	2017	129.1	4.3%
Customer H	AI software platform and related services Advanced AI software	2018	73.1	2.4%
Total			**795.8**	**26.3%**
2020				
Customer I	AI software platform and related services Advanced AI software	2019	411.6	11.9%
Customer J	AI software platform and related services	2020	202.9	5.9%
Customer K	AI software-embedded hardware Research and development services Advanced AI software	2018	187.9	5.5%
Customer F	AI software-embedded hardware Advanced AI software	2019	155.3	4.5%
Customer B	Research and development services	2017	124.3	3.6%
Total			**1,082.0**	**31.4%**
Six months ended June 30, 2021				
Customer L	AI software platform and related services	2020	378.3	22.9%
Customer I	AI software platform and related services Advanced AI software	2019	246.4	14.9%
Customer J	AI software platform and related services	2020	142.2	8.6%
Customer M	AI software platform and related services	2020	127.1	7.7%
Customer N	Advanced AI software	2019	85.8	5.2%
Total			**979.8**	**59.3%**

As of the Latest Practicable Date, except for SoftBank, none of our Directors, their associates or any of our shareholders, who owned or, to the knowledge of Directors, had owned more than 5% of our issued share capital, had any interest in any of our five largest customers.

SUPPLIERS

Our product offerings include AI software-embedded hardware. We procure servers and other hardware components, some of which designed by us with production outsourced to contract manufacturers, to be embedded with our AI software.

We typically engage reputable vendors to ensure the quality of our products. The factors that may affect our selection mainly include technological expertise, product quality, qualifications and credentials, market reputation and price. We generally enter into framework agreements with our vendors, which set forth the general terms and conditions of purchase.

Charges from our largest supplier for the years ended December 31, 2018, 2019, 2020 and the six months ended June 30, 2021 accounted for 9.6%, 15.6%, 22.8%, and 31.6%, respectively, of our total purchase during those periods. Purchase amounts from our five largest suppliers for the years ended December 31, 2018, 2019, 2020 and the six months ended June 30, 2021, accounted for 35.4%, 39.5%, 45.0% and 61.6%, respectively, of our total purchase during those periods.

Supplier	Type of products/services provided	Year of commencement of business relationship	Purchase amount *(RMB million)*	Percentage of our total purchase
2018				
Supplier A	Server	2018	91.6	9.6%
Supplier B	Other hardware	2016	85.2	9.0%
Supplier C	Other hardware	2016	68.8	7.2%
Supplier D	Server	2018	51.9	5.5%
Supplier E	Server	2018	39.2	4.1%
Total			**336.7**	**35.4%**
2019				
Supplier A	Server	2018	251.1	15.6%
Supplier F	Other hardware	2019	126.3	7.8%
Supplier G	Server	2019	107.0	6.6%
Supplier H	Other hardware	2019	77.8	4.8%
Supplier I	Other hardware	2019	75.1	4.7%
Total			**637.4**	**39.5%**
2020				
Supplier A	Server	2018	291.9	22.8%
Supplier J	Other hardware	2020	95.1	7.4%
Supplier E	Server	2018	79.2	6.2%
Supplier K	Server and other hardware	2020	55.6	4.3%
Supplier L	Server and other hardware	2020	53.1	4.2%
Total			**574.9**	**45.0%**
Six months ended June 30, 2021				
Supplier M	Server and other hardware	2021	106.9	31.6%
Supplier A	Server	2018	59.2	17.5%
Supplier N	Other hardware	2019	20.4	6.0%
Supplier O	Server and other hardware	2019	12.1	3.6%
Supplier P	Other hardware	2020	9.5	2.8%
Total			**208.1**	**61.6%**

As of the Latest Practicable Date, none of our Directors, their associates or any of our shareholders, who owned or, to the knowledge of the Directors, had owned more than 5% of our issued share capital, had any interest in any of our five largest suppliers.

OVERLAP OF CUSTOMER AND SUPPLIER

During the Track Record Period, a cloud computing company was one of our top five customers and acted as our supplier. Our sales to this company accounted for 8.7%, 1.2%, 0.1% and 0.5% of our total revenue in 2018, 2019, 2020 and the six months ended June 30, 2021, respectively. During the Track Record Period, our sales to this company, which serves as a system integrator for various smart city projects, primarily consisted of our Smart City software products and services. Our purchases from this company primarily consisted of servers and cloud services consumed in our R&D activities.

Negotiations of the terms of sales to the company mentioned above and purchases from it were conducted separately, and the sales and purchases were neither connected nor conditional upon each other. Our Directors are of the view that such arrangements are mutually beneficial, given that we negotiated with such company on an arm's-length basis. In addition, the terms of transactions with the company mentioned above are in line with market practice and similar to those with our other customers and suppliers.

LOGISTICS AND INVENTORY MANAGEMENT

Logistics

Our hardware products are typically delivered directly from our vendor warehouses to the venue specified by our customers. We also engage reputable third-party logistics service providers for delivery to our customers from the two warehouses that we lease and operate in Shenzhen. To the best of our knowledge, all of these logistics service providers are Independent Third Parties.

Inventory Management

Our inventories mainly include servers and other smart hardware devices. Our inventories amounted to RMB117.3 million, RMB430.1 million, RMB715.5 million and RMB667.2 million as of December 31, 2018, 2019 and 2020 and June 30, 2021, respectively. We regularly track our inventory to keep it at a level sufficient to fulfill customers' orders. We also proactively assess changes in market conditions and pre-store strategic raw materials in anticipation of potential supply shortage. Our supply management team reviews our inventory aging reports routinely with the business operation team and takes necessary actions to minimize risks of obsolescence.

QUALITY CONTROL

We are committed to providing customers with our products and services of consistently high quality. In compliance with industry standards, we have established a professional quality control team and formulated a set of quality control measures to closely monitor and standardize our full research-to-production cycle, including supervising the product design process, managing product

requirement documents, specifying design and technology requirements for product R&D and handling defective finished products. We also set up multiple quality control points to unify the standards of quality control throughout the entire production cycle, in order to optimize our product quality continuously.

In relation to our quality control and test automation, we independently developed a one-stop testing management tool for AI products to link up key control points such as automated testing and defect tracking and reporting. Before entering into partnership with contract manufacturers, we will carefully review their licenses, relevant credentials and technical expertise, to ensure our continuous quality monitoring throughout the cooperation.

In the meantime, we established a comprehensive quality control system, and obtained multiple professional qualifications, which laid a solid foundation for the consistent delivery of high-standard products. We have registered ISO9001 (Quality Management System), ISO/IEC20000 (IT Service Management), CMMI Level 3 certification ITSS (Information Technology Service Standards), ISO/IEC 27701 (Privacy Information Management) and other important qualifications. In the field of Smart Auto, we have obtained ASPICE L2 and ASIL-B certifications.

COMPETITION

The AI software market is highly competitive. It is characterized by rapid technological advances and frequent upgrades that have substantially expanded the application of AI technology. We are subject to competition from other companies that focus on developing and commercializing AI technology. We may also in the future face competition from new entrants that will increase the level of competition. For example, more established technology companies that possess substantial financial resources, sophisticated technological capabilities and broad distribution channels may develop AI solutions that directly compete with ours. Principal competitive factors important to us include our universal AI infrastructure, productivity of model training to tackle long-tail scenarios, cross-vertical service capabilities, continuous technological innovation, R&D capabilities and talents. For additional details regarding the competitive landscape of the industry in which we operate, see "Industry Overview."

For risks relating to our competitiveness in the industry, see "Risk Factors — Risks Relating to Our Business and Industry — If we fail to continuously develop and innovate our products and services to meet our customers' evolving requirements of functionality, performance, reliability, design and security, we may not be able to retain existing customers, attract new customers or increase sales."

EMPLOYEES

As of June 30, 2021, we had 5,286 employees. The following table sets forth the number of our employees by function:

Employee Function	Number of employees	% of Total
Research and Development	3,593	68.0
Sales and Marketing	925	17.5
Administration	768	14.5
Total	5,286	**100.0**

We participate in employee social security plans that are organized by applicable local municipal and provincial governments, including housing, pension, medical, work-related injury, maternity and unemployment benefit plans to the extent required under applicable laws and regulations. We enter into employment contracts and agreements regarding confidentiality, intellectual property and non-competition with our executive officers, managers and employees.

None of our employees are currently represented by labor unions. We believe we maintain a good working relationship with our employees and we have not experienced any material labor dispute or any difficulty in recruiting staff for our operations during the Track Record Period and up to the Latest Practicable Date.

INSURANCE

We consider our insurance coverage to be adequate as we maintain all the mandatory insurance policies required by PRC laws and regulations and in accordance with the commercial practices in our industry. Our employee-related insurance consists of pension insurance, maternity insurance, unemployment insurance, work-related injury insurance and medical insurance, as required by PRC laws and regulations.

In line with general market practice, we do not maintain any business interruption insurance or product liability insurance which are not mandatory under the laws of the relevant jurisdictions. We do not maintain keyman insurance, insurance policies covering damages to our network infrastructures or information technology systems. During the Track Record Period, we did not make any material insurance claims in relation to our business. See "Risk Factors — Risks relating to Our Business and Industry — Our limited insurance coverage could expose us to significant costs and business disruption" for further details.

HEALTH, SAFETY AND ENVIRONMENTAL MEASURES

We do not operate any production facilities. Therefore, we are not subject to significant health, safety or environmental risks. We do not expect to incur any material liabilities or expenditures in

these respects. During the Track Record Period and up to the Latest Practicable Date, we had not been subject to any material fines or other penalties due to non-compliance with health, safety or environmental regulations.

PROPERTIES

Our corporate headquarters are located in Shanghai and Hong Kong. As of the Latest Practicable Date, we owned one property in Xuhui District, Shanghai with a floor area of 30,716 square meters primarily for office purposes, and we owned the proprietary land use right with respect to the parcel of land of 12,112 square meters where the property is located. In addition, we own proprietary land use rights with respect to a parcel of land of 57,997 square meters in Pudong District, Shanghai and we are constructing our Shanghai Lingang AIDC thereon, which will launch in early 2022.

As of the Latest Practicable Date, we were leasing 95 properties in the PRC with an aggregate gross floor area of 70,557 square meters. Our leased properties are primarily used for registration and office purposes.

As of the Latest Practicable Date, we owned three properties in Japan with an aggregate gross floor area of 22,579 square meters for office and autonomous driving testing purposes.

U.S. EXPORT CONTROL LAWS AND REGULATIONS

On October 9, 2019, one of our subsidiaries, Beijing SenseTime, was added to the entity list (the "**Entity List**") administered by the U.S. Department of Commerce, Bureau of Industry and Security ("**BIS**"). The addition of this subsidiary to the Entity List (the "**Entity List Addition**") restricts Beijing SenseTime's ability to purchase or otherwise access certain goods, software and technology (collectively, "**items**") that are subject to the Export Administration Regulations (the "**EAR**") without a license from the BIS. Items subject to the EAR include, among other things, U.S.-origin items, as well as non-U.S. items that contain more than a *de minimis* portion of U.S.-origin controlled content, and certain items of non-U.S.-origin that are the direct product of certain U.S.-origin controlled software or technology. For further information, see "Regulatory Overview — U.S. Export Control Laws and Regulations."

The restrictions imposed on Beijing SenseTime as a result of the Entity List Addition do not apply to other Group entities that are legally distinct from Beijing SenseTime. Hughes Hubbard & Reed LLP, our legal advisors as to U.S. export control laws, confirmed that our suppliers can continue to provide items subject to the EAR to other Group entities that are legally distinct from Beijing SenseTime so long as (i) those items are not exported, reexported or transferred, directly or indirectly, to Beijing SenseTime; (ii) those items are not diverted to Beijing SenseTime by other legally distinct Group entities not identified on the Entity List; and (iii) Beijing SenseTime does not otherwise serve as the purchaser, intermediate consignee, ultimate consignee or end-user of the items. In addition, Hughes Hubbard & Reed LLP also confirmed that (i) our suppliers may continue

to provide items that are not subject to the EAR to Beijing SenseTime; and (ii) our customers may lawfully purchase items subject to the EAR from Beijing SenseTime, so long as those items were obtained lawfully by Beijing SenseTime (e.g., obtained prior to the Entity List Addition or obtained pursuant to a license from the BIS).

In order to address EAR-related risks after the Entity List Addition, we have put in place a series of export control compliance measures for the entire Group, in abundance of caution. This includes requiring all suppliers, as a matter of policy, to confirm that the items concerned are not subject to the EAR, by way of: (i) an acknowledgement in the procurement contract by such supplier; or (ii) a certificate given by such supplier (the "**Non-EAR Item Confirmation**").

For items that are subject to the EAR or items for which the supplier was unable to provide the Non-EAR Item Confirmation (the "**EAR Items**"), we have implemented internal compliance procedures to ensure that the EAR Items supplied in these instances are in compliance with the EAR. For further information, see "Business — Internal Control Measures." However, as a result of the Entity List Addition and the internal compliance procedures, the Group is unable to purchase certain EAR Items from certain suppliers (such as network switch, desktop computers, 3D modeling and design software). As at the Latest Practicable Date, these EAR Items whose supply have been disrupted or suspended, are not material to our business operations ("**Immaterial Affected Products**")).

Our purchase of the Immaterial Affected Products only accounted for an insignificant amount of the total hardware and software procurement costs for the two years ended December 31, 2019 and 2020 and the six months ended June 30, 2021, respectively.

In light of the above, the Entity List Addition has not had any material adverse impact on our business. In addition, as of the Latest Practicable Date, none of our material investors, customers or suppliers had withdrawn their investment or ceased doing business with us due to the Entity List Addition. However, we remain committed to having Beijing SenseTime removed from the Entity List and will proceed with our removal request as soon as an appropriate opportunity arises.

Internal Control Measures

To address concerns under the EAR, we have taken all reasonable steps to establish an export control compliance program supported by dedicated compliance resources, in accordance with the Export Compliance Guidelines — The Elements of an Effective Export Compliance Program issued by the BIS. Out of prudence, we have extended the export control compliance program to cover our entire Group.

We engaged an export control consultant which is a reputable Big Four accounting firm with an international trade practice to help develop an export control compliance program, with assistance from separate U.S. export control counsel in relation to certain aspects of the program.

Our export control compliance program incorporates all eight elements of an effective export control compliance program issued by the BIS and is consistent with the key findings of the export control consultant's risk assessment report:

(i) ***Management Awareness and Commitment:*** We have published and will continue to publish annual statements to all employees expressing the management team's support of export control compliance, the consequences of violating the EAR and the designated contact person for such matters. All employees are required to sign an acknowledgement confirming their compliance with our export control compliance policies and procedures.

(ii) ***Risk Assessment:*** Based on the risk assessment review conducted by our export control consultant and in line with our Export Control Compliance Manual, we are in the process of implementing, among others, policies and standard operating procedures to:

(a) identify, restrict and monitor access to software or technology that are subject to the EAR, such that Beijing SenseTime and its personnel will not have access to any such software or technology;

(b) (i) identify and classify items procured from our suppliers by obtaining the relevant export control information, export control classification numbers ("**ECCN**") if applicable and (ii) identify and classify items created by us by jurisdictional analysis and ECCN classification; and

(c) screen our business partners (including customers and suppliers etc.) against the restricted and sanctioned party lists under the U.S., the European Union, the United Nations and Australia regimes.

In addition, it is our policy that EAR Items shall be prevented from being provided to Beijing SenseTime by other Group entities.

(iii) ***Export Authorization:*** We will monitor and periodically review (internally and via an external consultant if necessary) our procured and saleable items, to determine whether they are subject to the EAR and, if so, the relevant classification and licensing requirements.

(iv) ***Record Retention:*** We have adopted a "SenseTime Group's Export Control Compliance Recordkeeping Management Policy" ("**Recordkeeping Policy**") that clarifies the requirements for recordkeeping, archiving and other related tasks in relation to export control compliance. We are in the process of standardizing the recordkeeping procedures in each department in accordance with the Recordkeeping Policy.

(v) ***Training:*** We will conduct export compliance training at least once a year in various forms (including in-person and online training) for our employees. The employees will be required to sign a training confirmation letter after each training course. As of the Latest Practicable Date, we have organized four export compliance training courses for all employees and relevant departments in 2021.

(vi) ***Audits:*** We will conduct annual internal audits of the relevant business lines and departments for compliance with our export control compliance program. Our internal control department has established an audit team to conduct such audits.

(vii) ***Export Violations and Corrective Actions:*** We have adopted a "SenseTime Group Export Control Violation Management Policy" that sets out the available reporting channel and investigation process on any reports regarding actual or suspected violations of with export control laws and regulations. The export control compliance department will investigate any potential issues, report to the Export Control Violation Management Committee, take corrective actions and where appropriate make voluntary disclosures to the relevant regulatory agencies. All reports are treated in a strictly confidential manner.

(viii) ***Export Control Compliance Manual:*** We have adopted an Export Control Compliance Manual that applies to all entities within our Group. The manual expressly sets out the rules and regulations related to the EAR and makes clear that the Group entities (other than Beijing SenseTime) are prohibited from transferring items subject to the EAR to companies that are on the Entity List including Beijing SenseTime. We will review and refresh this manual annually to ensure that it will reflect any changes to the EAR and company operations.

To ensure the sustainability of our export control compliance program, we have established a new export control compliance department to develop and implement export control compliance policies and procedures (including but not limited to those referred to above) and act as the central point of contact for employees in respect of any export control-related questions. The export control compliance department ensures compliance of our business operations with the export control laws and regulations.

Hughes Hubbard & Reed LLP have reviewed our export control compliance policies and are of the view that, assuming that we continue to rely upon experienced and reputable external counsel and consultants to review and advise on our export control compliance program on an ongoing basis and subject to the implementation and enforcement of the above compliance policies and the advice from our separate U.S. export control counsel and export control consultant, our export control compliance measures provide a reasonably adequate and effective internal control framework for us to identify and mitigate any material risk relating to the Entity List.

On the bases that (i) as stated in the legal opinion issued by Hughes Hubbard & Reed LLP, the Entity List licensing requirement only extends to Beijing SenseTime, and not to other Group entities that are not identified on the Entity List, nor to EAR Items; (ii) following the implementation of the export control compliance program, the relevant Group entities (excluding Beijing SenseTime) are able to continue to source EAR Items related to the Group's relevant businesses; (iii) the Immaterial Affected Products are not material to the Group as disclosed in the above paragraphs, the Joint Sponsors concur with the Company's view that the Entity List Addition has not had any material adverse impact on the Group's business.

LICENSES, APPROVALS AND PERMITS

Our Consolidated Affiliated Entities: (i) Shanghai SenseTime Technology Development has obtained a value-added telecommunication business operating license for providing internet data

center services (limited to internet resource collaboration services) and internet access services, the expiration date of which is August 11, 2025; and (ii) Shanghai SenseTime Qianshi has obtained a value-added telecommunication business operating license for information services business (limited to internet information services) (excluding information search services and instant information exchange services), the expiration of which is August 10, 2026. SugARSoft Intelligent plans to apply for the value-added telecommunication business operating license for internet information services. As of the Latest Practicable Date, as advised by our legal advisors of the relevant jurisdictions, we had obtained all material licenses and permits required for our business operations (i.e. business licenses of our PRC subsidiaries) in mainland China, Hong Kong, Singapore and Japan, and such business licenses had remained in full effect. In the opinion of our PRC Legal Advisors, we had complied with all relevant PRC laws and regulations with respect to such license, approvals and permits in all material aspects during the Track Record Period and as of the Latest Practicable Date.

LEGAL PROCEEDINGS AND COMPLIANCE

Legal Proceedings

From time to time, we may become involved in legal proceedings, such as litigation, administrative penalties or other disputes, in the ordinary course of our business. During the Track Record Period and up to the Latest Practicable Date, we had not been and were not a party to any material legal, arbitral or administrative proceedings against us that could, individually or in the aggregate, have a material adverse effect on our business, financial condition and results of operations.

Compliance

During the Track Record Period and up to the Latest Practicable Date, we had complied with the applicable laws and regulations in relation to our business in all material respects and were not involved in any non-compliance incidents which the Directors believe would, individually, or in aggregate, have a material adverse effect on our business as a whole.

RISK MANAGEMENT, INTERNAL CONTROL AND COMPLIANCE CULTURE

We are dedicated to the establishment and maintenance of a robust risk management and internal control system. We have adopted and continually improve our internal control mechanisms to ensure the compliance of our business operations. Furthermore, we conduct periodic review of the implementation of our risk management policies and internal control measures to ensure their effectiveness and sufficiency.

We have been committed to promoting a compliance culture and will adopt policies and procedures on various compliance matters, including the Stock Exchange's requirements on corporate governance and environmental, social and governance matters. Our Board will be collectively responsible for the establishment and operations of mechanisms in relation to corporate governance and environmental, social and governance. Our Directors are involved in the formulation of such mechanisms and the related policies.

We have adopted and implemented risk management policies in various aspects of our business operations to address various potential risks in relation to operations, compliance, information security and data privacy, intellectual property and investment.

Operational Risk Management

Operational risk refers to the risk of direct or indirect financial loss resulting from incomplete or problematic internal processes, personnel mistakes, IT system failures or external events. We have established a series of internal procedures to manage such risk.

We take a comprehensive approach with regard to operational risk management, and implement a mechanism with detailed and decentralized responsibilities and clear rewards and punishment systems. Our information technology, human resources, finance and operations departments are collectively responsible to ensure the compliance of our operations with internal procedures. In the event of a major adverse event, the matter will be escalated to our CEO and the Board to take appropriate measures. Through effective operational risk management, we expect to control operational risks within a reasonable range by identifying, measuring, monitoring and containing operational risks to reduce potential losses.

Compliance Risk Management

Compliance risk refers to the risk of being subject to legal and regulatory sanctions, and the risk of major financial and reputational losses as a result of our failure to comply with relevant laws, regulations, rules and guidelines.

Compliance management refers to the dynamic managing processes of our effective identification and management of compliance risks and proactively preventing the occurrence of risk events. Compliance risk management is the core of our risk management activities, the foundation for effective internal controls and an important aspect of our corporate culture. We have established a sound compliance risk management framework as part of our comprehensive risk management system, to achieve effective identification and management of compliance risk and ensure that our operations are in compliance with applicable laws and regulations.

Information Security and Data Privacy Risk Management

See "— Data Privacy and Personal Information Protection."

Intellectual Property Risk Management

We have implemented a set of comprehensive measures to protect our intellectual property. The key measures include:

- ***Uniform and centralized IP management***: We conduct uniform and centralized IP management through our legal and IP department. Any application, implementation, authorization or transfer of our intellectual property rights will need to be subject to the approval of our legal and IP department.

- ***Shared IP rights within Group***: Any of our intellectual property rights, as long as they are owned by one of our subsidiaries or controlled entities, can be shared among Group members for manufacturing, import, sales or promise to sell relevant products.

Investment Risk Management

We invest in or acquire businesses that are complementary to our business and aligned with our overall growth strategies, such as businesses that can expand our service offerings and strengthen our technological capabilities. In general, we intend to hold our investments for the long term in forms of preferred shares or ordinary shares with preference rights. In order to manage potential risks associated with investments, we generally obtain minority protection rights from our investment portfolio companies.

Our strategic investment department has primarily been responsible for our investment project sourcing, screening, due diligence, risk assessment, valuation, execution and post-investment monitoring. Each investment is assessed with consideration of strategic value, risks and reward. We have established investment project evaluation and approval processes. Our Investment Committee reviews and determines all new investments and major disposals.

Audit Committee Experience and Qualification and Board Oversight

To monitor the ongoing implementation of our risk management policies, we have established an Audit Committee to review and supervise our financial reporting process and internal control system on an ongoing basis to ensure that our internal control system is effective in identifying, managing and mitigating risks involved in our business operations. The Audit Committee comprises three members, namely LYN Frank Yee Chon, FAN Yuanyuan and LI Wei. LYN Frank Yee Chon is the Chairperson of the Audit Committee and an independent non-executive Director. Please refer to the section headed "Directors and Senior Management—Directors" in this document.

In addition to our internal control department, we have also established an internal audit department which is responsible for reviewing the effectiveness of internal controls and reporting issues identified and improving our internal control system and procedures by identifying internal control failures and weaknesses on an ongoing basis. The internal audit department reports any major issues identified to the Audit Committee and Board of Directors on a timely basis.