Translation

The following document, issued by the PRC government's standards-setting body in 2020, calls for the formulation of specific standards across the full spectrum of basic and applied AI technologies. The standards are particularly detailed in the fields of natural language processing and speech-related applications of AI.

Title
Guidelines for the Construction of a National New Generation Artificial Intelligence Standards System
国家新一代人工智能标准体系建设指南

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Source
Official website of the PRC central government. The *Guidelines* were formulated on July 27, 2020, printed on August 4, 2020, and uploaded to the website on August 9, 2020.

The Chinese source text is available online at:
http://www.gov.cn/zhengce/zhengceku/2020-08/09/5533454/files/bf4f158874434ad096636ba297e3fab3.pdf
An archived version of the Chinese source text is available at: https://perma.cc/7LST-LA9Q
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Guidelines for the Construction of a National New Generation Artificial Intelligence Standards System

The *Guidelines for the Construction of a National New Generation Artificial Intelligence Standards System* have been formulated in order to implement the decision and deployment of the Party Central Committee and the State Council on the development of artificial intelligence (AI), to promote the continuous self-optimization of AI technology in the open-source and open industrial ecosystem, to give full play to the leading role of basic general purpose standards, ethical standards, security standards, and privacy standards, to guide the formulation, revision, and coordination of AI national standards, industry standards, and group standards, and to form a new pattern in which standards lead the comprehensive and standardized development of the AI industry.

1. General Requirements

(1) Guiding ideology:

Fully implement the spirit of the 19th Party Congress and the Second, Third, and Fourth Plenums of the 19th Central Committee, implement the decisions and deployments of the Party Central Committee and the State Council on the development of new generation AI, combine market-driven and government guidance, and follow the principles of “overall planning, categorized policies, market-driven, urgent use first, cross-industry integration, coordinated advancement, independent innovation (自主创新), and open collaboration.” Take domestic demand as the foundation while also considering the international picture, establish a system of national standards for new generation AI, and strengthen top-level design and macro guidance on standards. Accelerate the conversion of innovative technologies and applications into standards, strengthen the implementation and supervision of standards, and promote the in-depth integration of innovative achievements and industries. Pay attention to coordination on and support for related standards systems such as for smart manufacturing, the industrial internet, robotics, and the Internet of Vehicles (IoV). Deepen international exchanges and cooperation in AI standards, pay attention to the synergy of international and domestic standards, give full play to the supporting and leading role of standards in the development of AI, and safeguard high-quality development.

(2) Construction Goals

By 2021, clarify the top-level design of AI standardization, study the general rules of standards system construction and standard development, clarify the relationship between standards, guide the orderly development of AI standardization, and complete pre-research work on more than 20 key standards such as for key general purpose technologies, key niche technologies, and ethics.

By 2023, an AI standards system will be initially established, focusing on the development of data, algorithms, systems, services, and other key and urgently needed standards, and take the lead in advancements in industries and fields such as manufacturing, transportation, finance, security, home furnishing, elder care, environmental protection, education, healthcare, and justice. Build an AI standards testing and verification platform to provide public service capabilities.

2. Construction Philosophy

(1) Structure of the AI standardization system.

The AI standards architecture includes "A: Basic general purpose," "B: Supporting technology and products," "C: Basic software and hardware platform," "D: Key general purpose technology," "E: Key niche technology," "F: Products and services," "G: Industry applications," and "H: Security and ethics." These are shown in Figure 1.

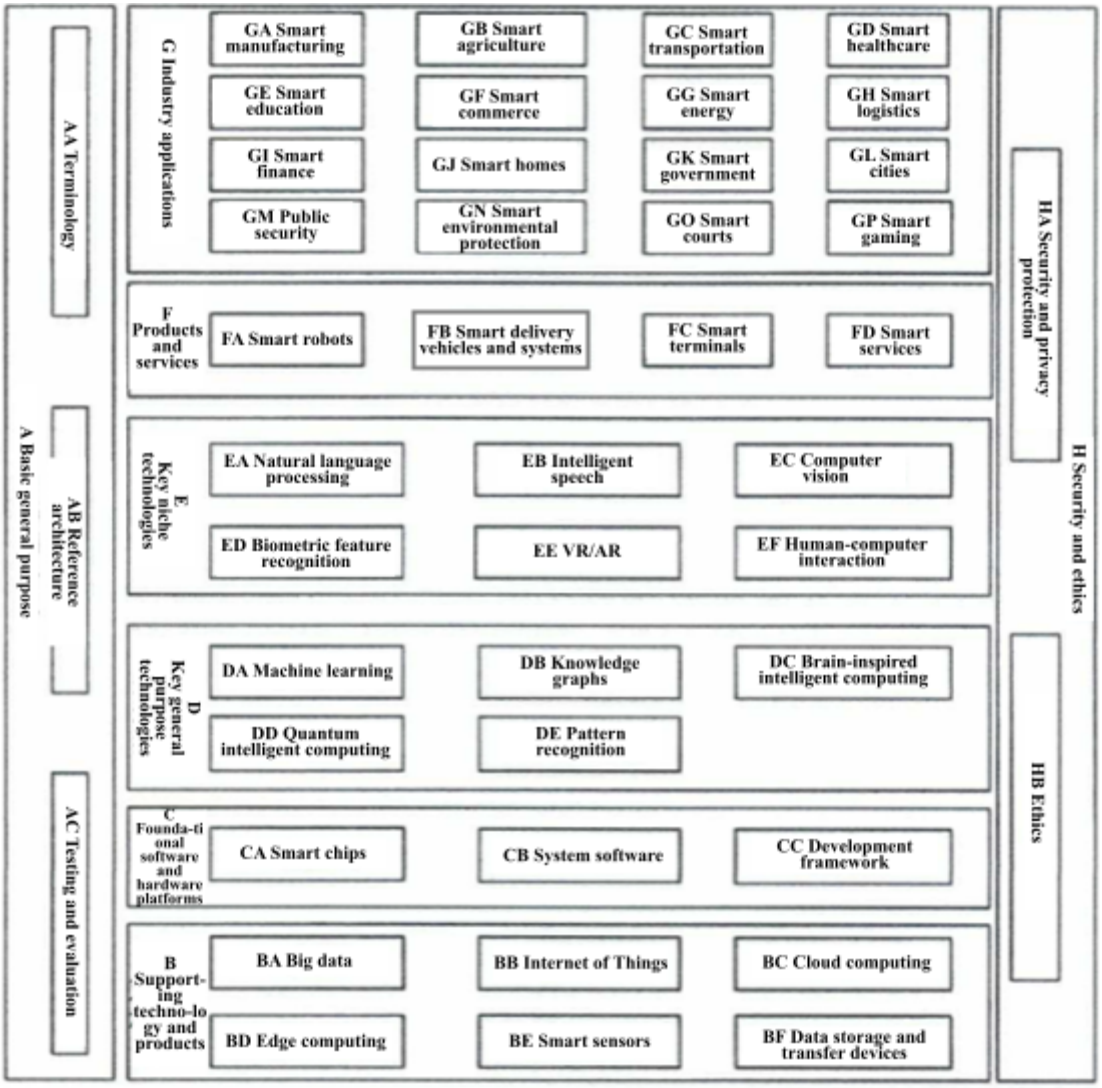

Fig. 1. AI Standards Architecture

Specifically: A. Basic general purpose standards includes three categories: terminology, reference architecture, and testing and evaluation. Located at the far left of the AI standards architecture, it supports other parts of the standards system structure.

B. Supporting technology and product standards provides basic support for the construction of AI software and hardware platforms, algorithm model development, and AI applications.

C. Basic software and hardware platform standards mainly focuses on smart chips, system software, and development frameworks to provide infrastructure support for AI.

D. Key general purpose technology standards mainly focuses on machine learning, knowledge graphs, brain-inspired intelligent computing, quantum intelligent computing, and pattern recognition to provide general purpose technological support

for AI applications.

E. Key niche technology standards mainly focuses on natural language processing, intelligent speech, computer vision, biometric feature recognition, virtual reality and augmented reality (VR/AR), and human-computer interaction to provide niche technology support for AI applications.

F. Product and service standards includes relevant standards for intelligent products and new service models formed in the field of AI technology.

G. Industry application standards is located at the top of the AI standards system structure and is oriented to the specific needs of industry, while other standards are refined to support the development of various industries.

H. Security and ethical standards is located on the far right side of the AI standards system structure and runs through the other parts to establish a compliance system for AI.

See the table below for a detailed list of standards development directions.

(2) AI standards system framework.

The framework of the AI standards system is mainly composed of eight parts: Basic general purpose, supporting technologies and products, basic software and hardware platforms, key general purpose technologies, key niche technologies, products and services, industry applications, and security and ethics, as shown in Figure 2.

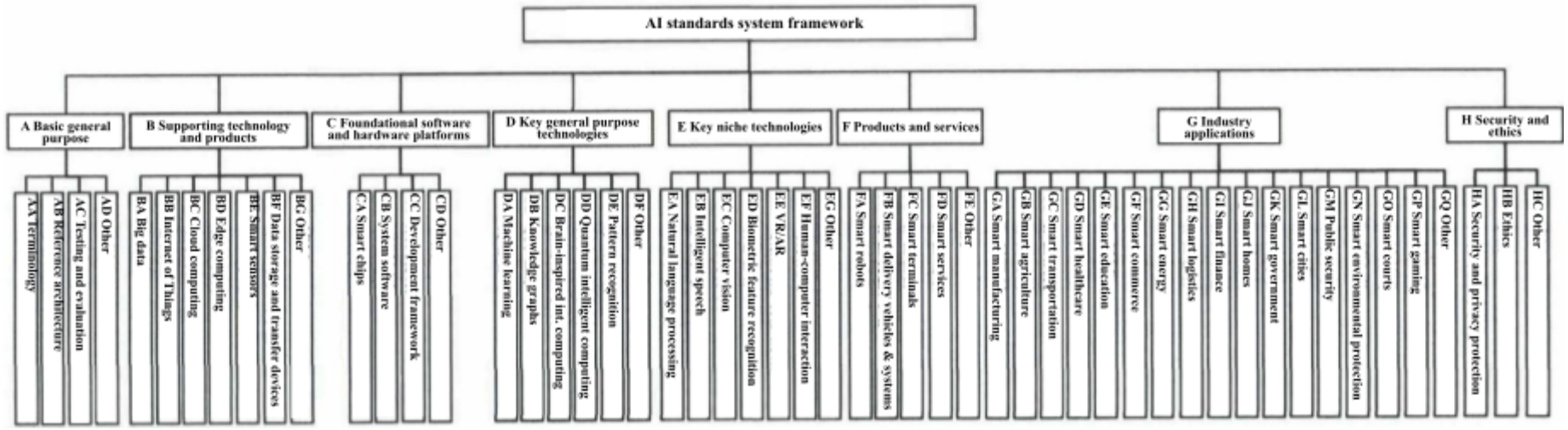

Figure 2. AI Standards System Framework

3. Content of construction

(1) Basic general purpose standards:

The basic general purpose standards mainly regulate the foundation of AI, including terminology, reference architecture, testing, and evaluation as shown in Figure 3.

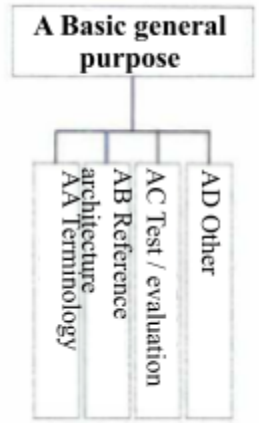

Fig. 3. Basic general purpose standards

1. Terminology standards: This is used to unify AI-related concepts, technologies, and industrial application scenarios, and to provide support for the formulation of other standards and for corporate AI research, including related definitions, categories, and examples of AI terms.

2. Reference architecture standards: Standardize the logical relationship and interaction of AI-related technologies, applications, and value chains and provide positioning and direction suggestions for the development of AI-related standards.

3. Testing and evaluation standards: The common requirements for testing and evaluation are extracted around the maturity of the development of AI technology, the level of industry development, and corporate capabilities. These include AI-related service capability maturity assessments, AI versatility testing guidelines, assessment principles and level requirements, corporate capability frameworks and evaluation requirements, and other standards.

Key points of basic general purpose standards construction
Terminology standards: Linking up with the current status of AI development, develop and revise AI terminology standards.
Reference architecture standards: In order to specify logical relationships, interactions, and development directions of AI-related technologies, applications, and value chains, formulate standards such as AI reference architectures.
Testing and evaluation criteria: Carry out the development of standards for AI-related service capability maturity assessments, technology or product

intelligence capability level assessments, and model quality.

(2) Supporting technology and product standards.

Supporting technology and product standards mainly include big data, Internet of Things, cloud computing, edge computing, smart sensors, data storage, and transmission equipment as shown in Figure 4.

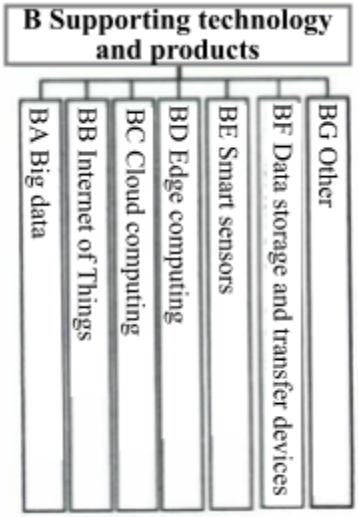

Fig. 4. Supporting technology and product standards

1. Big data standards: Standardize the data storage, processing, analysis, and other big data-related supporting technical elements involved in the process of AI research and development (R&D) and applications, including standards such as big data system products, data sharing and openness, data management mechanisms, and data governance.

2. Internet of Things (IoT) standards: Standardize the key technical elements of perception and execution involved in the development and application of AI and provide support for the collection, interaction, and interconnection of various types of perception information for AI. Include standards for smart sensing equipment, intelligent network interfaces such as interfaces and interoperability between sensing equipment and AI platforms, standards for integrated sensing and execution models, and multimodal and situational awareness standards.

3. Cloud computing standards: Standardize AI-oriented cloud computing platforms, resources, and services to provide support for the storage, operation, and sharing of AI information. Include virtual and physical resource pooling, scheduling, intelligent operations platform architecture, intelligent operations resource definitions and interfaces, application service deployments, and other standards.

4. Edge computing standards: Standardize the terminal computing devices, networks, data, and applications involved in AI applications. Include standards such as data transmission interface protocols, intelligent data storage, terminal-to-terminal collaboration, and terminal-to-cloud collaboration.

5. Smart sensor standards: Standardize high-precision sensors and new

micro-electro-mechanical system (MEMS) sensors to provide standard support for the development of AI hardware, including sensor interfaces, performance evaluations, test methods, and other standards.

6. Data storage and transmission equipment standards: Used to standardize data storage, technology related to transmission equipment, and data interfaces.

Focus of construction of supporting technology and product standards
Big data standards: Focus on the development of standards for data service interfaces for AI algorithms and applications, data management capability maturity assessments, data open sharing requirements, openness assessments, and data governance in sensitive industries (敏感行业).
IoT standards: Focus on the development of standards for new MEMS sensors, multimodal sensing fusion models, and real-time interdisciplinary computing methods.
Cloud computing standards: Focus on the development of AI-oriented heterogeneous computing resource pooling, scheduling, and management standards.
Edge computing standards: Focus on the development of standards such as cloud and edge AI data transmission interface protocols, specifications, and requirements for the operating environments of lightweight AI models.
Smart sensor standards: Focus on the formulation of relevant standards for high-precision sensors and new MEMS sensors.
Data storage and transmission equipment standards: Focus on the development of related standards for direct-attached storage (DAS) storage equipment, network storage and transmission equipment, and storage backup systems.

(3) Foundational software and hardware platform standards.

Foundational software and hardware platform standards mainly include smart chips, system software, and development frameworks, as shown in Figure 5.

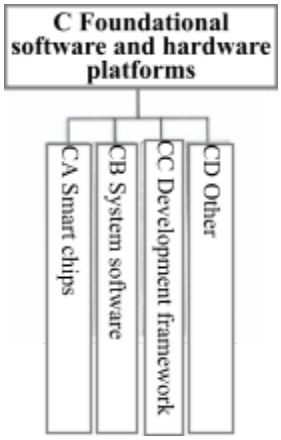

Fig. 5. Foundational software and hardware platform standards

1. Smart chip standards: Standardize intelligent computing chips, new sensing chips, and related low-level interfaces to provide computing power support for AI model training and inference. Include standards for instruction sets and virtual instruction sets, chip performance, power consumption testing requirements, data exchange formats, chip operating system designs, and testing.

2. System software standards: Standardize AI software and hardware optimization compilers, AI operator libraries, and AI software and hardware platform computing performance to promote the collaborative optimization of software and hardware platforms.

3. Development framework standards: Include standards for development of machine learning framework application development interfaces and neural network model expression and compression.

Key points of foundational software and hardware platform standards construction
Smart chip standards: Focus on the development of standards for smart chip architecture and design, chip performance, power consumption testing requirements, data exchange formats, and chip operating system design and testing.
System software standards: Focus on the development of AI software and hardware optimization compilers, AI operator libraries, and computing performance evaluation standards.
Development framework standards: Focus on the development of standards for machine learning framework application development interfaces and neural network model expression and compression.

(4) Key general purpose technical standards.

The key general purpose technical standards mainly include machine learning, knowledge graphs, brain-inspired intelligent computing, quantum intelligent computing, and pattern recognition, as shown in Figure 6.

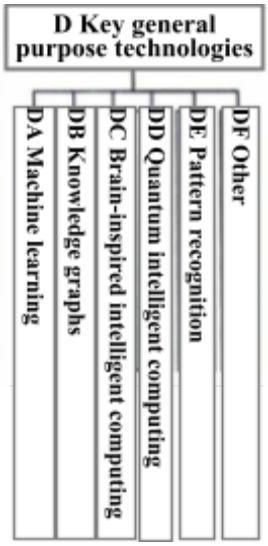

Fig. 6. Key general purpose technical standards

1. Machine learning standards: Standardize different types of models, training data, knowledge bases, and expressions and evaluations such as supervised learning, unsupervised learning, semi-supervised learning, ensemble learning, deep learning, and reinforcement learning.

2. Knowledge graph standards: Standardize the structural form, interpretation process, and technical requirements of knowledge depth semantics of knowledge description and solve the problem of uncertainty in the granularity and means of knowledge representation.

3. Brain-inspired intelligent computing standards: Standardize the basic model, performance, and application of brain-inspired computing algorithms, provide a new computing architecture for AI systems, and improve the ability of AI to handle complex problems. Include standards for brain-inspired intelligent computing reference architecture, brain feature mechanism computing model modeling and expression, algorithm requirements and performance evaluation based on biological mechanism modeling, and general purpose technology requirements for brain-inspired intelligent computing hardware devices.

4. Quantum intelligent computing standards: Standardize the basic models, performance, and applications of quantum computing algorithms to provide support for improving the computing capabilities of AI. Include quantum computing models and algorithms, high-performance and high-bitrate quantum AI processors, and real-time quantum AI systems that can interact with the external environment.

5. Pattern recognition standards: Standardize the characteristics, models, technical requirements, and evaluation methods for self-adaptive or self-organized pattern recognition systems.

Construction focus for key general purpose technical standards
Machine learning standards: Focus on the development of standards for machine

learning models and algorithms, training data, expression, and evaluation.

Knowledge graph standards: Focus on the development of standards for automatic knowledge acquisition, knowledge modeling and expression, semantic computing, knowledge evolution, and knowledge graph technical requirements and evaluation.

Brain-inspired intelligent computing standards: Focus on the development of standards for brain-inspired intelligent computing reference architecture, brain feature mechanism calculation model modeling and expression, algorithm requirements and performance evaluation based on biological mechanism modeling, and general technical requirements for brain-inspired intelligent computing hardware equipment.

Quantum intelligent computing standards: Focus on the development of standards for quantum computing models and algorithms, high-performance and high-bitrate quantum AI processors, and real-time quantum AI systems that can exchange information with the external environment.

Pattern recognition standards: Focus on the development of self-adaptive or self-organizing pattern recognition system characteristics, models, technical requirements, and evaluation standards.

(5) Standards for key niche technologies.

Standards for key niche technologies mainly include natural language processing, intelligent speech, computer vision, biometric feature recognition, VR/AR, and human-computer interaction, as shown in Figure 7.

Fig. 7. Standards for key niche technologies

1. Natural language processing standards: This specifies the technical requirements for the foundation of, information extraction from, and text content analysis for natural language processing and addresses problems in the consistency of

data, analysis methods, and semantic description in the process of computers understanding and expressing natural language. Natural language processing standards include four parts: Language information extraction, text processing, semantic processing, and application extension.

2. Intelligent speech standards: Standardize the technology and methods of human-computer language communication to ensure the accuracy, consistency, efficiency, and availability of speech recognition, speech synthesis, and their applications. Intelligent speech standards include five parts: Speech facilities and equipment, speech processing, speech recognition, speech synthesis, and speech interfaces.

3. Computer vision standards: This specifies the technical requirements for computer and visual perception equipment to detect, identify, and track targets and resolves the problems of consistency and interconnection in various links such as image or video collection, processing, identification, understanding, and feedback. Computer vision standards include three parts: Vision facilities and equipment, data and models, and image recognition and processing.

4. Biometric feature recognition standards: Standardize technical requirements for computers to use the inherent physiological characteristics of the human body (fingerprints, face, iris, voiceprint, DNA, etc.) or behavioral characteristics (gait, keystrokes, etc.) for personal identification and resolve problems in the description of biological characteristics, data, and interface consistency.

5. VR/AR standards: Provide users with general technical requirements for a consistent experience of multi-sensory information such as vision, touch, and hearing.

6. Human-computer interaction standards: Standardize multi-channel, multimodal, and multi-dimensional interaction channels, modes, methods, and technical requirements for people and information systems, resolves problems in the integration and coordination and efficient application of multimodal interactions such as voice, gesture, somatosensory, and brain-computer interactions, and ensure that interaction modes have high reliability and security. Human-computer interaction standards include three parts: Intelligent perception, dynamic recognition, and multimodal interaction.

Focus of construction of key niche technology standards
Natural language processing standards: Focus on development of application extension standards, including language information extraction standards such as optical character recognition (OCR), stemming, word vectoring, and part-of-speech tagging and descriptions; and also intelligent word segmentation, textual language identification, lexical analysis, parsing, grammatical analysis, content relevance analysis, sentiment analysis, and other text processing standards; large-scale intelligent semantic libraries, semantic data, semantic interfaces, semantic labeling, semantic understanding, semantic expression frameworks and models, data formats,

formal expression, and other semantic processing standards; automated question and answer (Q&A); and system architectures, models, and technical requirements and evaluations for machine translation.

Intelligent speech standards: Focus on the development of speech equipment standards for speech sensing equipment, chips, and network facilities; speech processing standards such as speech collection, speech corpuses, speech enhancement, sound source localization, speech encoding and decoding, and speech endpoint detection, far-field speech recognition, spoken language identification, dialect identification, command word recognition, speech dictation, speech transcription, and other speech recognition standards; online speech synthesis, offline speech synthesis, speech synthesis and differentiation, and other speech synthesis standards; and the development of speech interface standards such as spoken data cloud interfaces and local interfaces.

Computer vision standards: Focus on the development of equipment standards for vision facilities such as image sensing equipment, chips, and network infrastructure; visual databases, data description, data formats, video interfaces, shape and spatial modeling, and other data and model standards; and the development of image recognition and processing standards such as image recognition, semantic processing of images, and image synthesis and differentiation.

Biometric feature recognition standards: Focus on the development of standards for typical modalities (fingerprint, face, iris, voiceprint, etc.) and emerging modalities (DNA, gait, etc.) facilities and equipment, public document frameworks, application program interfaces (APIs), data exchange formats, and silhouette technology requirements.

VR/AR standards: Focus on the development of standards for content production, 3D environment understanding, and 3D interactive understanding.

Human-computer interaction standards: Focus on the development of intelligent perception standards such as scene perception, eye tracking, and three-dimensional input; dynamic recognition standards such as facial expression recognition, gesture recognition, and handwriting recognition; and multimodal interaction standards such as speech interaction, affective interaction, somatosensory interaction, brain-computer interaction, and full-duplex interaction.

(6) Product and service standards.

Product and service standards include smart robots, smart vehicles (智能运载工具), smart terminals, and smart services, as shown in Figure 8.

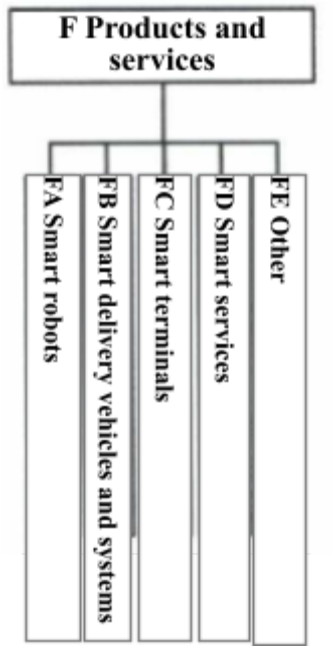

Fig. 8. Product and service standards

1. Smart robot standards: Combined with the work deployments of the *National Robotics Standards System Construction Guidelines*, in terms of service robots, improve the service robot hardware interface, safe use and multimodal interaction modes, function libraries (功能集), service robot application operating system frameworks, general purpose requirements for service robot cloud platforms, and other standards. In terms of industrial robots, focus on the development of standardization work on dynamic path planning for industrial robots and collaborative robot design.

2. Smart vehicle standards: Carry out the construction of a general purpose standards system and standards development for the application of AI technology in the field of smart vehicles, including high-performance collaborative sensing technology, vehicle interconnection and communication technology, and intelligentized (智能化) and networked security technology. Focus standardization work around general purpose key technologies such as integrated perception of the driving environment, intelligent decision-making and control, complex system reconstruction design, and multimodal testing and evaluation.

3. Smart terminal standards: Carry out standards research on the application of AI technology in the field of smart terminals, focusing on standardization work around image recognition, facial recognition, AI chips, and other related technologies for mobile smart terminal products.

4. Smart service standards: These include standards such as image recognition, intelligent speech, natural language processing, and machine learning algorithms. Focus on the development of standards such as the evaluation of mature AI service capabilities and smart service reference architecture.

Focus of product and service standards construction
Smart robot standards: For service robots, improve service robot hardware interfaces, safe use and multimodal interaction modes, function libraries, service robot application operating system frameworks, general purpose requirements for service robot cloud platforms, and other standards. For industrial robots, focus on the development of standardization work on dynamic path planning for industrial robots and the design specifications of collaborative robots.
Smart vehicle standards: Focus on standardization work around common key technologies such as integrated perception of the driving environment, intelligent decision-making and control, complex system reconstruction design, and multimodal testing and evaluation.
Smart terminal standards: Focus on standardization work around image recognition, facial recognition, AI chips, and other relevant technologies for mobile smart terminals.
Smart service standards: Focus on the development of standards for AI service capability maturity evaluation and smart service reference architecture.

(7) Industry application standards.

According to the *New Generation Artificial Intelligence Development Plan*[1] issued by the State Council and combined with the current development trend of AI applications, it is determined that the key industrial application fields for AI standardization include: Smart manufacturing, smart agriculture, smart transportation, smart healthcare, smart education, smart business, smart energy, smart logistics, smart finance, smart homes, smart government, smart cities, public security, smart environmental protection, smart courts, and smart gaming, as shown in Figure 9.

[1] Translator's note: For an English translation of the New Generation Artificial Intelligence Development Plan, see: https://www.newamerica.org/cybersecurity-initiative/digichina/blog/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017/

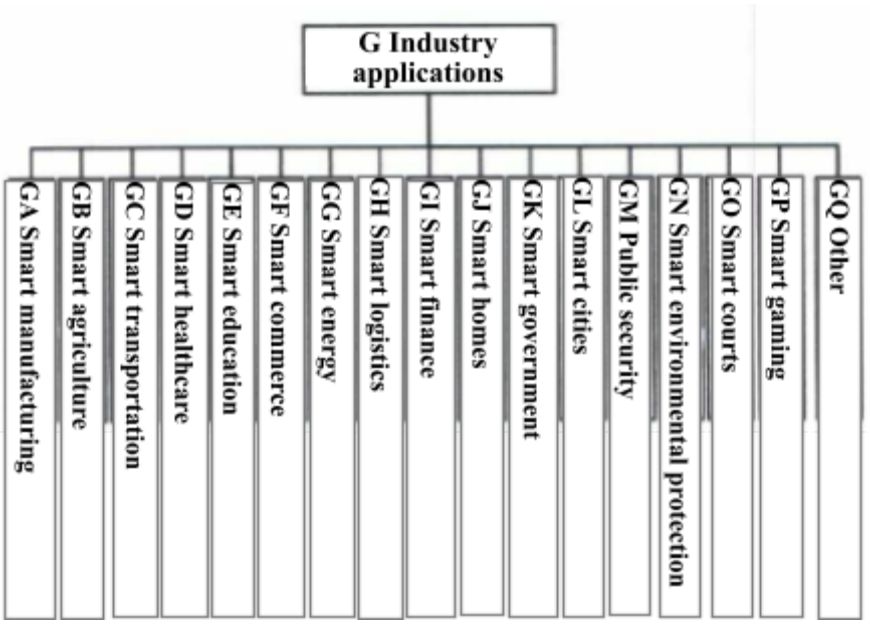

Fig. 9. Industry application standards

The industrial applications of AI have the characteristics of being cross-industry, cross-specialization, cross-field, and having multiple application scenarios, and different industries have different focuses. In the process of standards planning and research, market-driven orientation, industry guidance, and government support should be combined, based on industry needs, and the construction of a technology iteration system should be taken into account.

1. Smart manufacturing field: Standardize the technical requirements for information perception, autonomous control, system coordination, personalized customization, inspection and maintenance, and process optimization in industrial manufacturing.

2. Smart agriculture field: Standardize technical requirements for specialized sensors, networks, and predictive data models in agricultural environments with complex application environments and diverse application scenarios to assist in the production and processing of agricultural products and to increase crop yields.

3. Smart transportation field: Standardize the traffic information data platform and integrated management system so that dynamic and complex information on pedestrians, vehicles, and road conditions can be processed intelligently, leading to the promotion of technologies such as smart traffic lights.

4. Smart healthcare field: For medical data, medical diagnosis, medical services, and medical supervision, focus on standardizing the content of AI healthcare applications in data acquisition and data privacy management and include standards for medical data feature representation and AI medical quality assessment.

5. Smart education field: Standardize applications of AI related to the entire process of teaching and management in the new education system, establish an education service centered on learners, and realize the customization of daily education and lifelong education.

6. Smart business field: Primarily standardize the smart business field with complex application scenarios, including the categorization and management of service models, the intelligent analysis of business data, and the design requirements of corresponding recommendation engine system architectures.

7. Smart energy field: Standardize integrated smart applications in the entire process of energy development and utilization and production and consumption, including self-organization, self-checking, self-balancing, and self-optimization of energy systems.

8. Smart logistics field: Standardize technical and management requirements for the entire process of logistics from planning, purchasing, processing, storage, and transportation, and introduce smart identification, warehousing, scheduling, tracking, and configurations to improve logistics efficiency, strengthen the visibility of logistics information, and optimize logistics configurations.

9. Smart finance field: Standardize online payments, financing credit, investment consulting, risk management, big data analytics and forecasting, data security, and other application technologies to assist in improving credit investigations, product pricing, and investment research on the financial asset side, and payment methods, investment consulting, customer service, and other service capabilities on the client side.

10. Smart home field: Standardize products, services, and applications for smart home hardware, smart network connections, service platforms, and smart software. Promote the interconnection of smart home products, and effectively improve the smart home user experience with home lighting, monitoring, entertainment, health, education, information, and security.

11. Smart government affairs field: Standardize intelligentized applications in government affairs. From the perspective of open, transparent, and shared government information, improve the efficiency of government work in a standardized form, and strengthen preventative control and supervision during and after events.

12. Smart cities field: Standardize the technical requirements for smart applications in the future modeling of smart cities, including assessing the risks of AI technology in complex urban environments and assessing the level of intelligence of applications or products such as urban security and decision-making assistance.

13. Public security field: This specification involves detection and sensing for public security, various information processing, and comprehensive

analysis-related application technologies used to realize smart monitoring and early warning and comprehensive response.

14. Smart environmental protection field: Standardize related data models, platforms, and products such as environmental monitoring, natural resource management, and pollutant emission prediction so as to improve the level of intelligence in the environmental protection industry.

15. Smart courts field: Standardize the intelligent analysis and management requirements of information in the judicial process, realize the intelligent analysis of the elements of cases, and conduct mining and analysis of diversified data, thereby improving the efficiency of court trials.

16. Smart gaming field: Standardize game design and development, hardware equipment, human-computer interaction, game experiences, and other related AI technology applications, functional performance and testing, including game operating systems, game engines, multimedia rendering, voice and somatosensory dynamic interaction, autonomous learning by game characters, decision-making and confrontations, user data analysis, and game environment management.

Industry application standards construction focus
Smart manufacturing field: Focus on the development of large-scale personalized customizations, predictive maintenance (including the application of VR and AR technology), process optimization, manufacturing process logistics optimization, operation management optimization, and other standards.
Smart agriculture field: Urgently formulate relevant standards for agricultural sensors, narrowband Internet of Things (NB-IoT), pest prediction data models, and data platform interfaces.
Smart transportation field: Carry out research on standards such as smart transportation data information platforms, vehicle and road network communication, electronic license plate recognition, road priority lanes, the combination of IoV and AI, the combination of traffic lights and AI, and the combination of other industries (such as public security) and smart transportation.
Smart healthcare field: Focus on the development of standards for medical data monitoring and acquisition, medical data privacy and data exchanges, medical data labeling, medical data feature identification, medical data noise identification and quality evaluations, medical auxiliary diagnosis and risk assessment diagnosis, and medical supervision intelligentization.
Smart education field: Focus on the development of standards for AI technology education service platforms and interfaces, education data services, intelligent exam grading, intelligentized education supervision, and intelligent education application demonstration systems.
Smart business field: Urgently formulate standards for recommendation engine

system architectures, service management models, business data recognition technology, and precision marketing models.

Smart energy field: Urgently unify planning and top-level design with a research focus on basic concepts, term definitions, conceptual models, system architecture, and evaluation indicators.

Smart logistics field: Focus on standards research work in areas such as smart logistics planning, smart identification, smart warehousing and logistics process scheduling, tracking standardization, and logistics configuration requirements that align with the supply chain.

Smart finance field: Focus on carrying out corresponding research work on AI financial data standardization, financial risk controls, and data security, and strengthen forward-looking research on financial technology (fintech) frameworks.

Smart home field: Focus on standardization work in terms of product definition and categorization, fast access technology, cloud-based interconnection and control technology, smart interaction technology, energy savings, and intelligentized categorization.

Smart government affairs field: Focus on standardization work in data sharing, work collaboration, and open government information resources.

Smart cities field: Focus on standardization work for the level of urban security and the intelligence of decision-making aids, and develop relevant smart technology standards in conjunction with urban sewage treatment and other key areas that affect the people's livelihoods.

Public security field: Focus on the development of a variety of detection and sensing technologies, multi-source information fusion technology, video image information analysis and identification technology, biometric feature recognition technology integration, and the development of intelligentized monitoring and early warning and comprehensive response platform standards.

Smart environmental protection field: Focus on standard research on environmental monitoring technology, natural resource management, smart predictive data models for pollutant emissions, big data analysis platforms for smart environmental monitoring, and smart environmental monitoring networks for information sharing.

Smart courts field: Focus on the development of standards for a uniform and standardized court trial data format and for in-depth analysis of court trial data.

Smart gaming field: Focus on the development of standards such as game operating systems, game engines, multimedia rendering, voice and somatosensory dynamic interaction, autonomous learning by game characters, decision-making and confrontation, user data analysis, and game environment governance.

(8) Security and ethics standards.

Security and ethics standards include security and privacy protection and ethics

in the field of AI, as shown in Figure 10.

Fig. 10. Security and ethics standards

1. Security and privacy protection standards: This includes six parts: Basic security; data, algorithm and model security; technology and system security; security management and services; security testing and evaluation; and product and application security.

Of these, the basic AI security standard is the basic standard of the AI security standards system, is used to guide the whole process of AI security work, and mainly includes AI concepts and terminology, security reference architecture, and basic security requirements.

The security standards for AI data, algorithms, and models are proposed for prominent security risks in AI data, algorithms, and models and include the data security, privacy protection, and reliability of algorithm models.

AI technology and system security standards are used to guide the secure establishment of AI system platforms and mainly include AI open source framework security standards, AI system secure engineering standards, AI computing facility security standards, and AI security technology standards.

AI security management and service standards are mainly used to ensure AI management and service security and include security risk management, supply chain security, AI security operations, and AI security service capabilities.

AI security testing and evaluation standards mainly analyze the key points of security testing and evaluation from the aspects of AI algorithms, data, technology and systems, and applications and propose basic evaluation standards for AI algorithm model, system, and service platform security, data security, application risks, and testing and evaluation indicators.

Security standards for AI products and applications are mainly used to ensure the security of AI technologies, services, and products in specific application scenarios. Standards can be developed for smart door locks, smart speakers, intelligent risk control, smart customer service, and other fields with mature applications, wide uses,

or urgent security needs.

2. Ethics standards. These regulate requirements arising from the impact of AI services on traditional moral ethics and the legal order, and the key research areas are healthcare, transportation, emergency rescue, and other special industries.

Key points in security and ethical standards construction
AI basic security standards: Focus on the development of AI security terminology, AI security reference frameworks, AI basic security principles and requirements, and other standards.
AI data, algorithm, and model security standards: Focus on the development of standards for the use and management of anonymous user data, AI data security, AI data labeling security, and AI algorithm and model reliability.
AI technology and system security standards: Focus on the development of standards such as AI open source framework security and AI application security guidelines.
AI security management and service standards: Focus on the development of standards such as secure management practice guidelines for the AI supply chain and AI secure service capability requirements.
AI security testing and evaluation standards: Focus on the development of basic evaluation standards such as for AI algorithm, model, system, and service platform security, data security, application risks, and test evaluation indicators.
AI product and application security standards: Focus on the development of standards for smart door locks, smart speakers, smart risk control, smart customer service, and other fields with extensive applications or urgent security needs.
AI ethics standards: Focus on the development of AI-based healthcare, emergency response, and other standards involving ethics and morality.

Supplementary table

Table of areas for the development of AI standards

No.	Type	Type 2	Type 3	Description
1	A Basic general purpose	AA Terminology		Definitions, categories, and examples of AI terms.
2		AB Reference architecture		Standardizes the logical relationships and interactions between AI-related technologies, applications, and value chains.
3		AC Testing and evaluation		AI-related service capability maturity assessment, AI general purpose testing guidelines, assessment principles, and level requirements, corporate capability frameworks and evaluation

				requirements, etc.
4	B Basic tech and products	BA Big data		Big data system products, data sharing, and openness, data management mechanisms, data governance, etc.
5		BB Internet of Things		Smart network interfaces such as smart sensing devices, interfaces, and interoperability between sensing devices and AI platforms, integrated models of sensing and execution, multimodality and situational awareness, etc.
6		BC Cloud computing		Virtual and physical resource pooling and scheduling, smart computing platform architectures, smart computing resource definition and interfaces, application service deployment, etc.
7		BD Edge computing		Data transmission interface protocols, smart data storage, terminal-to-terminal collaboration, terminal-to-cloud collaboration, etc.
8		BE Smart sensors		Sensor interfaces, performance evaluations, test methods, etc.
9		BF Data storage and transfer devices		Data storage and transmission equipment-related technology and data interfaces.
10	C Founda-tional software and hardware platforms	CA Smart chips		Instruction sets and virtual instruction sets, chip performance, power consumption testing requirements, data exchange formats, chip operating system design and testing, etc.
11		CB System software		Standardization of AI software and hardware optimization compilers, AI operator libraries, AI software and hardware platform computing performance, etc.
12		CC Development framework		Development interfaces between machine learning frameworks and application systems, neural network model expression and compression, etc.
13	D Key general purpose tech	DA Machine learning		Standardization of different types of models, training data, knowledge bases, and expressions and evaluations such as supervised learning, unsupervised learning, semi-supervised learning, ensemble learning, deep learning, and reinforcement learning.
14		DB Knowledge graphs		Standardization of the technical requirements for the structural form, interpretation process, and semantic depth of knowledge description.
15		DC Brain-inspired intelligent computing		Brain-inspired intelligent computing reference architecture, brain feature mechanism computing model modeling and expression, algorithm requirements and performance evaluation based on biological mechanism modeling, and general technical requirements for brain-inspired intelligent computing hardware devices, etc.
16		DD Quantum intelligent computing		Quantum computing models and algorithms, high-performance and high-bit-rate quantum AI processors, and real-time quantum AI systems that

				can interact with the external environment, etc.
17		DE Pattern recognition		Standardization of the characteristics, models, technical requirements, and evaluation methods of the self-adaptive or self-organized pattern recognition system.
18	E Key niche tech	EA Natural language processing	EAA Language information extraction	OCR, stemming, word vectoring, part-of-speech tagging and description, etc.
19			EAB Text processing	Intelligent word segmentation, textual language recognition, lexical analysis, parsing, grammatical analysis, content relevance analysis, sentiment analysis, etc.
20			EAC Semantic processing	Large-scale smart semantic libraries, semantic data, semantic interfaces, semantic labeling, semantic understanding, semantic expression frameworks and models, data formats, formal expression, etc.
21			EAD Application extension	Automatic question answering, machine translation system architecture, models, technical requirements and evaluations, etc.
22		EB Intelligent speech	EBA Voice facilities and equipment	Voice sensing equipment, chips, network facilities, etc.
23			EBB Speech processing	Speech collection, speech corpuses, speech enhancement, sound source localization, speech encoding and decoding, speech endpoint detection, etc.
24			EBC Speech recognition	Far-field speech recognition, spoken language identification, dialect identification, command word recognition, speech dictation, speech transcription, etc.
25			EBD Speech synthesis	Online speech synthesis, offline speech synthesis, speech synthesis and differentiation, etc.
26			EBE Speech interfaces	Cloud interfaces, local interfaces, etc.
27		EC Computer vision	ECA Vision facilities and equipment	Image sensing equipment, chips, network facilities, etc.
28			ECB Data and models	Visual databases, data description, data formats, video interfaces, shapes and spatial modeling, etc.
29			ECC Image recognition and processing	Image recognition, image semantic processing, image synthesis and differentiation, etc.
30		ED Biometric feature recognition		Standardization of technical requirements for computers to use the inherent physiological characteristics of the human body (fingerprints, face, iris, voiceprint, DNA, etc.) or behavioral characteristics (gait, keystrokes, etc.) for personal identification.

31		EE VR/AR		Provision of general technical requirements for a consistent experience of multi-sensory information such as vision, touch, and hearing.
32				
33				
34		EF Human-computer interaction	EFA Smart sensing	Integration of scene perception, eye tracking, three-dimensional input, etc.
35			EFB Dynamic recognition	Expression recognition, gesture recognition, handwriting recognition, etc.
36			EFC Multimodal interaction	Speech interaction, emotional interaction, somatosensory interaction, brain-computer interaction, full-duplex interaction, etc.
37	F Products and services	FA Smart robots		Service robots, industrial robots, etc.
38		FB Smart delivery vehicles and systems		High-performance collaborative sensing technology, vehicle interconnection and communication technology, smart and networked security technology, etc.
39		FC Smart terminals		Mobile smart terminal product image recognition, facial recognition, AI chips, etc.
40		FD Smart services		AI service capability maturity evaluation and smart service reference architecture, etc.
41	G Industry applications	GA Smart manufacturing		Standardization of the technical requirements for information perception, autonomous control, system coordination, personalized customization, inspection and maintenance, and process optimization in industrial manufacturing.
42		GB Smart agriculture		Standardization of technical requirements for special sensors, networks, and predictive data models in agricultural environments with complex application environments and diverse application scenarios.
43		GC Smart transportation		Standardization of the traffic information data platform and integrated management system.
44		GD Smart healthcare		Standardization of the content of AI medical applications in data acquisition, data privacy management, etc.
45		GE Smart education		Standardization of the application of AI related to the whole process of teaching and management in the new education system.
46		GF Smart commerce		Standardization of the categorization and management of service models, smart analysis of business data, and the design requirements of the corresponding recommendation engine system architecture.
47		GG Smart energy		Standardization of integrated smart applications in the whole process of energy development and utilization, production, and consumption.
48		GH Smart logistics		Standardization of the technical and management requirements of the entire logistics process,

				including planning, purchasing, processing, storage, and transportation.
49		GI Smart finance		Standardization of application technologies such as online payment, financing, and credit, investment consulting, risk management, big data analysis and forecasting, and data security.
50		GJ Smart homes		Standardization of products, services, and applications for smart homes, smart hardware, smart networking, service platforms, smart software, etc.
51		GK Smart government		Standardization of smart applications for government affairs.
52		GL Smart cities		Standardization of technical requirements for smart applications in future models of smart cities.
53		GM Public security		Standardization of detection and sensing and various information processing and comprehensive analysis-related application technologies for public security.
54		GN Smart environmental protection		Standardization of related data models, platforms, and products such as environmental monitoring, natural resource management, and pollutant emission prediction.
55		GO Smart courts		Standardization of requirements for smart analysis and management of information in the judicial process.
56		GP Smart gaming		Standardization of game design and development, hardware equipment, human-computer interaction, game experiences, and other related AI technology applications, as well as functional performance and testing.
57	H Security and ethics	HA Security and privacy protection	HAA Basic security	AI concepts and terminology, security reference architecture, basic security requirements, etc.
58			HAB Data, algorithm, and model security	Data security, privacy protection, algorithm model reliability, etc.
59			HAC Technology and system security	AI open source framework security, AI system security engineering, AI computing facility security, AI security technology, etc.
60			HAD Security management and services	Security risk management, supply chain security, AI security operations, AI security service capabilities, etc.
61			HAE Security testing and evaluation	AI algorithm model, system, and service platform security, data security, application risk, testing and evaluation, etc.
62			HAF Product and application security	Assurance of AI technology, service, and product security in specific application scenarios.
63		HB Ethics		Standardization of requirements on AI service impacts on traditional moral ethics and the legal

				order.