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I S H A N G Q I

中国数字科技发展与创新生态
China’s Digital Technology Development and Innovation Ecosystem

—构建“数据+算法”驱动企业发展和投资新模式—

Building a “Data + Algorithm” Driven Model for Enterprise Growth and Investment

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北京上奇数字科技有限公司董事长

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简介/Profile

——孙会峰，现任北京上奇数字科技有限公司创始人兼董事长，北京智源人工智能研究院知识计算引擎创新中心主任，曾任工业和信息化部运行局特聘专家，国家开发银行评标专家等。**受邀主持国务院参事室、国家发改委、工信部、科技部、中国工程院等部委，主持国务院参事室、国家发改委、工信部、科技部、中国工程院等部委，以及北京、上海、广州、成都、南京等规划课题**。 Sun Huifeng, Founder and Chairman of Beijing Shangqi Digital Technology Co., Ltd., and Director of the Knowledge Computing Engine Innovation Center at the Beijing Academy of Artificial Intelligence (BAAI). Former expert at the Ministry of Industry and Information Technology (MIIT) and Bid Evaluation Expert for the China Development Bank. **I have led research projects commissioned by the State Council, NDRC, MIIT, MOST, CAE, and local governments in Beijing, Shanghai, Guangzhou, Chengdu, and Nanjing.**

——在数据分析、产业图谱、算法引擎等方面拥有20余年从业经历，主持**完成了科技部十四五重点专项“面向未来产业培育的科技服务平台”、工信部“产业大数据服务平台”**、深圳证券交易所“湾创100旗舰指数”、北京市“产业知识图谱系统”、深圳“大湾区国际科技情报系统”、北京“人工智能产业大脑”、上海“闵行产业大脑”等数字化平台，多次受邀在世界互联网大会（乌镇）、世界人工智能大会（上海）、世界智能网联汽车大会（北京）、世界计算大会（长沙）等做主题报告，作为优秀企业家受邀参加了国庆70周年现场观礼。

With over 20 years of experience in data analytics, industrial mapping, and algorithmic engine development, I have **directed multiple national and regional digital platforms, including the Future Industry Service Platform (MOST), Industrial Big Data Platform (MIIT)**, Bay Innovation 100 Index (SZSE), Industrial Knowledge Graph System (Beijing), Greater Bay Area S&T Intelligence System (Shenzhen), AI Industry Brain (Beijing), and Minhang Industry Brain (Shanghai). I have delivered keynote speeches at major global technology events such as the World Internet Conference, World Artificial Intelligence Conference, World Intelligent Connected Vehicles Conference, and World Computing Conference, and was invited as a distinguished entrepreneur to attend the 70th Anniversary Celebration of the PRC.

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国家信息中心 State Information Center

十七世纪

重农主义Physiocracy

“农业是一切财富的源泉”

“Agriculture is the source of all wealth”

十八世纪 70年代

“资本和劳动对国民财富的影响”

亚当·史密斯《国富论》

Adam Smith:

Capital and labor drive national wealth

十九世纪 40年代

John Stuart Mill

“生产的必要条件”，后来被改为生产要素

"Essential Factors of Production"

(later evolved into "Factors of Production")

二十世纪 20年代

“技术作为生产的重要输入”

Cobb-Douglas生产函数

Technology as a key production input

二十世纪 80、90年代

“企业家是生产要素”

“信息、信息技术是生产要素”

Entrepreneurs as a Production Factor/

Information and Information Technology as Production Factors

二十一世纪初

智力资本（知识）是生产要素

Intellectual Capital (Knowledge) as a Production Factor

十九届四中全会

“数据可作为生产要素按贡献参与分配”（2019年）

Data as a production factor that contributes to value distribution

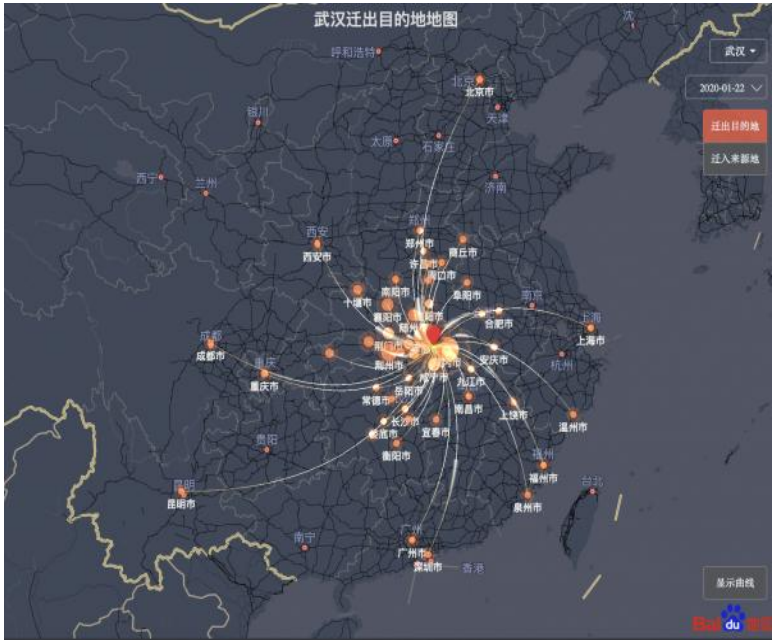
数据是最具时代特征的新生产要素

Data is recognized as the most defining new production factor of the digital era.

历史阶段 Historical Stages		生产要素 Factors of Production
农业时代 Agricultural Age		**土地、劳动力 Land, Labor**
工业时代 The Industrial Age	第一次工业革命 First Industrial Revolution	土地、劳动力、**资本** Land, Labor, **Capital**
	第二次工业革命 Second Industrial Revolution	土地、劳动力、资本、**技术** Land, Labor, Capital, **Technology**
	第三次工业革命 Third Industrial Revolution	土地、劳动力、资本、技术、**管理、知识** Land, Labor, Capital, Technology, **Management, Knowledge**
数字时代 Digital Age		土地、劳动力、资本、技术、管理、知识、**数据** Land, Labor, Capital, Technology, Management, Knowledge, **Data**

数据资源成为大国必争的基础性战略性资源
Data Resources Have Become a Foundational and Strategic Asset Highly Contested by Major Powers

发布时间 Release Year	国家 Country/Region	文件名称 Document Name
2018年	美国 USA	《数字经济的定义与衡量》Defining and Measuring the Digital Economy
2018年	美国 USA	《澄清境外数据的合法使用法案（CLOUD）》Clarifying Lawful Overseas Use of Data Act (CLOUD Act)
2019年	美国 USA	《联邦数据战略与2020年行动计划》Federal Data Strategy and 2020 Action Plan
2020年	欧盟 EU	《塑造欧洲的数字未来》Shaping Europe's Digital Future
2020年	欧盟 EU	《欧洲数据战略》A European Strategy for Data
2020年	欧盟 EU	《欧洲数据保护监管局战略计划（2020-2024）——塑造更安全的数字未来》*EDPS Strategy 2020-2024 — Shaping a Safer Digital Future*
2020年	欧盟 EU	《欧洲数字主权》European Digital Sovereignty
2020年	欧盟 EU	《塑造欧洲数字化转型》Shaping Europe's Digital Transformation
2020年	欧盟 EU	《数字治理法案》（草案）Data Governance Act (Proposal)
2021年	美国 USA	《美国的全球数字经济大战略》U.S. Strategic Approach to the Global Digital Economy
2021年	美国 USA	《联邦数据战略与2021年行动计划》Federal Data Strategy and 2021 Action Plan



2020年初新冠疫情爆发之后，大数据在中国政府、互联网、电信、工业、金融、健康医疗等行业均提供了强有力的支撑。Following the COVID-19 outbreak in early 2020, big data played a critical role in providing robust support across various sectors in China, including government, internet services, telecommunications, industry, finance, and healthcare.

“十四五”是我国从数据大国迈向数据强国的关键时期
The 14th Five-Year Plan period is key for China to become a global data powerhouse.

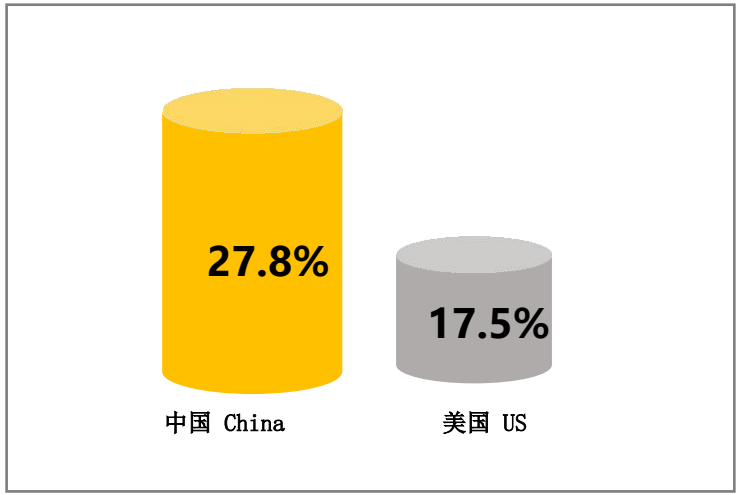
国家信息中心
State Information Center

2017年-2022年我国数据产量及全球占比情况
China's Data Output & Global Share (2017-2022)

2022年我国数据产量达8.1ZB，同比增长22.7%，全球占比达10.5%，位居世界第二。
In 2022, China's data output reached 8.1 ZB, a year-on-year increase of 22.7%, accounting for 10.5% of the global total and ranking second in the world.

来源：国家互联网信息办公室《数字中国发展报告（2022年）》
Source: National Internet Information Office, "Digital China Development Report (2022)"

2025年中美数据资源占比
2025 Projected Data Resource Share: China vs. US



据IDC测算，到2025年，中国拥有的数据量将占全球27.8%，远高于美国的17.5%。
According to IDC forecasts, by 2025, China's share of global data volume will reach 27.8%, significantly higher than the 17.5% share projected for the United States.

经营主体层面，数据要素市场创新创业活力不断增强
Data Factor Market: Dynamic Growth

国家信息中心 State Information Center

据不完全统计，全国新建各类数据交易机构80多家，全国省级以上政府提出推进建设数据交易中心（所）的近30家。
Innovation and entrepreneurship in the data factor market continue to gain momentum. Approximately 80 new data trading institutions have been established nationwide, with nearly 30 provincial governments actively promoting such centers.

北京国际大数据交易所
Beijing International Big Data Exchange

山西数据交易平台Shanxi Data Trading Platform

郑州数据交易中心
Zhengzhou Data Trading Center

甘肃丝路辉煌大数据交易中心
Gansu Silk Road Data Trading Center

西咸新区大数据交易中心
Xixian New Area Big Data Trading Center

四川数字资产交易中心
Sichuan Digital Asset Exchange Center

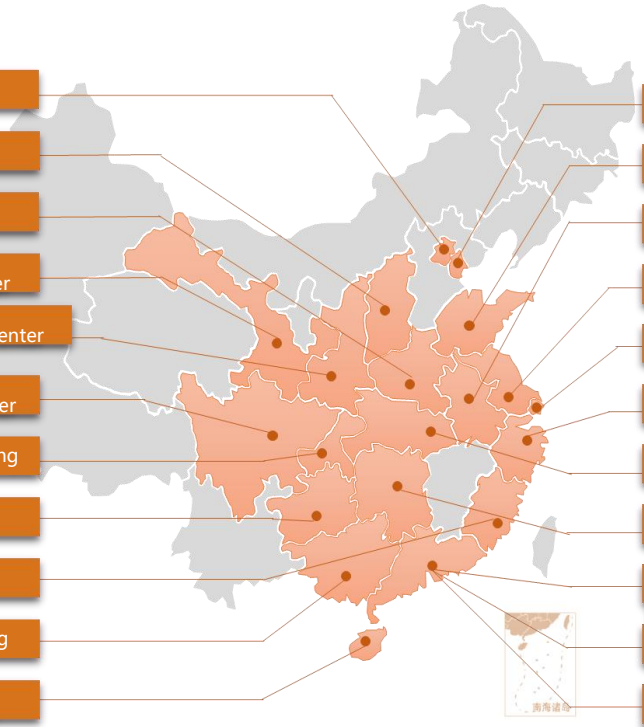
西部（重庆）大数据交易中心
Western (Chongqing) Big Data Trading Center

贵阳大数据交易所
Guiyang Big Data Exchange

福建数据交易所
Fujian Data Exchange

广西北部湾大数据交易中心
Guangxi Beibu Gulf Big Data Trading Center

海南省数据产品超市
Hainan Data Product Supermarket



天津北方大数据交易中心Tianjin Northern Big Data Trading Center

山东数据交易公司Shandong Data Trading Company

安徽大数据交易中心Anhui Big Data Trading Center

江苏华东大数据交易中心Jiangsu East China Big Data Trading Center

上海数据交易所Shanghai Data Exchange

浙江大数据交易中心Zhejiang Big Data Trading Center

华中大数据交易中心Central China Big Data Trading Center

湖南大数据交易所Hunan Big Data Exchange

华南（广东）国际数据交易有限公司South China (Guangdong) International Data Transaction

广州数据交易所Guangzhou Data Exchange

深圳数据交易所Shenzhen Data Exchange

北京国际大数据交易所
Beijing International Big Data

累计实现数据交易额**15.57亿元**
发放数据资产登记凭证**40张**
Cumulative transaction value: 1.557 billion yuan
40 data asset registration certificates issued

上海数据交易所
Shanghai Data Exchange

签约数据商**超500家**
登记挂牌数据产品达**1200个**
Signed over 500 data merchants
1,200 data products registered and listed

深圳数据交易所
Shenzhen Data Exchange

累计**交易额突破65亿元**
形成**数据产品超1800个**
导入 经营主体**共1260家。**
Cumulative transaction value exceeded 6.5 billion yuan
Facilitated over 1,800 data products
Involved 1,260 business entities

贵阳大数据交易所
Guiyang Big Data Exchange

入驻**数据商612家**
上架产品1245个
累计交易额已突破**18亿元**
612 data merchants settled in
1,245 products listed
Cumulative transaction value surpassed 1.8 billion yuan

数据要素“方法论”：数据的四层分类法
The Data Element "Methodology": A Four-Tier Data Classification Framework

国家信息中心 State Information Center

- 在传统信息理论中，根据加工情况通常将信息分为零次信息、一次信息、二次信息、三次信息。类比到数据要素市场领域，同样可以从数据要素开发利用层次的角度，对不同开发利用层次的数据要素产品形态、权属流转、价值分配、流通治理、优化配置等开展研究。
- In traditional information theory, information is typically categorized into zero-order, first-order, second-order, and third-order based on its level of processing. Analogously, within the data element market, we can study product forms, ownership transfer, value distribution, circulation governance, and optimal allocation for data elements at different development and utilization levels.

数据产品和服务-二级市场
Data Products & Services - Secondary Market

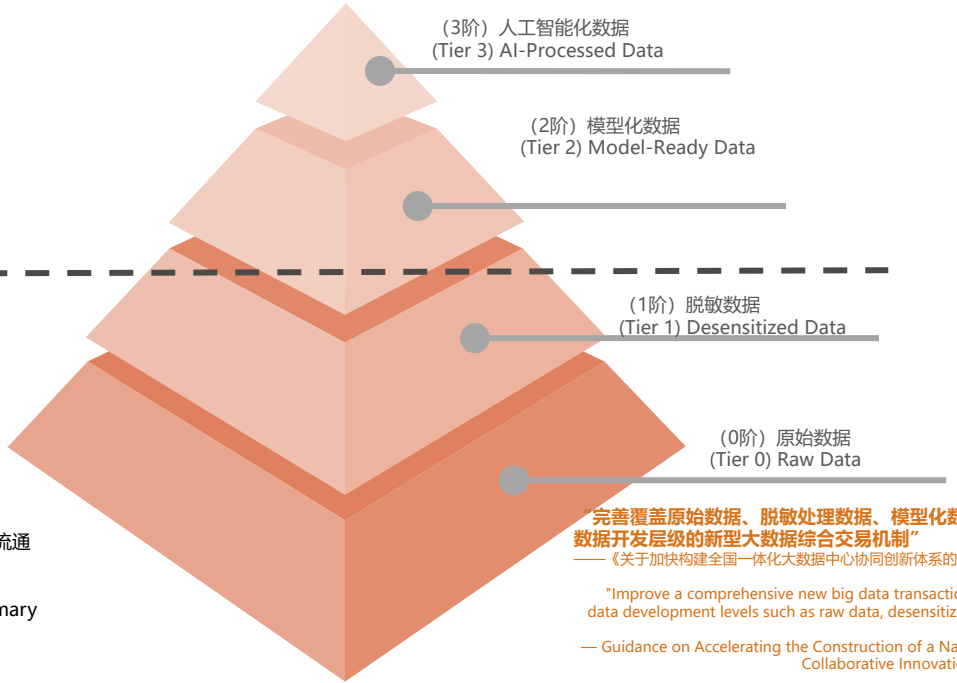
依托原生数据开发的数据产品和服务（具体交付形式可能是软件、指数、模型、报告等形态），承载其流通的数据市场即“二级市场”（数据产品和服务市场）
Data products and services developed based on raw data (deliverables may include software, indices, models, reports, etc.). The market facilitating their circulation is the "Secondary Market" (Data Products & Services Market)

数据资源-一级市场
Data Resources - Primary Market

主要以数据集或数据接口等方式流通的数据资源，承载这类要素流通的数据市场即“一级市场”（数据资源市场）
Data resources circulated primarily as datasets or via API interfaces. The market facilitating this circulation is the "Primary Market" (Data Resource Market)

四阶数据要素形态
Four Tiers of Data Element Forms

依据数据开发利用层级划分(Categorized by Data Development & Utilization Level)



“完善覆盖原始数据、脱敏处理数据、模型化数据和人工智能化数据等不同数据开发层级的新型大数据综合交易机制”
——《关于加快构建全国一体化大数据中心协同创新体系的指导意见》（发改高技〔2020〕1922号）

"Improve a comprehensive new big data transaction mechanism that covers different data development levels such as raw data, desensitized data, model-ready data, and AI-processed data.
— Guidance on Accelerating the Construction of a Nationally Integrated Big Data Center Collaborative Innovation System (NDRC [2020] No. 1922)

数据要素“价值论”：数据要素价值化的“两次飞跃”

The Data Element "Value Paradigm": The Two Leaps in Data Element Value Realization

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第一次飞跃
价值实现：做加法

第二次飞跃
流通交易：做乘法

数据资源/ Data Resource

数据聚集到一定规模形成资源
-采集基础数据，扩大增量数据
-聚焦数据存储规模、数据质量、采集效率
-数据资源汇聚融合、主体权属

Data aggregated to a certain scale forms a resource.
Collect foundational data, expand incremental data
Focus on storage scale, data quality, collection efficiency
Integration of data resources, ownership rights

数据资产/ Data Asset

价值可计量、数据可应用、产品可流通
-数据资产权属界定、估值、定价、流通等
-聚焦数据-标准化、数据应用、数据产品
-数据资产纳入企业会计报表

Value measurable, data applicable, products tradable.
Ownership definition, valuation, pricing, circulation
Focus on standardization, application, productization
Inclusion in corporate accounting statements

数据资本/Data Capital

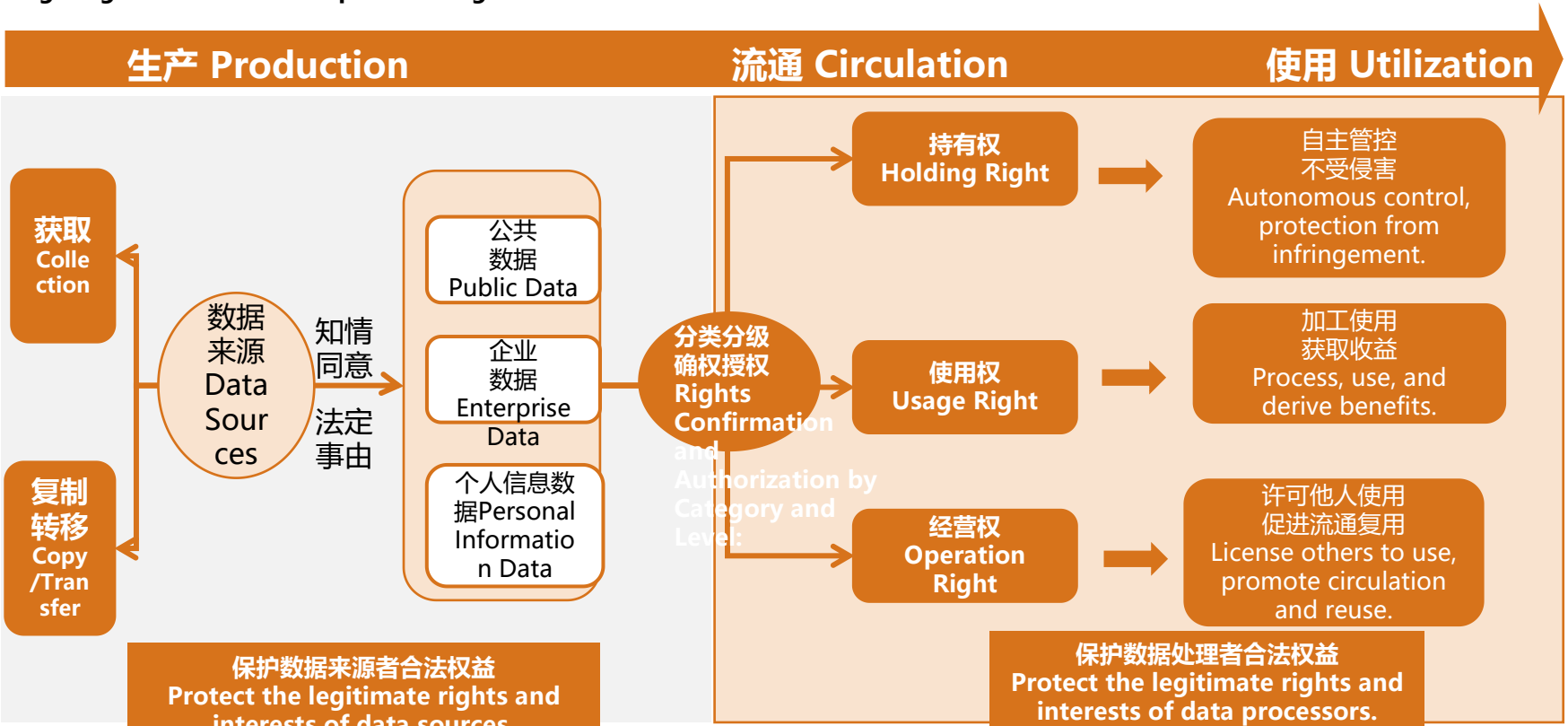
新生产力，成为资本市场核心力量
-数据产品服务资本化、数据资产证券化
-优化财政、税收、投资、金融市场配套政策
-数据作为资本融资、多级市场

New productive force, becoming core in capital markets.
Capitalization of data products/services, securitization of data assets
Optimize supporting policies in finance, taxation, investment
Data as capital financing, multi-tiered markets

探索数据产权结构性分置制度
Exploring a Structurally Separated Data Property Rights System

■ **建立数据资源持有权、数据加工使用权、数据产品经营权等分置的产权运行机制**

Establish an operational mechanism for data property rights that separates:Data Resource Holding Rights、Data Processing and Usage RightsData Product Operation Rights



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以数字科技为支撑的产业发展方向
Future Industries Driven by Digital Technology

面向国家高质量发展战略需求和大国竞争关键领域，立足我国科技创新与产业基础，紧扣经济社会发展与现代化产业体系建设需要，按照梯次培育、动态调整的原则，重点培育发展7大未来产业。Aligned with national strategic needs and global competition, we will leverage China's technological and industrial foundation to develop **seven future industries** through tiered cultivation and dynamic adjustment.

信息网络 Networks

- 全光通信网络 All-optical Networks
- 新一代移动通信 6G
- 卫星互联网 Satellite Internet
- 算力网络 Computing Power Grids

未来能源 Energy

- 可控核聚变 Nuclear Fusion
- 氢能 Hydrogen
- 储能 Storage
- CCUS

未来材料 Materials

- 前沿功能材料 Functional Materials
- 先进结构材料 Structural Materials
- 高性能复合材料 Composites

智能领域 Intelligence

- 通用人工智能General AI
- 具身智能Embodied AI
- 类脑智能Brain-inspired Computing

量子科技Quantum

- 量子通信 Quantum Communication
- 量子计算 Quantum Computing
- 量子精密测 Quantum Sensing

未来空间 Space

- 深海 Deep Sea
- 深地 Underground
- 空天 Aerospace

未来生物 Biotech

- 细胞和基因诊疗 Cell & Gene Therapy
- 生物制造 Biomanufacturing
- 生物育种 Bio-breeding
- 脑机接口 Brain -Computer Interface

智能领域-通用人工智能
Intelligence Sector - Artificial General Intelligence

我国高度重视通用人工智能的发展，2024年，“人工智能+”首次被写入《政府工作报告》，2024年12月召开的中央经济工作会议强调，开展“人工智能+”行动，培育未来产业。China places high importance on the development of Artificial General Intelligence (AGI). In 2024, "AI+" was officially included in the Government Work Report for the first time. The Central Economic Work Conference held in December 2024 emphasized the implementation of the "AI+" initiative to cultivate future industries.

定义内涵 Definition：

- ✓ **通用人工智能**是能够在任何智力任务上达到或超越人类水平，并通过自主学习与适应，在未知情境中完成跨领域推理与决策的人工智能系统。这里的通用人工智能主要指以大模型为代表的**信息智能。**Artificial General Intelligence refers to an AI system capable of matching or surpassing human levels in any intellectual task. It achieves cross-domain reasoning and decision-making in unknown scenarios through autonomous learning and adaptation. Here, AGI primarily refers to information intelligence represented by large models.

发展现状 Development Status:

- **美国**在人工智能领域起步较早，拥有谷歌、Facebook、微软、OpenAI等全球领先的通用人工智能企业。The United States started early in the field of artificial intelligence and boasts globally leading AGI companies such as Google, Meta (Facebook), Microsoft, and OpenAI.
- **我国**人工智能发展注重**整体布局与产业协同**，而非单一技术指标的突破，百度、阿里巴巴、字节跳动、科大讯飞等自研大模型接入业务系统。China's AI development focuses on overall strategic layout and industrial collaboration rather than breakthroughs in single technical metrics. Companies like Baidu, Alibaba, ByteDance, and iFlytek have integrated their self-developed large models into business systems.

产业规模预测 Scale Forecast:

2030年

中国的通用人工智能市场规模为**0.4–0.7万亿元**
China's AGI market size is estimated at 0.4 - 0.7 trillion yuan

2035年

中国的通用人工智能市场规模为**1.5–2.5万亿元**
China's AGI market size is estimated at 1.5 - 2.5 trillion yuan

产业链环节（信息通用智能）Industry Chain Components (General-Purpose AI)		
一、上游：基础支撑层 Upstream: Foundational Support Layer	算力基础设施（元器件—算力基础服务器—数据中心） Computing Infrastructure	AI芯片、存储芯片、光模块、电源、固态硬盘、机柜、传感器——通信、服务器、云计算——数据中心 Components: AI Chips, Memory Chips, Optical Modules, Power Supplies, SSDs, Cabinets, Sensors
	数据资源 Data Resources	第三方合规数据 数据治理 数据管理 数据标注 数据分析 Third-party Compliant Data Data Governance Data Management Data Annotation Data Analysis
	算法框架 Algorithm Frameworks	模型训练开发平台 操作系统 深度学习框架/开源模型 Model Training & Development Platforms Operating Systems Deep Learning Frameworks / Open-Source Models
二、中游：通用人工智能核心技术层 Midstream: Core AGI Technology Layer	人工智能模型训练 AI Model Training	预训练大模型 多模态大模型 推理模型 Pre-trained Large Models Multimodal Large Models Inference Models
三、下游：应用场景与服务 Downstream: Application Scenarios & Services	行业应用 Industry Applications	电商、医疗、教育、金融、营销、办公、影视、工业、交通、物流、人工智能智能体等 E-commerce, Healthcare, Education, Finance, Marketing, Office Work, Media & Entertainment, Industrial, Transportation, Logistics, AI Agents
	产品服务（端侧通用人工智能）Product Services (Edge-side AGI Applications)	人工智能眼镜、智能机器人、人工智能玩具等 AI Glasses, Intelligent Robots, AI Toys

图2 通用智能产业链关键环节（信息通用智能）
Figure 2. Key Components of the General-Purpose AI Industry Chain

智能领域-具身智能
Embodied AI

2023年工信部等17个部门联合发布《“机器人+”应用行动实施方案》提出加速具身智能在制造业、物流、医疗等领域的场景落地，建设国家级试验中心。2025年政府工作报告指出培育具身智能等未来产业 China's "Robot+" Action Plan (2023) accelerates Embodied AI deployment in manufacturing, logistics, and healthcare; 2025 Government Work Report confirms Embodied AI as key future industry

定义内涵 Definition：

✓ **具身智能**是指具备物理实体且能够与真实世界进行交互的智能体，具有自主感知、规划/推理、决策、执行以及动态调整等能力。具身智能兼具**认知智能与物理执行**双重属性，正重塑人机协同方式并开辟下一代生产力范式。Embodied AI refers to intelligent physical systems that perceive, reason, decide, and act in real-world environments. Combining cognitive intelligence with physical execution, it enables new human-machine collaboration models.

发展现状 Development Status：

- **美国、欧盟、日本、韩国、中国等**均发布相关政策支持具身智能领域的前沿技术攻关及重要场景落地。United States, European Union, Japan, South Korea, China and others have all issued relevant policies to support cutting-edge technological breakthroughs and implementation in key scenarios within the embodied intelligence field.
- 具身智能发展同时涉及软硬件技术，其链条长且技术栈复杂，其中，以**具身大模型**为代表的软件技术最关键。具身模型当前发展的主要瓶颈是**数据**。The development of embodied intelligence involves both hardware and software technologies, characterized by long chains and complex technology stacks. Among these, software technology, represented by large embodied models, is the most critical.

产业规模预测 Scale Forecast::

2030年

中国人形机器人出货量有望达到35万台，市场空间有望至**581亿元**
China's humanoid robot shipments are projected to reach 350,000 units

2035年

全球新兴人形机器人市场规模约**2742亿元**
Global emerging humanoid robot market: ≈274.2 billion RMB

2050年

全球人形机器人市场规模可能超过**36万亿元**
Total addressable global humanoid robot market: >36 trillion RMB

产业链环节		
一、上游：基础支撑层 Upstream: Foundational Support Layer	1. 机器人实现运动和感知涉及的核心零部件 Core components for robot motion and perception:	1）传感器件（视觉传感器、力觉/触觉传感器、位置/姿态传感器、其他传感器） 2）驱动系统（电机、减速器、执行器、运行模组） 3）控制系统（主控芯片、运动控制器、嵌入式系统） 4）能源系统（电池、电源管理芯片） 5）通信模块 Sensors (Vision sensors, Force/Tactile sensors, Position/Posture sensors, Other sensors) Drive Systems (Motors, Reducers, Actuators, Motion modules) Control Systems (Main control chips, Motion controllers, Embedded systems) Energy Systems (Batteries, Power management chips) Communication Modules
	2. 训练具身智能大模型的数据集Datasets for training embodied AI large models:	1）感知数据集 2）交互数据集 3）物理世界数据集 4）合成数据集 Perception datasets, Interaction datasets, Physical world datasets, Synthetic datasets
	3. 提供开发工具和平台的软件基础设施 Software infrastructure providing development tools and platforms:	1）操作系统 2）仿真平台 3）云计算平台 4）开发工具包 Operating systems, Simulation platforms, Cloud computing platforms, Development kits
二、中游：具身智能本体集成 Midstream: Embodied Intelligence Entity Integration	1. 具身智能模型Embodied AI Models:	1）世界模型 2）感知控制 3）运动控制 4）决策规划 5）人机交互模型 6）算法研发 7）迁移学习/多模态融合 World Models Perception Control Motion Control Decision-making & Planning Human-Computer Interaction Models Algorithm R&D Transfer Learning / Multimodal Fusion
	2. 机器人本体制造Robot Ontology Manufacturing:	1）工业机器人 2）服务机器人 3）特种机器人 Industrial Robots Service Robots Special-purpose Robots
	3. 整机平台与系统集成Complete Machine Platforms & System Integration:	系统集成和解决方案提供System integration and solution provision
三、下游：应用场景与服务 Downstream: Application Scenarios & Services	1. 应用领域和场景Application Fields and Scenarios:	1）工业领域（智能制造、柔性制造、仓储物流等）2）农业领域（精准农业）3）服务领域（家庭服务、医疗护理、教育娱乐、餐饮酒店、安防巡逻）Industrial Sector (Smart Manufacturing, Flexible Manufacturing, Warehousing & Logistics, etc.) Agricultural Sector (Precision Agriculture) Service Sector (Home Services, Medical Care, Education & Entertainment, Catering & Hospitality, Security & Patrol)
	2. 服务和支持Services and Support:	1）机器人运维服务 2）数据服务 3）云平台服务 4）培训服务Robot Operation & Maintenance Services Data Services Cloud Platform Services Training Services

图2 具身智能产业链关键环节
Figure 2. Key Components of the Embodied AI Industry Chain

智能领域-类脑智能
Brain-inspired Intelligence

2017年国务院发布《新一代人工智能发展规划》，提出了到2030年在类脑智能领域取得重大突破的发展目标。在国家“十四五”规划纲要中明确指出类脑智能是前瞻谋划未来产业的重要方向之一。China's 2017 Next-Generation AI Development Plan set 2030 as target for breakthroughs Included as key future industry in 14th Five-Year Plan

定义内涵 Definition:

- ✓ **类脑智能**是人工智能的前沿领域之一，以模拟大脑的神经结构和认知原理为核心，旨在使计算系统能够具备类似人类的感知、推理和学习能力。
- ✓ 类脑智能是推进人工智能跨越式发展的重要突破口，可以与计算、生物、信息等多领域相互支撑，形成**“乘数效应”**。Brain-inspired intelligence simulates brain's neural structures and cognitive principles to develop human-like perception, reasoning and learning capabilities. It represents a breakthrough opportunity with multiplier effects across computing, biology and IT.

发展现状 Development Status:

- **美国**通过《推进创新神经技术脑研究划》（BRAIN计划）全面支撑类脑智能发展，处于全球领先地位。US: Leads globally through BRAIN Initiative
- 我国2021年正式启动创新**2030“脑科学与类脑研究”**（中国脑科学计划）以来，围绕脑与认知、类脑研究和脑的健康3个核心问题，统筹安排脑科学的基础研究、转化应用和相关产业发展，形成“一体两翼”布局。China: Launched Brain Science and Brain-Inspired Research project (2021) with three core focus areas: Brain cognition mechanisms,Brain-inspired research,Brain health

产业规模预测 Scale Forecast:

2030年

在自动驾驶领域、工业制造等领域实现大规模应用，整体产业规模达到**193.03亿元**

Large-scale implementation in autonomous driving and industrial manufacturing has driven total market size to 193.03 billion RMB

2035年

机器人大脑处理器技术实现重大突破，整体产业规模达到**587.91亿元**

Major breakthroughs in robot brain processor technology have propelled the industry scale to 587.91 billion RMB

2050年

类脑智能芯片性能大幅度提升，有望支撑通用人工智能算力需求

Significant performance improvements in brain-inspired chips now enable them to support the computational demands of Artificial General Intelligence (AGI)

环节Sector	主要内容Focus Areas	典型研究院所与企业Key Institutions & Companies
基础理论 Theory	●脑科学 ●脑认知与神经计算 ●大脑可塑性机制 ●多尺度生物成像技术 Brain science Neural computing Brain plasticity Bio-imaging	●北京脑科学与类脑研究所 ●上海脑科学与类脑研究中心 Beijing BIIR Shanghai BIRC
硬件 Hardware	●类脑芯片（非冯架构） ●忆阻器、传感器、深脑电极等关键元器件 Neuromorphic chips Memristors Sensors Deep brain electrodes	●灵汐科技 ●时识科技 ●清华大学 ●Intel ●IBM Lingxi Tech • SynSense • Tsinghua • Intel • IBM
软件算法 Software	●脉冲神经网络（SNN） ●多模态融合算法 ●开发框架 ●类脑计算软件 Spiking Neural Networks • Multimodal algorithms • Development frameworks	●Google ●脑虎科技 ●脑陆科技 ●时识科技 ●SynSense Google • Brain Tiger Tech • Brain Land Tech • SynSense
产品应用 Applications	●类脑计算机 ●类脑机器人 ●医疗、工业、消费电子等行业应用 Neuromorphic computers • Robots • Medical/Industrial/Consumer electronics	●千诀科技 ●岩思类脑 ●灵汐科技 ●臻泰智能 Qianjue • Yansi • Lingxi • Zhentai

图1 类脑智能产业链关键环节
Figure 1. Key Components of the Brain-inspired Intelligence Industry Chain

量子科技-量子计算
Quantum Computing

量子计算是量子信息科技中最具投资价值的“发动机”。“十四五”国家发展规划提出，加快布局量子计算等前沿技术。Quantum computing serves as the prime investment "engine" within quantum information technology. China's 14th Five-Year Plan explicitly calls for accelerated deployment of cutting-edge technologies including quantum computing.

定义内涵 Definition：

- ✓ **量子计算**是利用量子力学为经典计算机解决更困难问题的前沿技术，主要以量子比特为基本单元，利用量子叠加和干涉等原理实现并行计算。Quantum computing harnesses quantum mechanics to solve complex problems beyond classical computers' reach. Using qubits and principles like superposition, it enables parallel processing.

发展现状 Development Status：

- ◘ **美国**能源部联合学术界、产业界和国家实验室于2024年发布面向未来20年的《量子信息科学应用路线图》，以量子计算、量子传感和量子网络为核心，推动**量子计算技术**研究及产业发展。US: DOE's 2024 Quantum Information Science Roadmap guides R&D in quantum computing, sensing and networks
- ◘ **我国**已布局**超导量子、光量子**等技术途径，在光量子计算领域国际领先。“九章三号”实现了基于256个光量子比特模拟玻色采样应用。China: Leads in photonic quantum computing with "Jiuzhang 3.0" (255 qubits)

产业规模预测 Scale Forecast：

2025年

全球量子计算产业规模预计达到**61亿美元**。中国量子计算产业规模预计将达到**115.6亿元**

Global quantum computing market is projected to reach $6.1 billion.China's quantum computing market is expected to hit ¥115.6 billion

2035年

全球量子计算产业规模预计将突破**8077.50亿美元**

The global quantum computing market is forecast to exceed $807.75 billion

2050年

量子纠错实现逻辑比特，具备研制**大规模通用量子计算机**的能力

Breakthroughs in quantum error correction enabling logical qubits are paving the way for large-scale universal quantum computers

上游	关键核心硬件	稀释制冷剂、测控系统、低温组件、真空系统等
	软件开发工具包	软件开发环境、量子编程框架、量子算法库等
中游	整机	通用门型量子计算机、专用量子计算机等
	操作系统	量子算法、逻辑优化、量子比特控制与纠错等
下游	量子云平台	硬件接入、量子模拟器、算法库与用例模板
	应用软件	量子计算编译软件、人工智能、组合优化等
	行业应用	医疗制药、智慧城市、人工智能加速计算等

图1 量子计算产业链示意图
Diagram of the Quantum Computing Industry Chain

上游包括量子计算硬件制造所需的核心材料、器件、组件及环境支撑与测控系统；**中游**可分为原型机和操作系统；**下游**主要为量子云平台、应用软件和各行业应用

Upstream: Core materials, components, control systems
Midstream: Prototype machines, operating systems
Downstream: Cloud platforms, software, industry applications

信息网络-高速全光通信和新一代移动通信
High-Speed All-Optical & Next-Gen Mobile Communication

围绕泛在、高效、智能、融合、安全等下一代信息通信网络发展需求，前瞻布局高速全光通信、新一代移动通信等先进通信。China is strategically advancing high-speed all-optical communication and 6G mobile networks to meet next-generation info-communications demands for pervasive, efficient, and secure connectivity.

高速全光通信

发展意义 Development Significance

✓ 下一代光通信以**高速、智能、绿色、安全**为主要特征
Next-gen optical communication features high speed, intelligence, energy efficiency, and security.

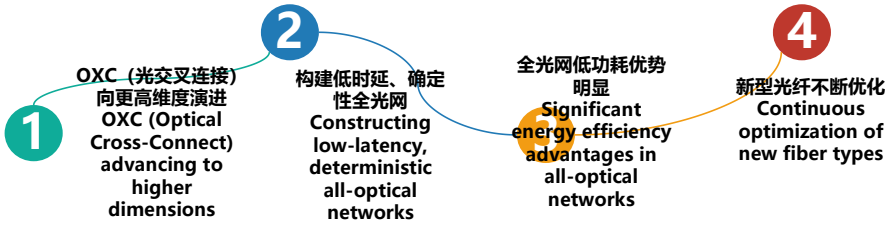
✓ 下一代光通信是**数字基础设施底座**，是驱动新一轮内生性增长的新动能。
It forms the foundation of digital infrastructure and drives new endogenous growth.

顶层指导 Policy Guidance

- 2022年，国务院发布《“十四五”数字经济发展规划》，明确“推进光纤网络扩容加速工程，加快**千兆光纤网络**部署，持续推进**新一代超大容量、超长距离、智能调度**的光传输网建设。” China's 14th Five-Year Plan for Digital Economy promotes gigabit optical network deployment and ultra-large-capacity, intelligent optical transmission systems.

发展趋势 Development Trend

- **预计未来10年**可实现大规模产业化，使我国在高速全光通信技术、标准和产业发展的竞争格局中保持领先水平。Large-scale industrialization is projected within 10 years, maintaining China's leading position in high-speed all-optical technology and standards.



新一代移动通信

发展意义 Development Significance

✓ 新一代移动通信是全球大国战略博弈的**制高点**。
Represents a strategic focus in global power competition.

✓ 新一代移动通信是经济社会高质量发展的**引擎**。
Serves as an engine for high-quality economic development.

✓ 6G是构建现代化产业体系的**基石**。
Forms the cornerstone of modern industrial systems.

顶层指导 Policy Guidance

- 《“十四五”数字经济发展规划》，明确“前瞻布局**第六代移动通信（6G）**网络技术储备，加大6G技术研发支持力度，积极参与推动6G国际标准化工作。The 14th Five-Year Plan mandates forward-looking R&D in 6G, enhanced technical support, and active engagement in international 6G standardization.

发展趋势 Development Trend

2025
确定6G的应用场景，并开展6G早期关键技术的研究
Defining 6G application scenarios and initiating early-stage key technology research

2025年以后
转入到6G关键技术的突破阶段，启动国际标准化工作
Transitioning to breakthrough phase in core 6G technologies and launching international standardization

2028年左右
进入到6G规模化商用产品的研发阶段
Advancing to large-scale commercial product development stage

2030年
6G开始商用、产业化
Commencing commercial deployment and industrialization of 6G

生物领域-脑机接口
Brain-Computer Interface (BCI)

工信部等七部委联合发布的《关于推动未来产业创新发展的实施意见》将“脑机接口”列为未来产业十大标志性产品之一，提出要重点突破脑机融合、类脑芯片、大脑计算神经模型等关键技术和核心器件。China has designated BCI as one of ten flagship future industries, focusing on breakthroughs in brain-machine fusion, neuromorphic chips, and computational neural models.

定义内涵 Definition：

- ✓ **脑机接口（简称BCI）**是在人或动物脑（或者脑细胞的培养物）与外部设备间创建的直接通路。脑机接口可以理解为一种新型的**信息传输渠道**，通过这种渠道，信息能够绕过原有的肌肉及外围神经通路。BCI establishes direct communication pathways between the brain and external devices, enabling information transfer bypassing conventional neuromuscular channels.

发展现状 Development Status：

- ✓ 美国、欧盟、日本均在战略层面对脑机接口进行布局。**美国启动“大脑研究计划”**，欧盟发起“人类脑计划”。Global leaders (US, EU, Japan) have launched major brain initiatives (e.g., US BRAIN Initiative, EU Human Brain Project).
- ✓ **我国脑机接口技术**发展迅速，2022年我国脑机接口市场规模为23.34亿元，2024年增长至**32.03亿元**。China’s BCI market grew from ¥2.33B (2022) to ¥3.20B (2024).

领域Field	应用案例Examples
医疗—输入型 Medical-Input	通过脑机接口实时监控和测量人体神经系统状态 Real-time monitoring of neural activity
医疗—输出型 Medical-Output	用于治疗和康复帕金森病、癫痫、轻度认知障碍、阿尔茨海默病、焦虑、抑郁、创伤后应激障碍及强迫症等。Treating Parkinson’s, epilepsy, Alzheimer’s, depression, PTSD
智能家居 Smart Home	脑机接口可充当“遥控器”，帮助用户通过意念控制灯光、门窗及窗帘等，甚至进一步操控家庭服务机器人。Thought-controlled lighting, appliances, and service robots
娱乐 Entertainment	为游戏玩家提供超越传统控制方式的操作维度，允许通过意念控制虚拟现实（VR）界面的菜单和选项，极大丰富了游戏内容并提升了体验。VR/Game control via brain signals
军事 Military	协助操控无人装备，替代战士执行危险任务，未来脑控武器是军事武器自动化与智能化的重要发展方向。Operating unmanned systems and brain-controlled weapons

产业规模预测 Scale Forecast：

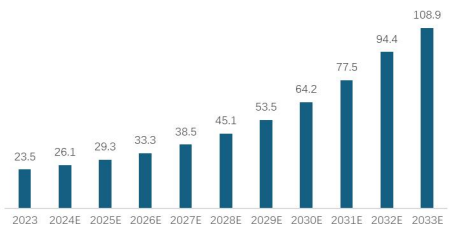


图1：2023-2033全球脑机接口市场规模（亿美元）
2023-2033 Global Brain-Computer Interface Market Size (USD 100 million)

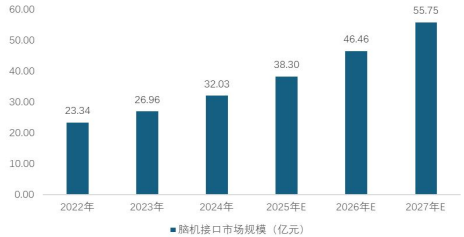


图2：中国脑机接口市场规模及预测（亿元）
China BCI Market Size and Forecast (100 million yuan)

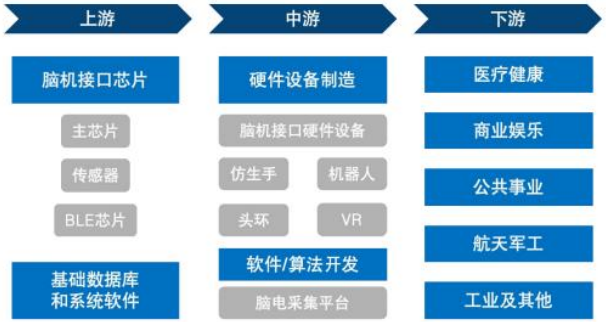


图3 脑机接口产业链
BCI Industry Chain

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以场景创新挖掘商业机会

Unlocking business potential with scenario innovation

以金融工具实现合作共赢

Achieving shared success via financial instruments

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