

# **Three-Year Action Plan for Promoting Development of a New Generation Artificial Intelligence Industry (2018–2020)**

Currently, a new round of technological revolution and industrial revolution is under way. The formation of big data, the innovation of theoretical algorithms, the improvement of computing power, and the evolution of network facilities have driven the development of artificial intelligence (AI) to a new stage. Intelligence has become an important direction for the development of technology and industry. AI has a significant spillover effect, which will further promote the progress of other technologies and promote the overall breakthrough of strategic emerging industries. It will become a new impetus for advancing supply-side structural reforms, a new opportunity for rejuvenating the real economy, and a new engine for building China into both a manufacturing and cyber superpower. This Action Plan has been drafted in order to implement the "New Generation of Artificial Intelligence Development Plan" and carry out "Made in China 2025" in an in-depth manner. We should seize the historical opportunity, make breakthroughs in key areas, promote the development of the AI industry, enhance the intelligent manufacturing industry, and promote the in-depth integration of AI and real economy.

## **1) Overall Requirements**

### **(1) Guiding Ideology**

Comprehensively carry out and implement the spirit of the 19th Party Congress, taking Xi Jinping's ideology of socialism with Chinese characteristics for a new era as guidance. In accordance with the "five in one" overall layout and the "four comprehensives" strategic layout, diligently promote the Party Central Committee and State Council's policy directive to focus on deep integration of information technology and manufacturing technology, to advance industrialization and integrated application of new generation AI technology, develop high-end smart products, reinforce the core foundations, enhance the level of intelligent manufacturing, improve the public support system, all to promote the development of a new generation AI industry. Advance the building of China into a science and technology superpower and a cyber superpower, and help the real economy to transform and upgrade.

### **(2) Basic Principles**

*Systemic Layout.* Grasp the development trends of AI. Based on national conditions and regional industrial bases, combine top-level guidance and regional cooperation, strengthen systematic deployment, engage in phased implementation, and construct and perfect a new generation AI industrial system.

*Key Breakthroughs.* Focus on key weaknesses in industrial development, concentrate [China's] superior forces and resources on innovation, support the development of AI products in key areas, accelerate the industrialization and deployment of applications, and promote the overall improvement of the industry.

*Collaborative Innovation.* Act as a policy guide; promote the combination of production, academia, and research; support strengthening collaboration among leading enterprises and upstream and downstream small and medium enterprises; and build a favorable industrial ecosystem.

*Open and orderly.* Strengthen international cooperation, promote the openness and sharing of common AI technologies, resources, and services. Improve the development environment, improve safety and security capabilities, and achieve healthy and orderly industrial development.

### **(3) Action Goals**

Through the implementation of four key tasks, strive to achieve a major breakthrough in a series of landmark AI products by 2020, establish an international competitive advantage in several key areas, improve the deepening of integration of AI and the real economy, and further optimize the industrial development environment.

—Scale-up the development of key AI products, substantially increase the technology level of intelligent networked vehicles, achieve the large-scale application of intelligent service robots, strengthen global competitiveness of products such as intelligent unmanned aerial vehicles, expand clinical application of medical image diagnosis systems, and ensure that video image recognition, intelligent voice, intelligent translation, and other products reach an internationally advanced level.

—Significantly enhance core competencies in AI. Achieve breakthroughs in the design, foundry, packaging, and testing technologies for intelligent sensor technology products to reach international levels. Achieve the mass production of neural network chips and their large-scale application in key domains, and the initial availability of open source development platforms to support the rapid development of industrial capacity.

—Deepen the development of smart manufacturing, accelerate integrated applications of complex environment identification, new-type human-machine interaction, etc., AI technologies in key technical equipment. Significantly improve the level of application of new models such as intelligent production, large-scale personalized customization, and predictive maintenance. Significantly improve the level of intelligentization in key industries.

— Establish the foundation for an AI industry support system, establish and open up a high-quality annotated data resource base with a certain scale of standard test data sets. Establish an initial framework for standard AI systems, test and evaluation systems, and security assurance systems. Gradually establish intelligent network infrastructure systems, and better perfect an environment for industrial development.

## 2) Foster the Development of Smart Products

Driven by market demand, actively cultivate innovative AI products and services, promote the industrialization of AI technology, and promote the integrated application of smart products in the fields of industry, healthcare, transportation, agriculture, finance, logistics, education, culture, and tourism. Develop intelligent control products, accelerate breakthroughs in key technologies, and develop and apply a series of intelligent devices featuring intelligent equipment for complex environment perception, intelligent human-machine interaction, flexible and precise control, and real-time group collaboration, etc. Meet the requirements of high usability, high reliability, security, etc. Enhance devices' ability to handle complex, unexpected, and extreme conditions. Cultivate intelligent understanding products. Accelerate the R&D and industrialization of core technologies, such as pattern recognition, intelligent semantic understanding, and intelligent analysis and decision-making. Support the design of a batch of smart products or modules with intelligent levels and high reliability, and optimize the supply structure of intelligent systems and services. Promote the popularization of intelligent hardware, deepen the application of AI technologies in fields such as smart home, health management, mobile intelligent terminals, and vehicle-mounted products. Enrich the intelligentization functions of end products, and promote the upgrading of information consumption. Focus on achieving initial breakthroughs in the following areas:

**A) Intelligent Networked Vehicles.** Support vehicle intelligent computing platform systems and architectures, product R&D for automotive smart chips, autonomous driving operating systems, vehicle intelligence algorithms, and other key technologies. Build an integrated software, hardware, and algorithm vehicle intelligentization platform. By 2020, establish a strongly reliable, secure, real-time intelligent Internet-connected vehicle intelligentization platform; create platform-related standards; and support highly autonomous driving (HA level).

**B) Intelligent Service Robots.** Support the development of key technologies such as intelligent interaction, intelligent operation, and multi-machine collaboration; enhance the intelligence level of household service robots in applications including cleaning, elder care, rehabilitation, disability, and children's education; and promote public service robots for innovative applications such as inspection, navigation, and fire rescue. Develop three-dimensional imaging positioning, intelligent precision safety control, human-computer interface, and other key technology. Support the development of surgical robot operating systems to promote the use of surgical robots in clinical medicine. By 2020, make breakthroughs in key technologies, such as environment awareness, natural interaction, autonomous learning, and human-computer collaboration for intelligent service robots; intelligent home service robots and intelligent public service robots should achieve mass production and application in medical rehabilitation, assistance to elderly and the disabled, and fire and disaster relief, perfect technological and functional prototype production, and achieve demonstrations for over twenty applications.

**C) Intelligent Unmanned Aerial Vehicles.** Support intelligent obstacle avoidance, automatic cruise, autonomous flight for complex environments, group engagements, and research and development of other key technologies and applications to promote new-generation communications, positioning, and navigation technology in UAV data transmission, link control, monitoring, and management applications. Develop intelligent flight control systems, highly integrated specialized chips, and other key components. By 2020, intelligent consumer UAV 3-axis mechanical stabilization units should achieve a precision of 0.005 degrees, achieving 360-degree omnidirectional perception avoidance and realizing automatic and intelligent forced avoidance of air traffic control areas.

**D) Medical Imaging Diagnosis Systems.** Promote the standardization of medical image data collection, and support the research and development of medical imaging aids in the domains of common diseases of the brain, lung, eye, bone, cardiovascular system, and breast. Accelerate the commercialization and clinical applications of medical imaging diagnosis support systems. By 2020, the most advanced multimodal medical imaging diagnostic system in China should detect more than 95% of the above common diseases, with a false negative rate of less than 1%, and a false positive rate of less than 5%.

**E) Video Image Identification Systems.** Support biotech, video comprehension, cross-media fusion, and other technological innovations. Develop typical applications, such as biometrically verified ID cards, video surveillance, image search, and video summarization, and expand application in key domains, such as security and finance. By 2020, the effective detection rate of facial recognition in complex dynamic scenes should exceed 97%, and the

correct recognition rate should exceed 90%, with support for recognition of facial features in different regions.

**F) Intelligent Voice Interactive Systems.** Support the innovation and application of new-generation speech recognition frameworks, colloquial speech recognition, personalized speech recognition, intelligent conversation, audio and video integration, speech synthesis, and other technologies. Carry out popularization and application in such key domains as smart manufacturing and smart home. By 2020, the average accuracy rate of Chinese-language speech recognition in multi-scenarios should reach 96%, the recognition rate of 5 meters in far field applications will exceed 92%, and the accuracy of user dialogue intentional recognition rate should exceed 90%.

**G) Intelligent Translation Systems.** Promote the application of high-precision intelligent translation systems, and use machine learning techniques to enhance the accuracy and practicability for typical scenarios such as multilingual translation and simultaneous interpretation. By 2020, achieve clear breakthroughs in multilingual intelligent mutual translation. The accuracy of translation of products in Chinese-English translation and English-Chinese translation should exceed 85%, and the accuracy rate of intelligent translation between ethnic minority languages and Chinese should be significantly improved.

**H) Smart Home Products.** Support the application of intelligent sensors, Internet of Things, machine learning, and other technologies to smart home products in order to enhance the level of intelligence, the practicality, and the safety of home appliances, smart networked equipment, water and electricity meters, and other products. Develop intelligent security, smart furniture, smart lighting, smart appliances, and other products. Construct several smart home test evaluations, and demonstration projects and promotions. By 2020, the categories of smart home products should be significantly enriched, the penetration rate of the smart TV market should exceed 90%, and the intelligent product level of security products should significantly increase.

### 3) Breakthroughs in Core Foundations

Accelerate the research and development and application of high-precision, low-cost smart sensors; make breakthroughs in the neural network chips and supporting tools for cloud training and terminal applications; support the research and development of AI development frameworks, algorithm libraries, and toolsets; and support the construction of open source platforms. Lay out intelligent software designed for AI applications, and consolidate the hardware and software foundation for the development of the AI industry. Focus on the following areas to achieve leading breakthroughs:

**A) Smart Sensors.** Support the research and development of key technologies, such as miniaturization and reliability design, precision manufacturing, integrated development tools, and embedded algorithms; support the research, development and application of smart sensors based on new requirements, new materials, new processes, and new principles. Develop new biological, gas, pressure, flow, inertial, distance, imaging, acoustic, and other smart sensors with promising market prospects; promote technological innovations in such materials as piezoelectric materials, magnetic materials, infrared radiation materials, micro-electro-mechanical systems (MEMS), and complementary metal-oxide-semiconductor (CMOS) integration technologies to develop and develop intelligent sensors based on new principles, such as magnetic induction, ultrasound, non-visible light, and biochemistry for new application scenarios; and promote high-performance intelligent sensors with accuracy, high reliability, low power consumption, and low cost. By 2020, the performance of piezoelectric sensors, magnetic sensors, infrared sensors and gas sensors should be greatly improved. There should be acoustical sensors with a signal-to-noise ratio of 70 dB and acoustic overload point of 135 dB that will be capable of achieving mass-production. For pressure sensors, absolute accuracy should be within 100 Pa and the noise level within 0.6 Pa to achieve mass commercial production, weak magnetic field resolution 1pT magnetic sensor. Achieve international advanced levels in simulation, design, MEMS technology, packaging, and personalized testing technologies, with system design capabilities for mobile wearables, the Internet, automotive electronics, and other key areas.

**B) Neural Network Chips.** Develop high-performance, scalable, and low-power cloud neural network chips for machine learning training applications. For terminal applications, develop low-power, high-performance neural network chips suitable for machine learning algorithms. Develop industrialized support tools for neural network chips such as compilers, driver software, and development environments. By 2020, achieve breakthroughs in technologies for neural network chips and cloud neural network chips with performance levels of 128 TFLOPS (16-bit floating point) and the energy efficiency ratio of more than 1 TFLOPS/Watt; develop terminal neural network chips with an energy efficiency ratio that exceeds 1 TFLOPS/Watt (using 16-bit floating point as a bench), support one or several mainstream neural network algorithms, such as convolutional neural networks (CNN), recurrent neural networks (RNN), and long- and short- term memory networks (LSTM); and achieve scaled commercial use of neural network chips in smart terminals, autonomous driving, smart security, smart homes, and other key domains.

**C) Open-Source Platforms.** For common technologies, such as machine learning, pattern recognition, intelligent semantic understanding, and other key industries, such as autopilot [systems], support the development of cloud-based training and terminal development frameworks, and algorithm libraries and toolsets; support open-source development platforms, open technology networks, and the construction of an open-source community; encourage the construction of an open computing service platform that meets the needs of

complex training and encourages key leading enterprises to build a new industrial ecosystem based on open source and open technologies for software, hardware, data and application collaboration. By 2020, open-source development platforms for cloud training should support large-scale distributed clusters, various hardware platforms, and various algorithms. Open-source platforms for terminal applications, should possess properties such as being lightweight, modular, and reliable.

#### 4) Deepen the Development of Intelligent Manufacturing

For in-depth implementation of intelligent manufacturing, encourage a new generation of AI technology in all aspects of exploration and application of industry, and support increasing levels of intelligence to support key areas of algorithm breakthroughs and application innovation, system upgrade manufacturing equipment, manufacturing processes, and industrial applications. Focus on the following areas to take the lead in achieving breakthroughs:

**A) Intelligent manufacturing of key technologies and equipment.** Enhance the self-testing, self-tuning, self-adapting, self-organizing and intelligence level of high-end CNC machine tools and industrial robots, and improve the machining accuracy and product quality of additive [3D] manufacturing equipment by using AI technology. Optimize intelligent sensors and decentralized control systems (DCS), programmable logic controllers (PLC), supervisory control and data acquisition systems (SCADA), high performance and high reliability embedded control systems, and other control equipment in complex work environments. Improve the perception, cognition, and control ability. Improve digital non-contact precision measurement, online non-destructive testing systems and other intelligent detection equipment measurement accuracy and efficiency; and enhance the flexibility of assembly equipment. Enhance the intelligence level of logistics equipment such as high-speed sorters, multi-layer shuttle cars, and high-density storage shuttles to realize accurate, flexible, and efficient material distribution and unmanned intelligent warehousing.

By 2020, further improve the intelligence level of high-end CNC machine tools. Mass produce and apply a new generation of industrial robots with human-machine coordination, natural interaction, and autonomous learning. The forming efficiency of the additive manufacturing equipment should exceed 450 cm<sup>3</sup>/hr, and the continuous working time should exceed 240h. Realize intelligent sensor and control equipment integration in the fields of machine tools, robots, petrochemicals, rail transit, and other fields. The accuracy of industrial field visual recognition of intelligent detection and assembly equipment should reach 90%, and measurement accuracy and speed should meet the actual production needs. Open more than 10 intelligent logistics and warehousing facilities.



**B) A new model of intelligent manufacturing.** Encourage discrete manufacturing enterprises to network production equipment based on intelligence, the application of machine learning technology analysis and processing of field data, equipment online diagnosis, real-time control of product quality, and other functions. Encourage process-oriented manufacturing enterprises to build out a complete process, intelligent production management, and security systems, in order to achieve continuous production and intelligent production safety management. Create a network of collaborative manufacturing platforms to enhance man-machine collaboration under the guidance of AI and collaboration between enterprise R&D design and production capacity. Develop customized service platforms to improve the depth of learning and analysis of the characteristics of user needs, optimize product modular design capabilities and personalized portfolio. Set up a control and automatic diagnosis system based on standardized information collection, accelerate the training and optimization of fault prediction models and user habit information models, and improve the life cycle analysis ability of products and core accessories.

By 2020, reduce operating costs of digital workshops by 20% and shorten the product development cycle by 20%. Use smart factory products to reduce the rate of defective products by 10% and the energy utilization rate by 10%. In aerospace and automotive industries, accelerate the promotion of parallel internal and external organizations and collaborative optimization of new models; in clothing, home appliances and other fields, universally improve the entire workflow and flexibility for large-scale and small quantity individualized orders; and in equipment manufacturing, spare parts manufacturing, and other areas, promote intelligent equipment health monitoring and early warning and other remote operation and maintenance services.

## 5) Build Support Systems

Support the construction and opening up of a large number of AI mass training resource bases, standard test data sets, and cloud service platforms for key product research and development and industry application needs. Establish and improve AI standards and test evaluation systems, and establish service platforms for intellectual property, etc. Speed up the construction of an intelligent infrastructure system and establish an AI network security system. Focus on the following areas to take the lead in achieving breakthroughs:

**A) Industry training resources.** In such basic fields as speech recognition, visual recognition, and natural language processing—as well as industrial, medical, financial, and transportation industries—support the construction of high-quality AI training resource bases and standard test data sets, and promote sharing. Encourage the construction of knowledge maps and algorithm training, product optimization, and other common service open cloud platforms. By 2020, greatly increase the amount of public training data such as basic speech, video



images, and text dialogues, and bring together sector-specific data on a wide range of industries such as industry, healthcare, finance and transportation to support entrepreneurial innovation.

**B) Standard testing and intellectual property service platforms.** Establish an AI industry system of standards; establish and improve basic commonality, connectivity, security and privacy, industry application and other technical standards to encourage industry to actively participate in international standardization work. Construct an AI product evaluation system, evaluate intelligence levels, the reliability and safety of key intelligent products and services, and improve the quality of AI products and services. Research and establish AI technology patent synergy mechanisms to support the construction of a patent cooperation operation platform and an intellectual property service platform. By 2020, establish an AI industry standards system, build a third-party pilot testing platform, and conduct evaluation and assessment services. Build an intellectual property service platform with basic support capabilities in areas such as pattern recognition, semantic understanding, autonomous driving, and intelligent robots.

**C) Intelligent network infrastructure.** Speed up the deployment of a highly intelligent next-generation Internet; a fifth generation mobile communication (5G) network with high-speed, high-capacity, and low-latency; a navigation network with fast and accurate positioning; and the integration and efficient interconnection of integrated information network deployment and construction. Speed up the construction of the industrial Internet and Internet of Vehicles, and gradually form an intelligent network infrastructure system to enhance its support service capabilities. By 2020, meet the application needs of the AI industry for broadband access and latency in over 90% of the country. More than 10 key enterprises should realize the demonstration of industrial Internet covering the entire production process, and the network infrastructure of key areas should be basically completed.

**D) Cybersecurity systems.** In order to solve the security technology problems such as vulnerability discovery, security testing, threat warning, attack detection, and emergency response, enterprises should promote the advanced application of advanced AI technology in the field of cybersecurity —by focusing on the key products or applications of AI such as smart cars, and smart homes—and accelerate the construction of shared resources such as vulnerabilities, risk libraries, and case sets. By 2020, perfect the layout of the AI cybersecurity industry to form the framework of an AI security prevention and control system, and initially establish a security assurance platform with the basic abilities of AI security situational awareness, test evaluation, threat information sharing, and emergency response.

## 6) Assurance Measures

**A) Strengthen organization and implementation.**

Strengthen synergies and vertical sectoral cooperation, establish and improve organization in government, enterprises, and industry and synergies in industry alliances, think tanks, and elsewhere, to promote mechanisms to strengthen technical research, standards, and other aspects of coordination. Strengthen cooperation between provinces and ministries and rely on the construction of a national demonstration base for new industrialized industries to support qualified areas in exerting their own resource advantages, fostering a group of leading enterprises in AI, and exploring the construction of AI industrial clusters to promote breakthroughs in the AI industry. For the key industries and key areas, promote the application of landmark AI products. Establish an AI industry statistics system and key product and service catalogs. Strengthen follow-up research, supervision, and guidance to ensure that key work progresses in an orderly manner.

### **B) Increase support.**

Give full play to the existing funds for industrial transformation and upgrading (Made in China 2025) and other state funds (major projects and funds), guided by national science and technology programs (projects and funds). Support the development of qualified AI products and basic software and hardware, pilot demonstration and support platform construction, etc., to encourage local governments to increase their investment in related fields. Take major needs and industry applications as the lead, build a typical test environment, build a product reliability and safety verification platform, organize collaborative research, support the development and adaptation of key application technologies of AI, and support innovative product design, system integration, and industrialization. Support AI enterprises and financial institutions to strengthen cooperation in docking, and through market mechanisms guide multi-party capital to participate in industrial development. First, establish a major technical equipment insurance premium compensation policy, to explore the introduction of AI integration of technology and equipment, production lines, and other key areas.

### **C) Encourage innovation and entrepreneurship.**

Accelerate the construction and continuous improvement of innovation centers for intelligent networking, smart voice, smart sensors, robots, and other AI-related areas of manufacturing, and establish key laboratories in the field of AI. Support enterprises, research institutes, and universities to jointly carry out AI key technology research and development and industrialization. Encourage AI innovation and entrepreneurship and solutions contests to encourage manufacturing enterprises, Internet companies, and basic telecommunications companies to build "double innovation" platforms, to play a leading role in key enterprises, to strengthen technical cooperation in research and development and application, and enhance industrial development and innovation and international competitiveness. Cultivate AI innovation benchmarking enterprises, and build AI enterprise innovation exchange platforms.

#### **D) Speed up personnel training.**

Implement "Guidelines for the Development of Manufacturing Talents" and deepen the reform of the talent system and mechanisms. Attract and train high-end talent for AI and innovative entrepreneurship in a variety of ways, and support the growth of a group of leading talent and top-notch young talents. Relying on major projects, encourage cooperation between schools and enterprises, colleges, and universities to support the construction of AI-related disciplines, to guide vocational schools to guide the development of industries in urgent need of skilled personnel. Encourage leading enterprises, service providers, and other institutions to cultivate a high level of AI personnel, and key industries to provide industry solutions to promote best practices in the industry.

#### **E) Optimize the development environment.**

Carry out research on relevant policies, laws and regulations of AI and create a good environment for the healthy development of the industry. Strengthen industry linkages, promote the industry to open up data rationally, actively apply new technologies and new businesses, and promote the integration of AI and industry development. Government departments are encouraged to be the first to use AI to enhance business efficiency and manage service levels. Take full advantage of the bilateral and multilateral cooperation mechanisms, and seize the opportunity of the Belt and Road Initiative to encourage scientific research institutes, enterprises, and trade organizations at home and abroad to broaden the channels of communication and conduct extensive cooperation to achieve mutual benefits and win-win cooperation.

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