

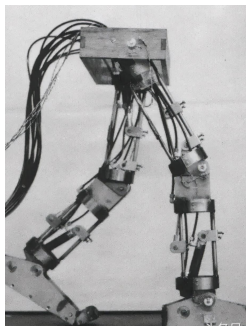


Embodied AI Empowers Humanoid to Accelerate Scenario Applications

UBTECH ROBOTICS
VP, Dr. Pang Jianxin



Research History of Bipedal Humanoid Robots



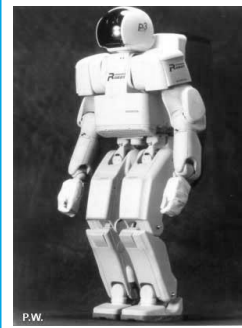
1969
Waseda University



1980
MIT-leg



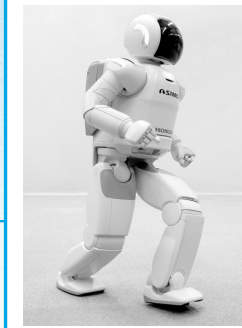
1997
Spring Turkey MIT



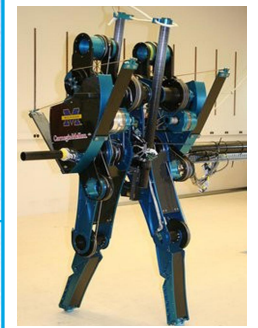
1997
Honda P3



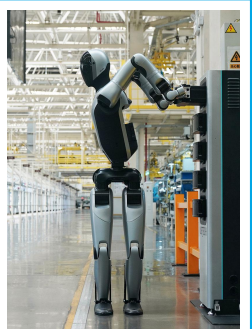
1997
HRP1 AIST



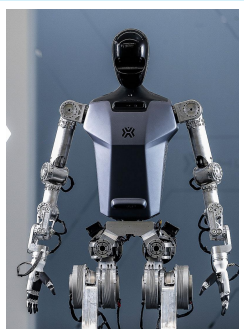
2000
Honda ASIMO



2008
MABEL



2025
Walker S2



2024
TianGong



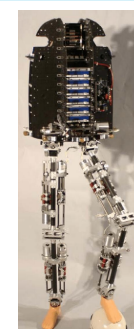
2022
TeslaOptimus



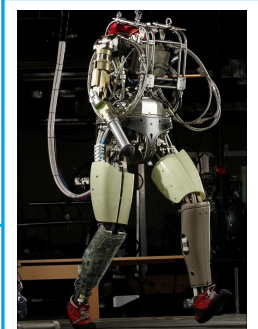
2019
UBTECH Walker



2013
Atlas
Boston Dynamic

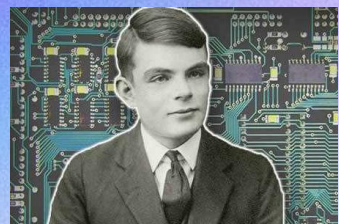


2012
M2V2 IHMC



2009
Petman
Boston Dynamic

AI is advancing the intelligence of humanoid robots



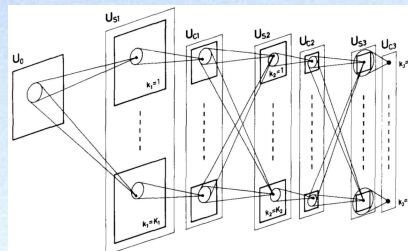
1950
Turing Test

Eliza Chat bot

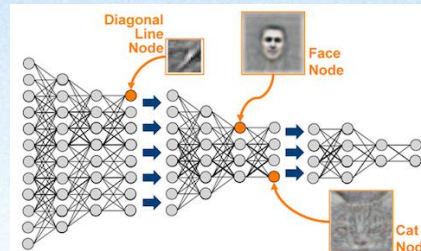
> Hello. My name is Eliza. How may I help you?
• Hello
> How are you today.. What would you like to discuss?
• yes
> I understand.
• how are you?
> Why are you interested in whether or not I am ?

chat:

1964
Eliza Robot



1980
Neocognitron



2006
Deep learning



2022
ChatGPT



2024
ChatGPT 4o

1956
AI
Dartmouth Conference



1972
Shakey



1997
DeepBlue



2016
AlphaGo



2024
Sora



2025
DeepSeek R1

deepseek
探索未至之境

Humanoid robots are one of the ultimate forms of robots in the future



发展阶段	特点	应用	规模
初级机器人	基本不动+重复执行	机械手、轨道机器人等	约 50 万个/年
中级机器人	行走+独立执行	清洁，环卫，仓储搬运，室内外配送机器人等	未来达到 1000 万/年
具身智能机器人	自主行走+自主执行	人形机器人等	未来与人类比例超过 1:1，总量将达 100-200 亿

Humans are accelerating into an AI era powered by humanoid robots

The History of Science and Technological Progress



The 1st Industrial
Revolution
Steam Technology

Mechanization



The 2nd Industrial
Revolution
Electrical Technology

Electrification



The 3rd Industrial
Revolution
Information Technology

Automation



The 4th Industrial
Revolution
Ai-Quantum Technology

Intelligentization

Background of Labor Supply and Demand in China's Manufacturing Industry

By 2025, the shortage of manufacturing workers in China will be close to 30 million, with a shortage rate of 48%!

—— 《Guidelines for the Development Plan of Manufacturing Talents》
by the Ministry of HRSS、 IIT、 Edu.

Frontline workers face high labor intensity, which is the main reason for the labor shortage in the manufacturing industry.



Assembler: Repetitive tasks



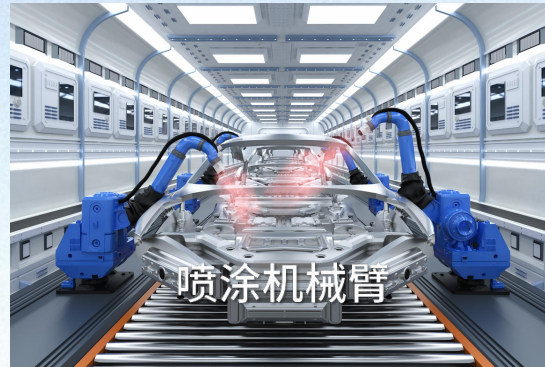
Sorter: Frequent Bending



Inspector: Prolonged Standing

Humanoid alleviating the contradiction between labor supply and demand in the manufacturing industry.

Traditional robots are widely used in structured environments and still cannot replace frontline workers in unstructured environments.

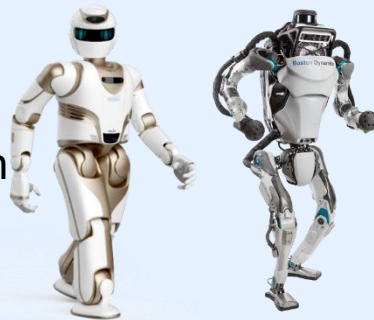


Frontline workers in unstructured environments
Assembly/Sorting/inspection/...
(Are still not replaced)

Humanoid can adapt to unstructured environments, which can alleviate the contradiction between frontline labor supply and demand

Humanoid

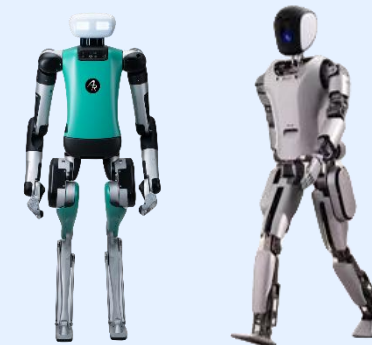
- Bipedal Locomotion
- Dual-Arm Manipulation
- Dexterous Hand



Industrial Scenarios

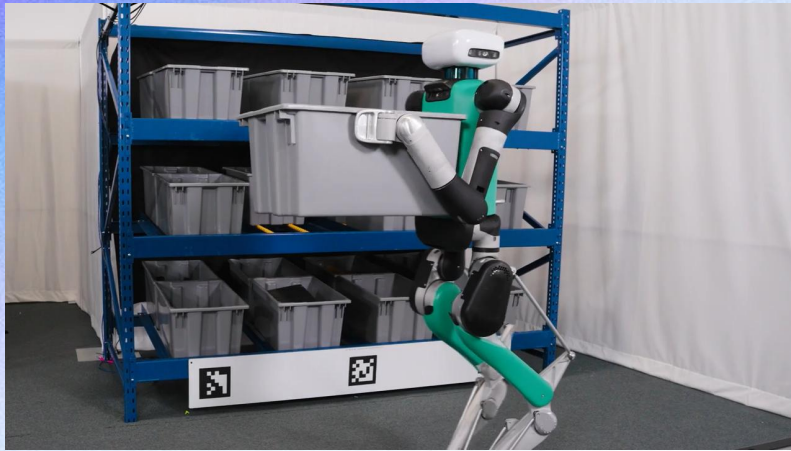


Industry Humanoid

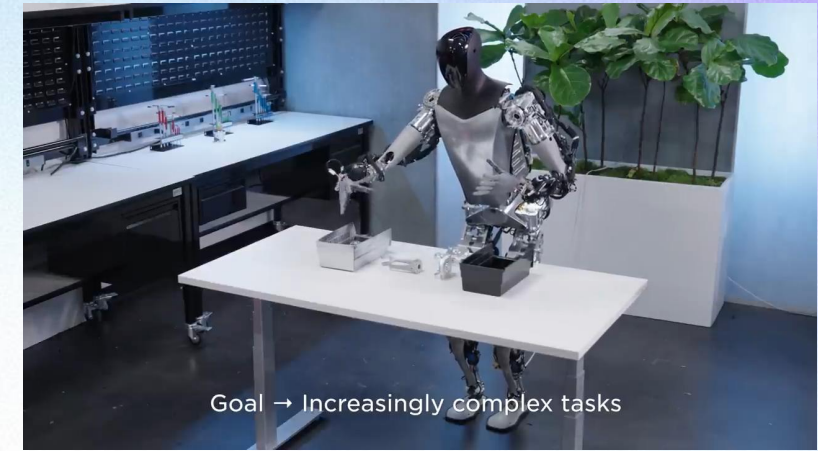


Internationally, New Humanoid Robots for Industrial Scenarios Have Been Released

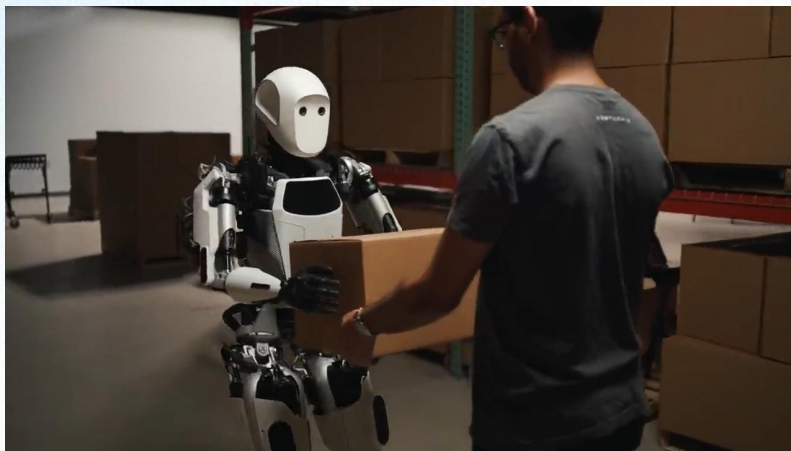
2021 Agility Digit



2022 Tesla Optimus



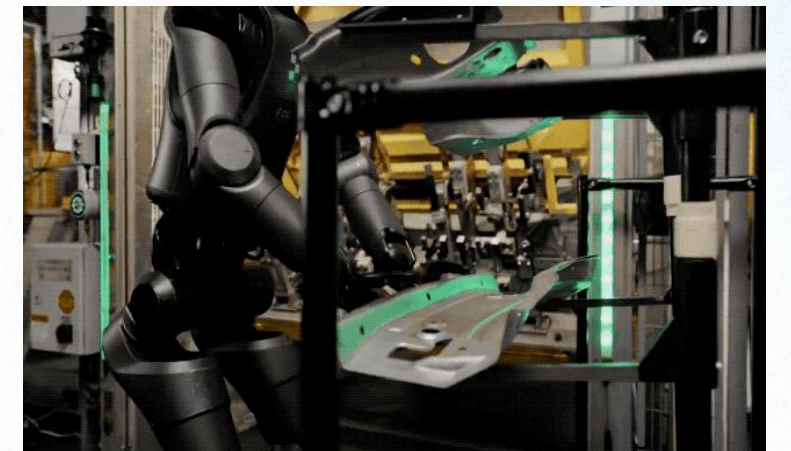
2023 Apptronik Apollo



2023 Figure 01



2024 Figure 02



Internationally, New Humanoid Robots for Industrial Scenarios Have Been Released

2024 Physical Intelligence



2024 BD Atlas



2024 Tesla Optimus



2024 Sanctuary AI Phoenix



2024 1X NEO Beta



2024 Tesla Optimus



Governments Introduced Policies to Support the Development of the Humanoid Robot Industry



2023 MIIT 《Guiding on the Innovation and Development of Humanoid Robots》

“聚焦3C、汽车等制造业重点领域，提升人形机器人工具操作与任务执行能力，打造人形机器人示范产线和工厂，在典型制造场景实现深度应用。面向结构化生产制造环节，推动人形机器人在装配、转运、检测、维护等工序的应用和推广。面向非结构化生产制造环节，加强人形机器人与设备、人员、环境协作交互能力，支撑柔性化、定制化生产制造。”

Promote the Application and Popularization of Humanoid Robots in Processes Such as Assembly, Transfer, Inspection, Maintenance and Others.

Embodied AI Development Elevated to Policy Priority

Embodied AI is listed in China's Government Work Report for the First Time

- 2025年政府工作报告中，首次将“具身智能”纳入国家未来产业发展规划，培育生物制造、具身智能等未来产业成为重点。
- 国家工信部、教育部、科技部等部委密集出台相关政策，地方政府纷纷响应，通过深化人形智能机器人的产学研合作，推动具身智能科技创新和产业创新深度融合。

Ministry of Education States: AI Empowers the Development of a Strong Education Country

“推进人工智能全学段教育和全社会通识教育，源源不断培养高素质人才。”

——习近平总书记4月25日在主持二十届中共中央政治局第二十次集体学习时强调

“人工智能是年轻的事业，也是年轻人的事业”。

——习近平总书记4月29日在上海考察时指出

China is accelerating Embodied AI policy support at both central and local levels.

时间	发布单位	政策名称
2023.1	工信部等十七部门	《“机器人+”应用行动实施方案》
2023.11	工业和信息化部	《人形机器人创新发展指导意见》
2024.1	工信部等七部门	《关于推动未来产业创新发展的实施意见》
2025.2	北京市科学技术委员会、中关村科技园区管理委员会等3部门	《北京具身智能科技创新与产业培育行动计划（2025-2027年）》
2025.3	深圳市科技创新局	《深圳市具身智能机器人技术创新与产业发展行动计划（2025—2027年）》

- 《教育强国建设规划纲要（2024—2035年）》《关于加快推进教育数字化的意见》中将人工智能与教育深度融合纳入教育强国建设战略布局，明确人工智能在教育数字化转型中的关键作用，为高校人工智能机器人专业发展提供了政策指引和依据。
- 教育部召开国家教育数字化战略行动2025年部署会，明确要培养更多既“懂技术”，又“懂教育”，更“懂人心”的教师，培育学生终身发展和社会发展所需要的正确价值观、必备品格和关键能力，共同提高人工智能素养，营造共生、共学、共研、共创的未来教育新格局。

Industrial manufacturing will be the first large application field for humanoid robots

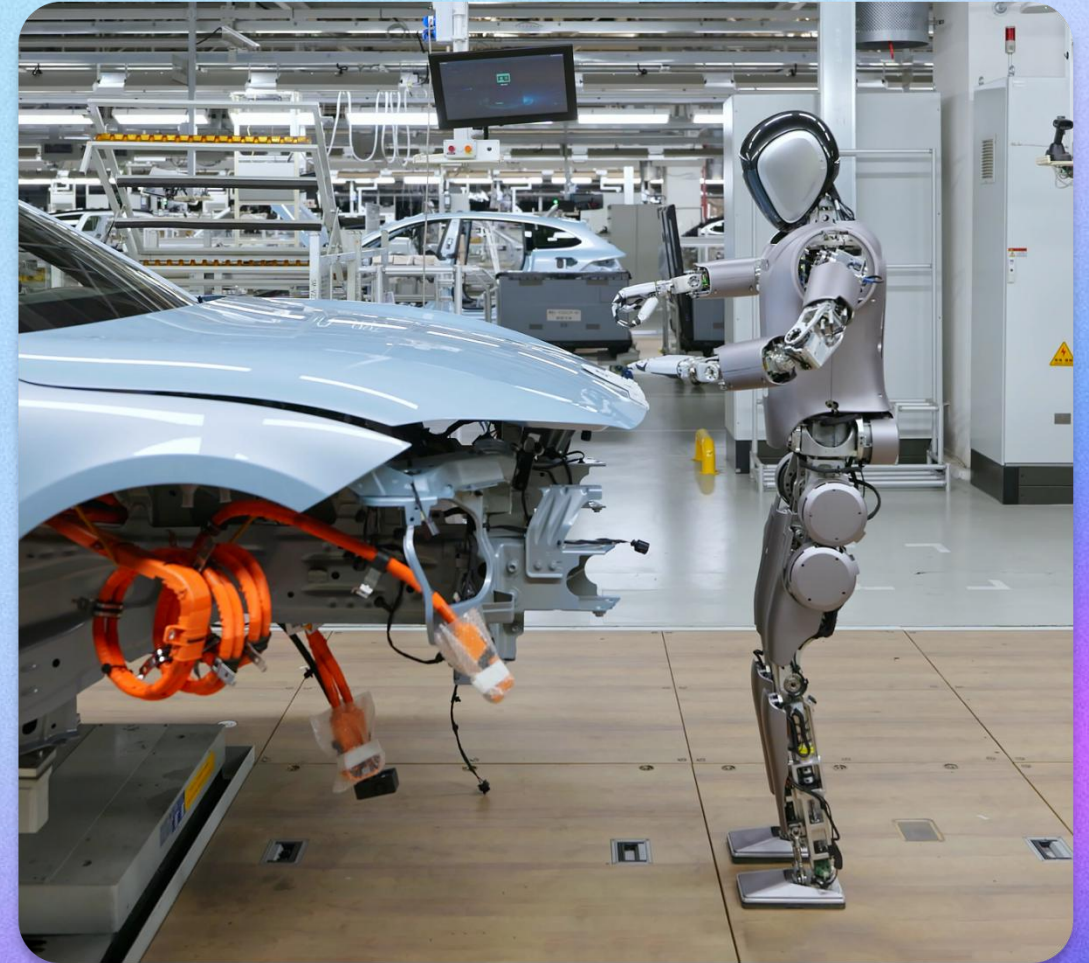
Market Space



Industrial Investment



Massive Deployment of Smart Manufacturing



Policy Support



Industrial manufacturing has emerged as the global battleground for humanoid robots



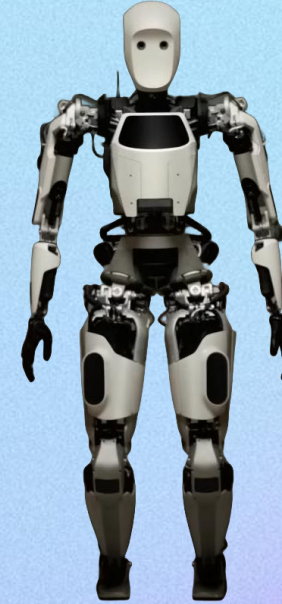
Walker S2
176cm / 73kg
2025



Digit
175cm / 48kg
2021



Optimus
173cm / 63kg
2024



Apollo
172cm / 72kg
2023

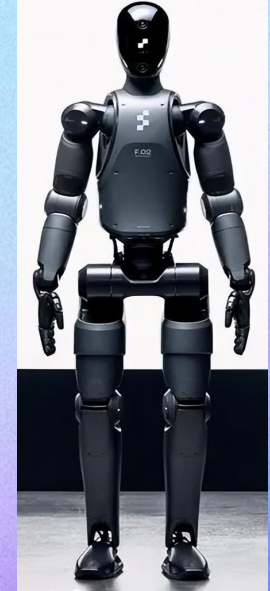


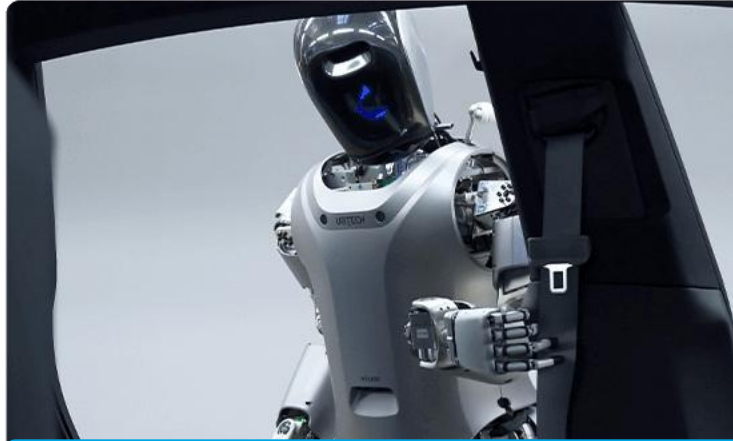
Figure 02
168cm / 70kg
2024



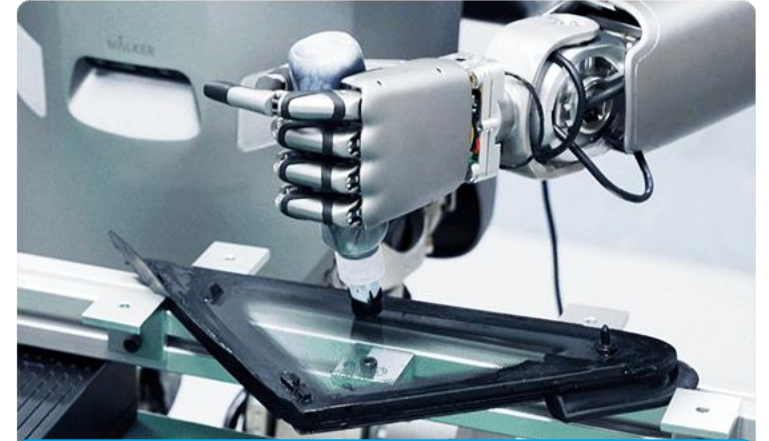
Humanoid robots will perform highly repetitive, high-risk, and highly complex tasks.



Parcel-Tote Handling



Quality Inspection



Chemical Handling



Bolt Tightening



Part Assembly



SPS Sorting

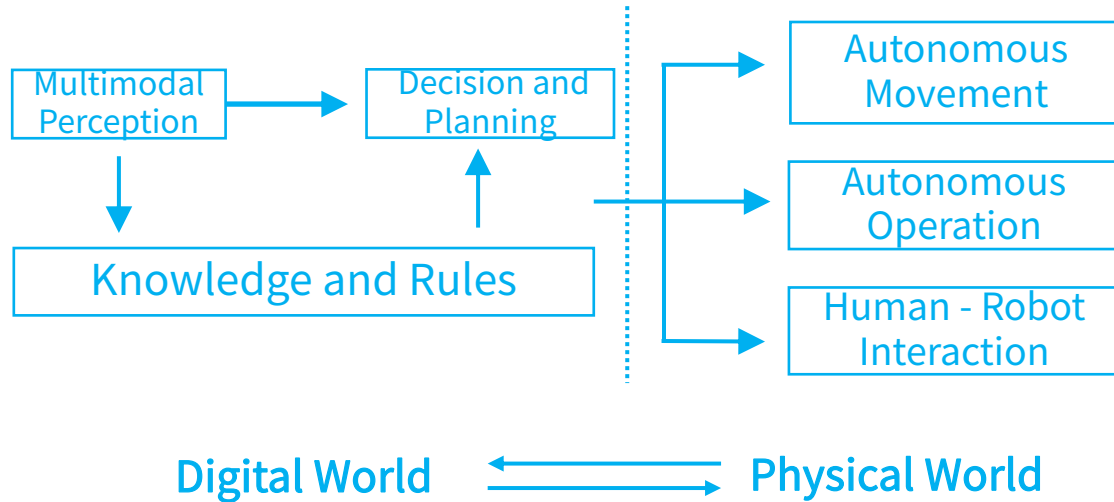
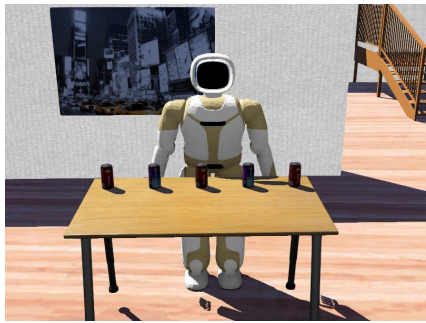
Technological Boom Empowers Humanoid Robots

- Humanoid robots are the ultimate physical carrier of AI.
- They form a closed loop covering perception, decision-making, planning, execution, and learning.
- Multimodal large models enable humanoid robots to better understand the world.
- The combination of multimodal large models and humanoid robots represents a major step forward toward artificial general intelligence .



From Internet AI to Embodied AI

Jensen Huang: The Next Wave of Artificial Intelligence (AI) Will Be Embodied AI : Intelligent system capable of understanding, reasoning, and interacting with the physical world



From "Observational Learning" to "Experiential Learning"
Actively perceive or interact with the world by doing tasks

Multimodal LLM

Embodiment

Robot

Embodied
Evolution

Machine Learning
Evolutionary Learning

Embodied
System

Operating System
Computing Power

Embodied
Perception

Computer Vision
Speech Recognition
Multimodal Sensors

Embodied
Cognition

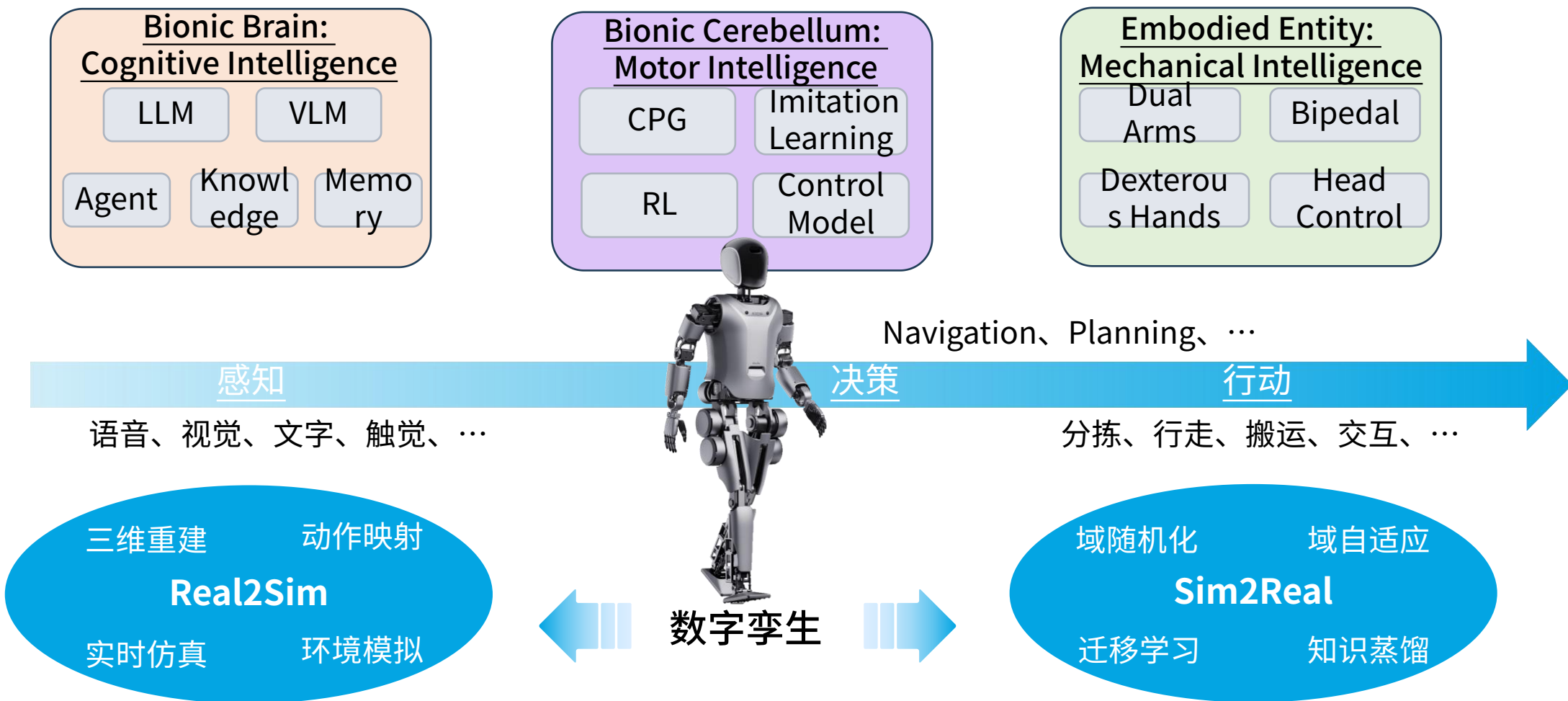
Cognitive Science
Decision - Making
Task Planning

Embodied
Behavior

Motion Planning
Motion Control
Safety
HRI

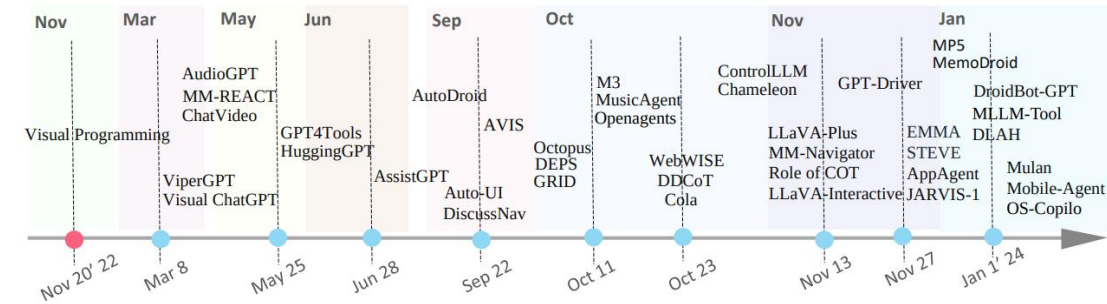
Embodied AI is the key to large-scale industrial implementation

Embodied AI technology covers key technology groups of the "brain" and "cerebellum", enabling humanoid robots to perceive, make decisions and act autonomously.



Key Technology of Embodied AI - Large Model

Multimodal LLMs continue to evolve, supporting the autonomy of robots



End2End large models for humanoid robots have become a hot topic

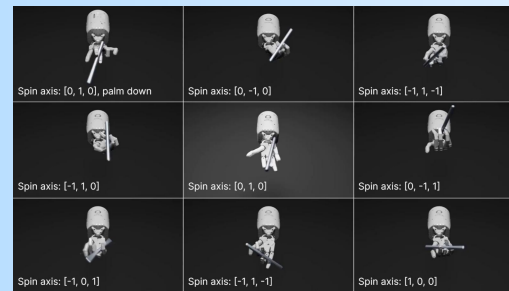
2024 Figure 01+Open AI



Task Planning



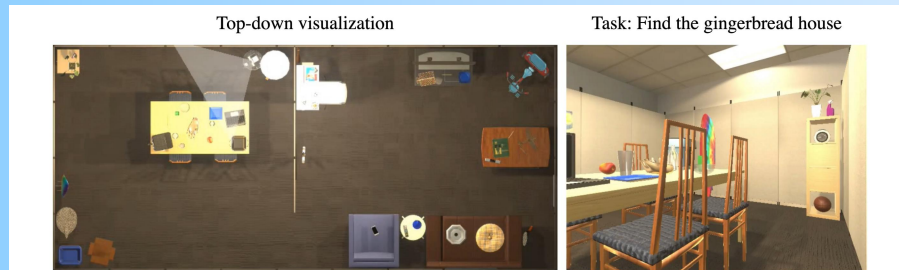
Motion control



2024 NVIDIA GROOT



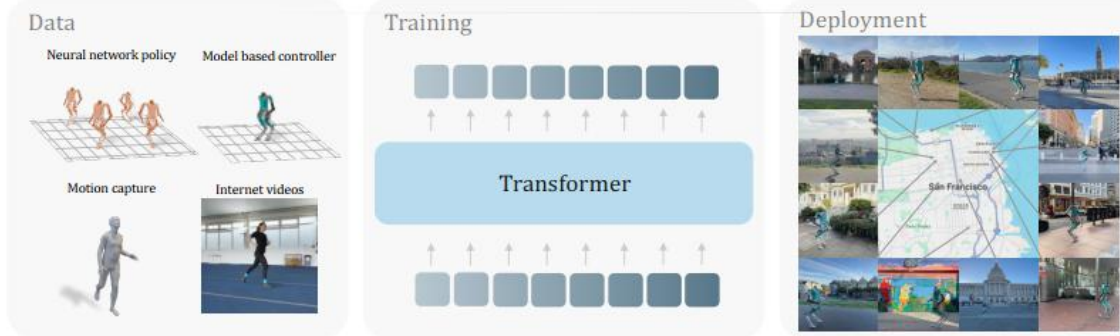
SLAM



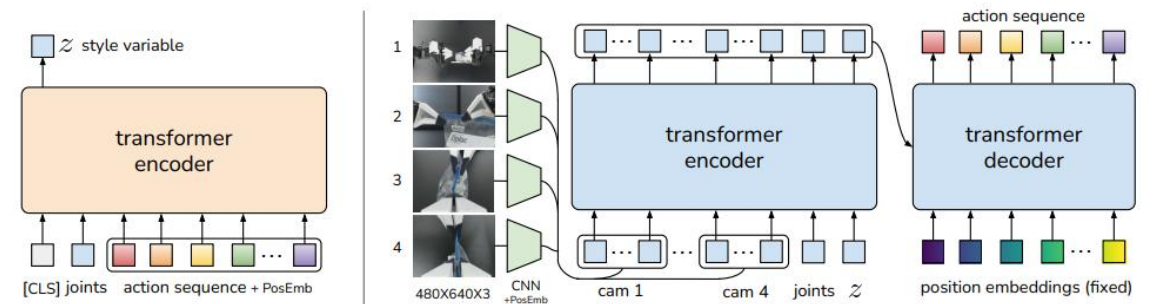
Key Technology of Embodied AI — Learning-Based Motion Control

Learning-based motion control enables humanoid robots to better adapt to new environments and new tasks, while enhancing control robustness.

Walking--Digit Robot from UCB/OSU



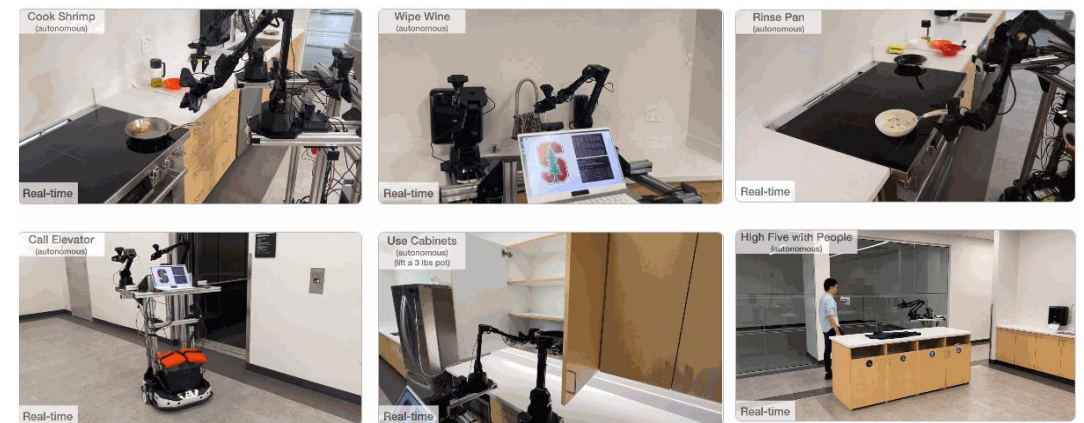
Manipulation--Aloha from Stanford University



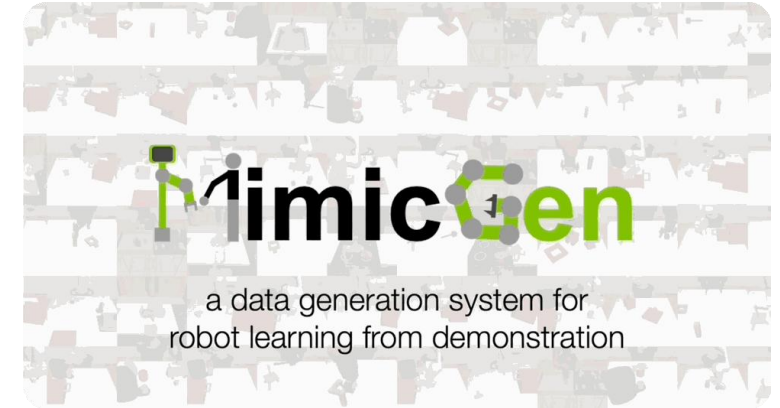
Transformer



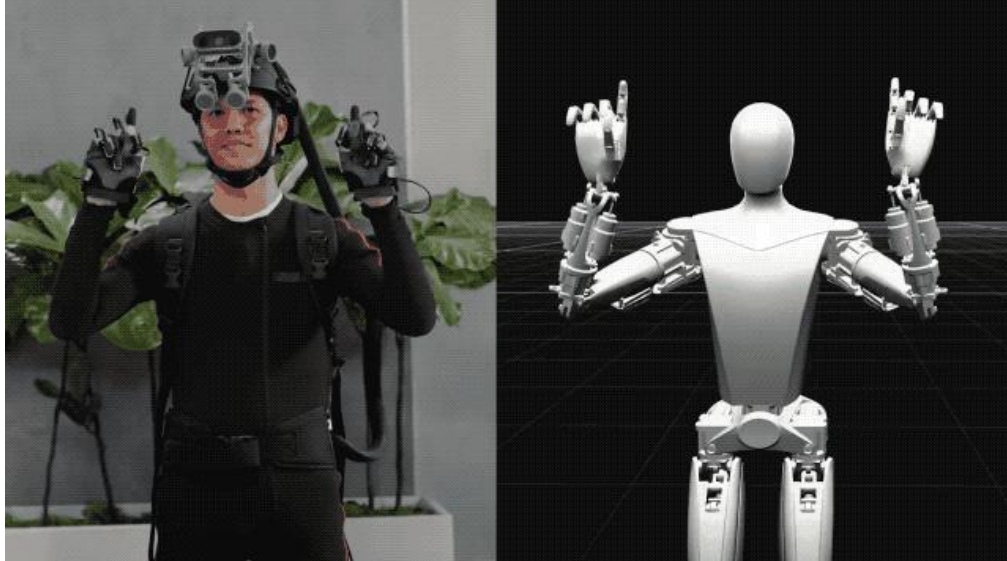
Action Chunking with Transformers (ACT)



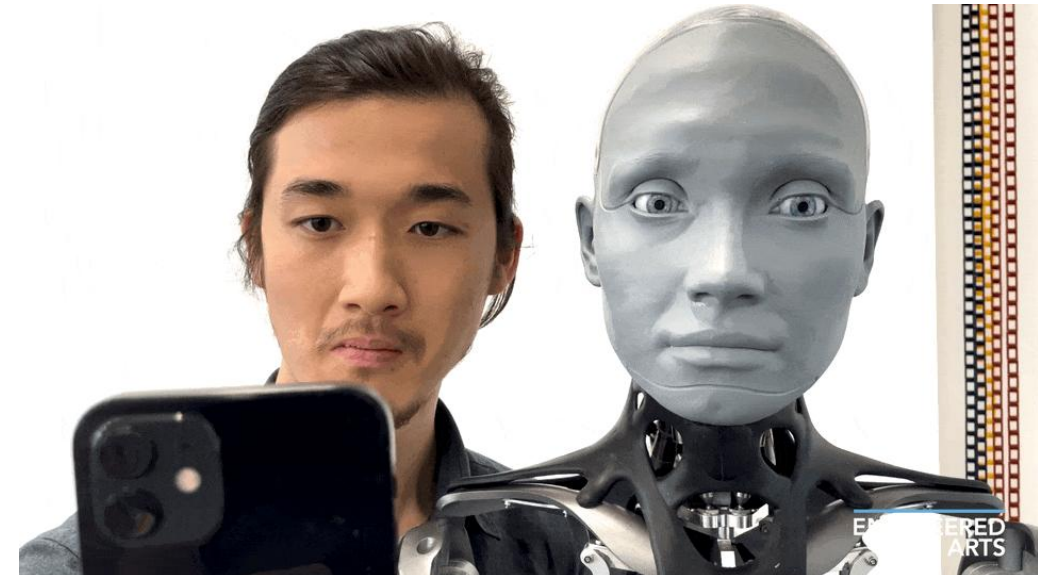
Key Technology of Embodied AI — Learning-Based Motion Control



2024.7.31, NVIDIA's GR00T used Apple Vision Pro to solve the most painful data expansion difficulty in the robot field, providing more data support for the development of humanoid robots



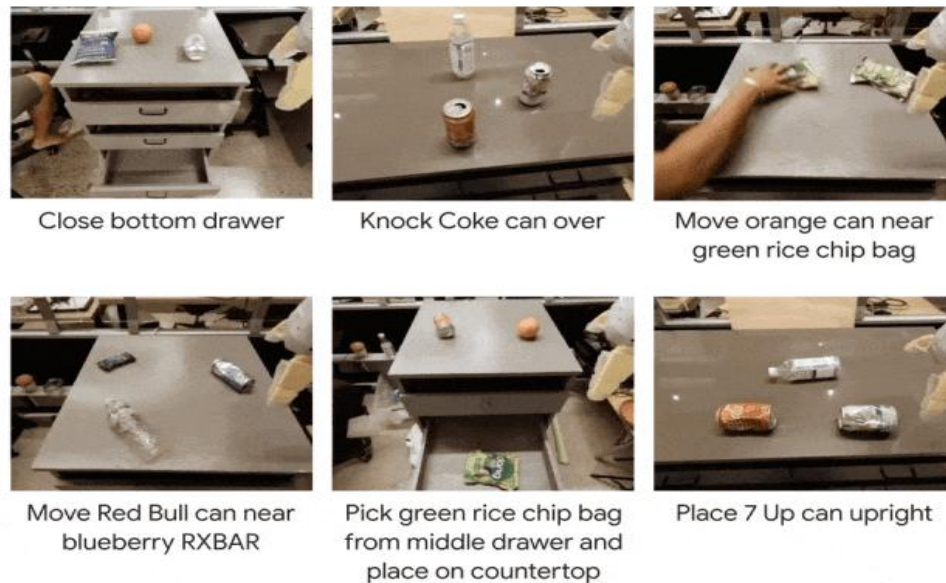
Tesla leverages VR and teleoperation technology for robot imitation learning to conduct data collection.



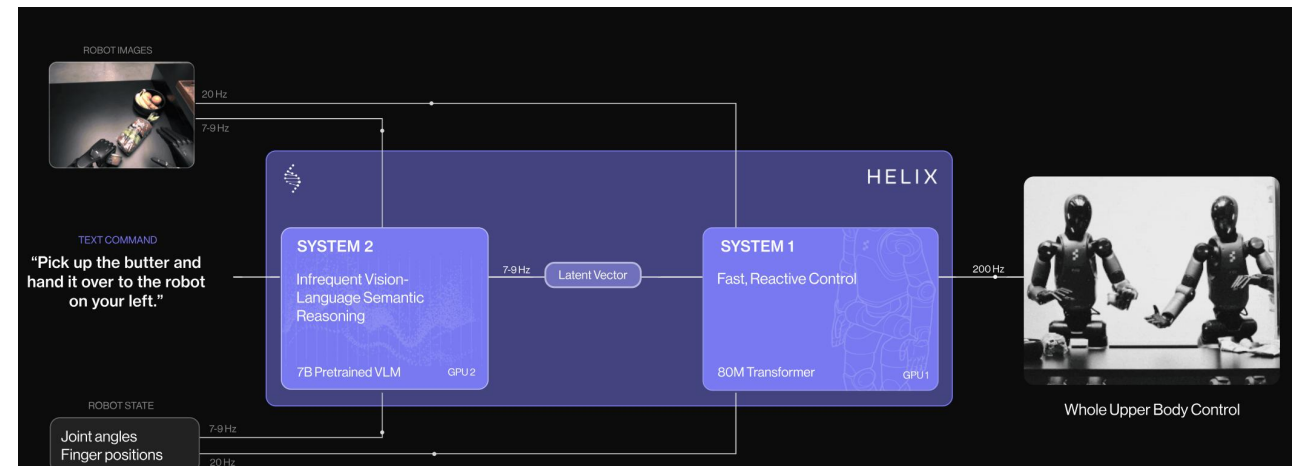
Ameca robot performs facial expression imitation using video data.

References: SIGGRAPH2024; <https://nerdist.com/article/robot-gets-more-realistic-expressions-engineering-arts-ameca/>

Key Technology of Embodied AI—from VLM to VLA



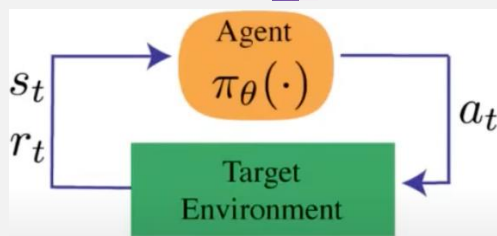
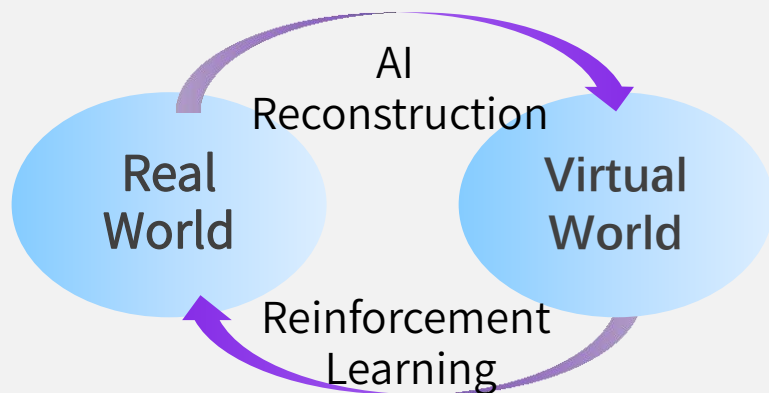
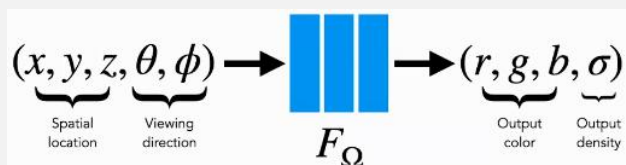
References: Stanford、UC Berkeley、TRI、Deepmind和MIT:
“OpenVLA: An Open-Source Vision-Language-Action Model” ,
<https://www.figure.ai/news/helix>



AI Agent-Based Simulation System UNDERS2

Simulate and generate diverse scenes for robots at low cost (environments, objects, and changes)

Products and Human Interacting with Robot



Improve End-End Ability

Simulate changes in environment: illumination/weather/object textures/occlusion/dynamic scenes

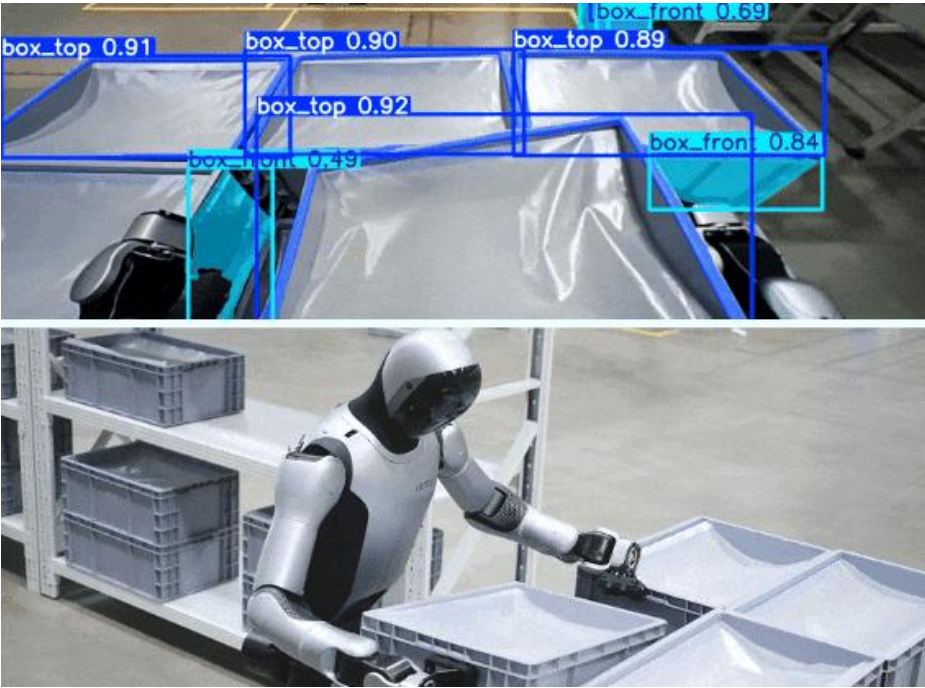


UBTech's self-developed humanoid robot's brain "Thinker" has won 4 global No.1.

MS COCO detection challenge- Segmentation Mask

MS COCO detection challenge - Bounding Box

RoboVQA and Egoplan-bench2



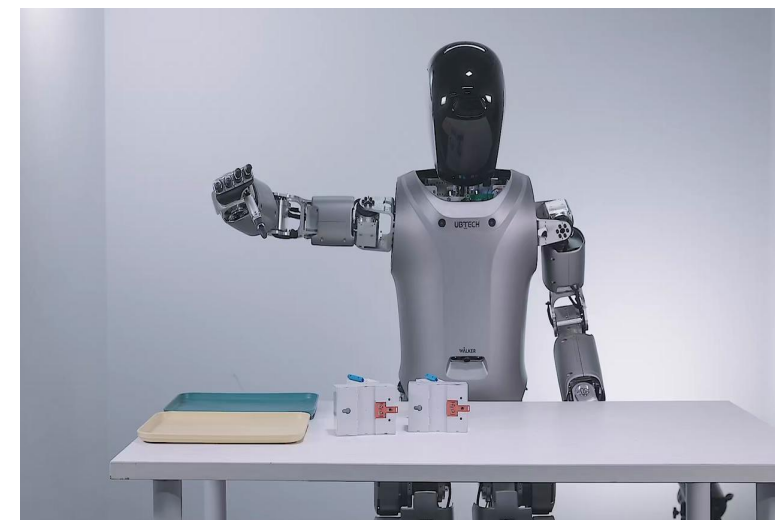
UBTECH Humanoid Robots Scene Exploration



The practical training of humanoid robots in new energy vehicle factories.



Box Carrying



LLM-Powered Unordered Sorting



Multi-Robot Collaboration

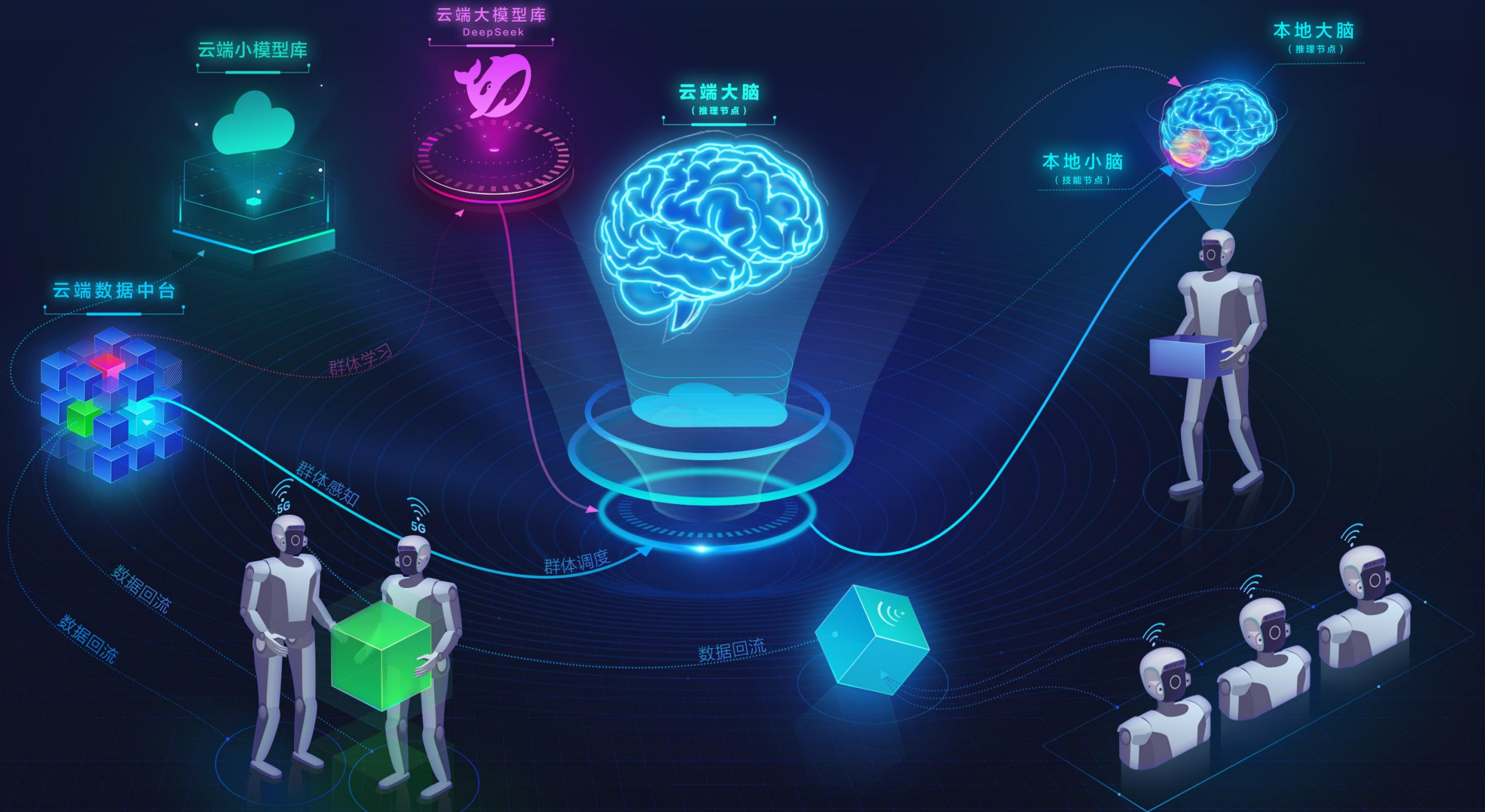


Screw Tightening and Gluing

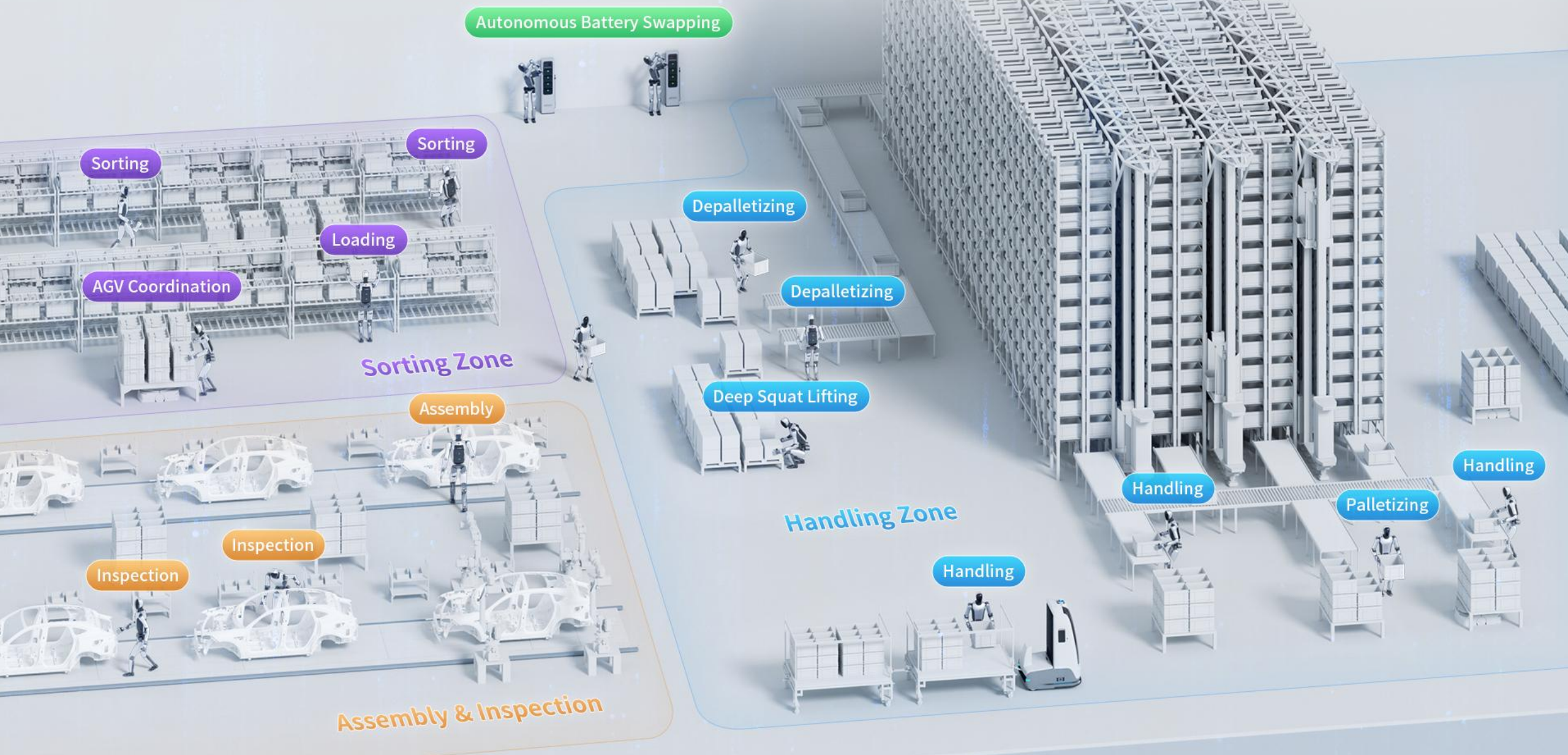


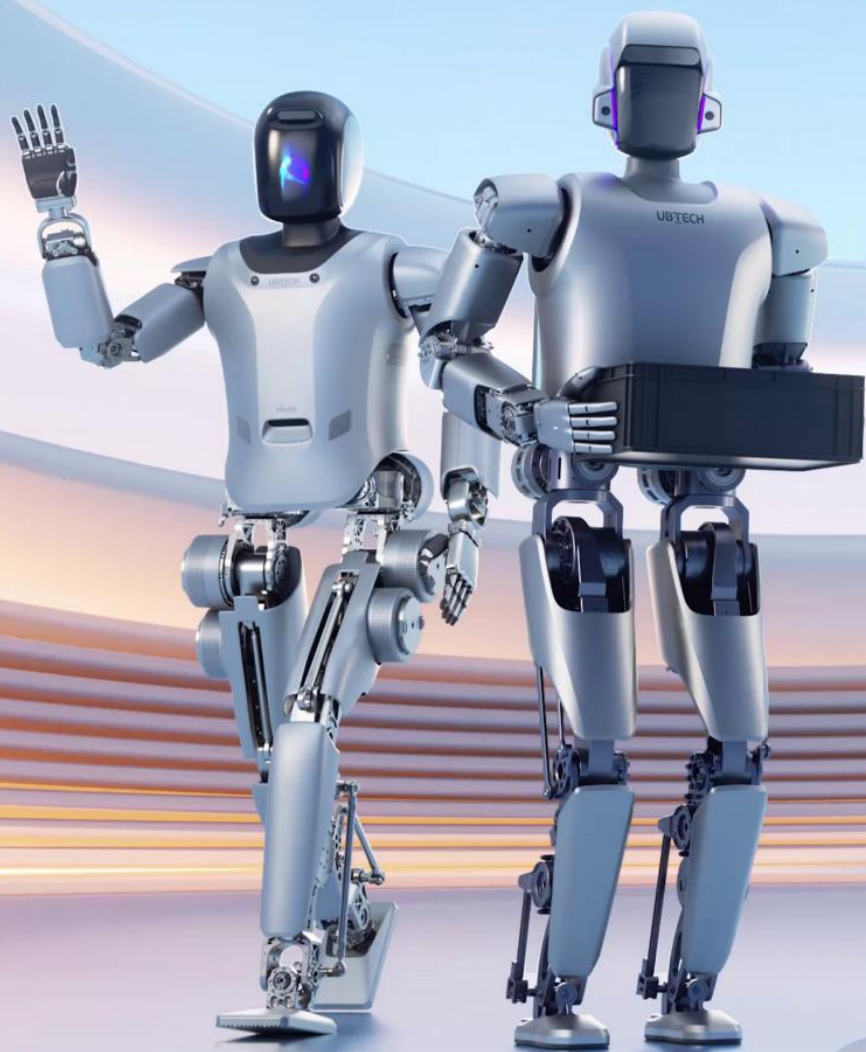
Multimodal LLM General-Purpose Services

UBTech BrainNet & Swarm Intelligence



Production Line Task-Driven Swarm Intelligence for Humanoid "BrainNet 2.0" + Co-Agents Building the Dual-Loop AI System





UBTECH

Humanoid Robot Industrial Application Solution

Our Partners



天奇股份
MIRACLE AUTOMATION



HUMANOID
北京人形机器人创新中心

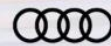


东风柳汽



吉利汽车
GEELY AUTO

BAIC
北汽新能源



奥迪一汽



一汽-大众汽车有限公司青岛分公司
FAW-VOLKSWAGEN AUTOMOTIVE CO., LTD. QINGDAO BRANCH

BYD

FOXCONN®
富士康科技集团



EXPRESS
顺丰速运

The background image shows several humanoid robots, specifically the Walker S1 model, in a factory or industrial environment. They are grey with purple accents on their heads and joints. One robot in the foreground is reaching out with its right arm towards a blue plastic bin. Other robots are visible in the background, some blurred, suggesting a busy, multi-robot workspace. The lighting is industrial, with some green and yellow lights visible in the distance.

优必选Walker S1进厂实训2.0

全球首例 **多**台 **多**场景 **多**任务人形机器人协同作业

A humanoid robot, the Walker S2, is shown from the chest up. It has a black head with a blue 'T' logo on its face and a white torso with 'UBTECH' printed on it. The robot is standing in a blurred industrial or factory environment. The text 'Walker S2' is overlaid in white, followed by '全新一代工业人形机器人' in a larger white font, and '群脑网络2.0+Co-Agent 构建AI双循环' in a smaller white font at the bottom.

Walker S2

全新一代工业人形机器人

群脑网络2.0+Co-Agent 构建AI双循环

Scenario data, as a key asset, supports the application and implementation of humanoid robot technology.

Scenario Applications

Commercial Services

household Services

Industrial Manufacturing

Extreme Operations

.....

Bionic Brain

LLM

VLM

Agent

Knowl
edge

Memo
ry

Bionic Cerebellum

CPG

RL

RL

C M

Embodiment

Dual Arms

Bipedal

Dexterous Hands

Head Control

感知

语音、视觉、文字、触觉……

决策

导航、规划……

行动

分拣、行走、搬运、交互……

Real2Sim

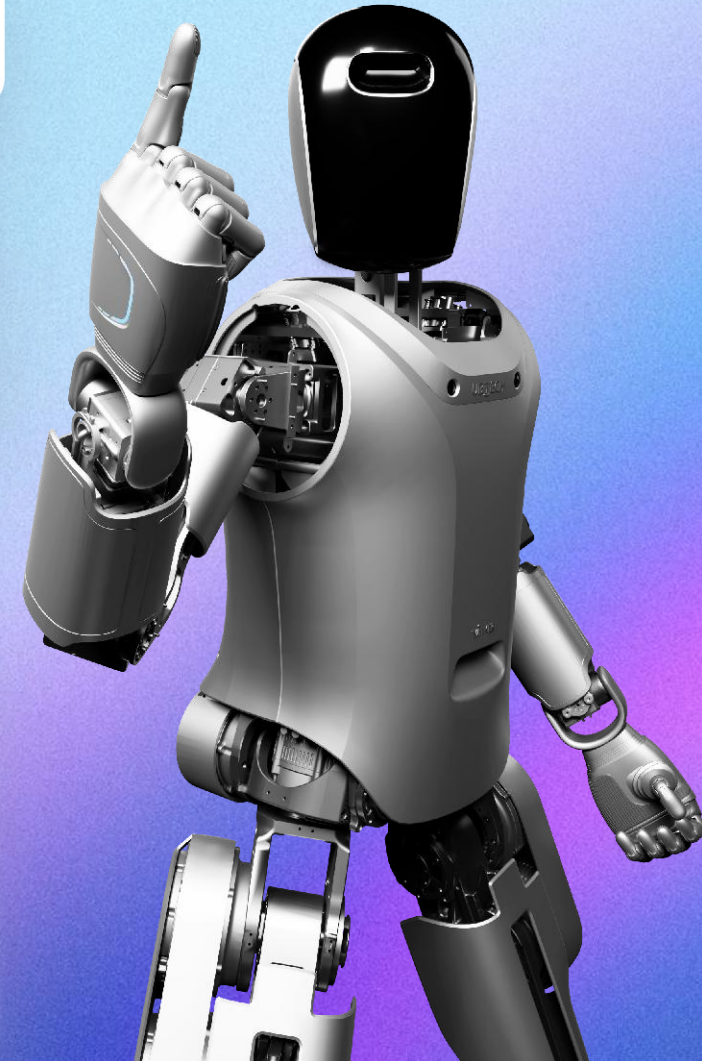
三维重建 | 动作映射
实时仿真 | 环境模拟

场景数据生产

数字孪生
数据采集-数据仿真

Sim2Real

域随机化 | 域自适应
迁移学习 | 知识蒸馏



Governments Are Actively Promoting Data Collection and Training Centers, with Industrial Scenarios Emerging as a Key Focus Area

Data Collection Centers Are Being Promoted Across the Country



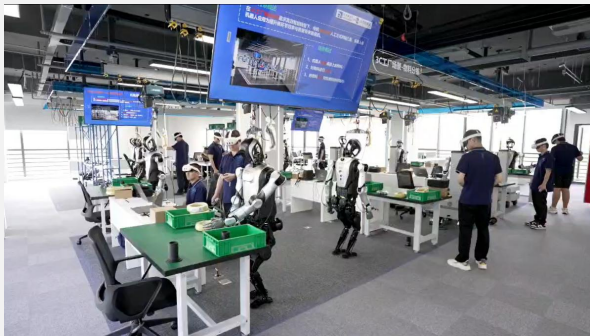
Shanghai Guodi Center: Embodied Intelligence Training Ground



Beijing Guodi Center: Embodied Intelligence Training Ground



Beijing Humanoid Robot Data Training Center



Yangtze River Delta Intelligent Robot Training Center

Policy

时间	发布单位	政策名称
2023.10	工业和信息化部	《人形机器人创新发展指导意见》
2024.12	国家发改委、数据局等	《关于促进数据产业高质量发展的指导意见》
2025.2	北京市科学技术委员会、中关村科技园区管理委员会等	《北京具身智能科技创新与产业培育行动计划（2025-2027 年）》
2025.3	深圳市科技创新局	《深圳市具身智能机器人技术创新与产业发展行动计划（2025—2027年）》

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Data Collection Centers Support the Rapid Implementation of Industrial Scenario Applications Through Scenario Data Production, Model Training.

Market Demand

新能源汽车
传统机械制造
3C制造
物流
纺织
.....

5G网络

第一类数采空间

用于产线级场景、多机协同场景、多类型任务场景的数采任务
模拟场景 + 遥操作设备 + 人形机器人 + 采集工程师 + 云平台

1

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场景配置区

模块化元素
高仿真度元素

机器人维保区

机器人易损件
标定工具
维保人员

第二类数采空间

用于工位级场景、单机作业场景、全流程任务场景的数采任务
模拟场景 + 遥操作设备 + 人形机器人 + 采集工程师 + 云平台

1

2

3

4

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数据管理区

存储服务器
数据平台
数据标注员

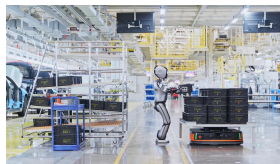
仿真与训练区

训练服务器
仿真训练平台
数据挖掘人员

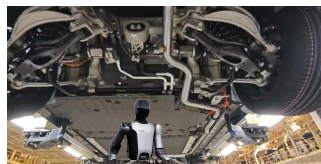
数据采集中心作业场景



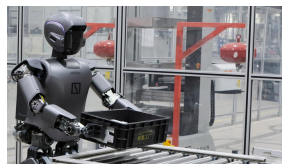
物流场景—料箱搬运码放



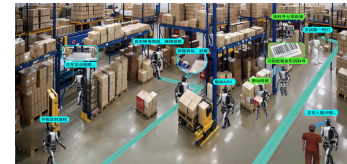
物流场景—线边投料



总装车间—整车出厂质检



焊装车间—金属件搬运



仓储场景—限定条件综合作业



规模数据采集基地



海量数据赋能模型训练



强干扰反应式规划能力



工业场景数据采集

Support the Embodied AI industry

PB级垂域数据集

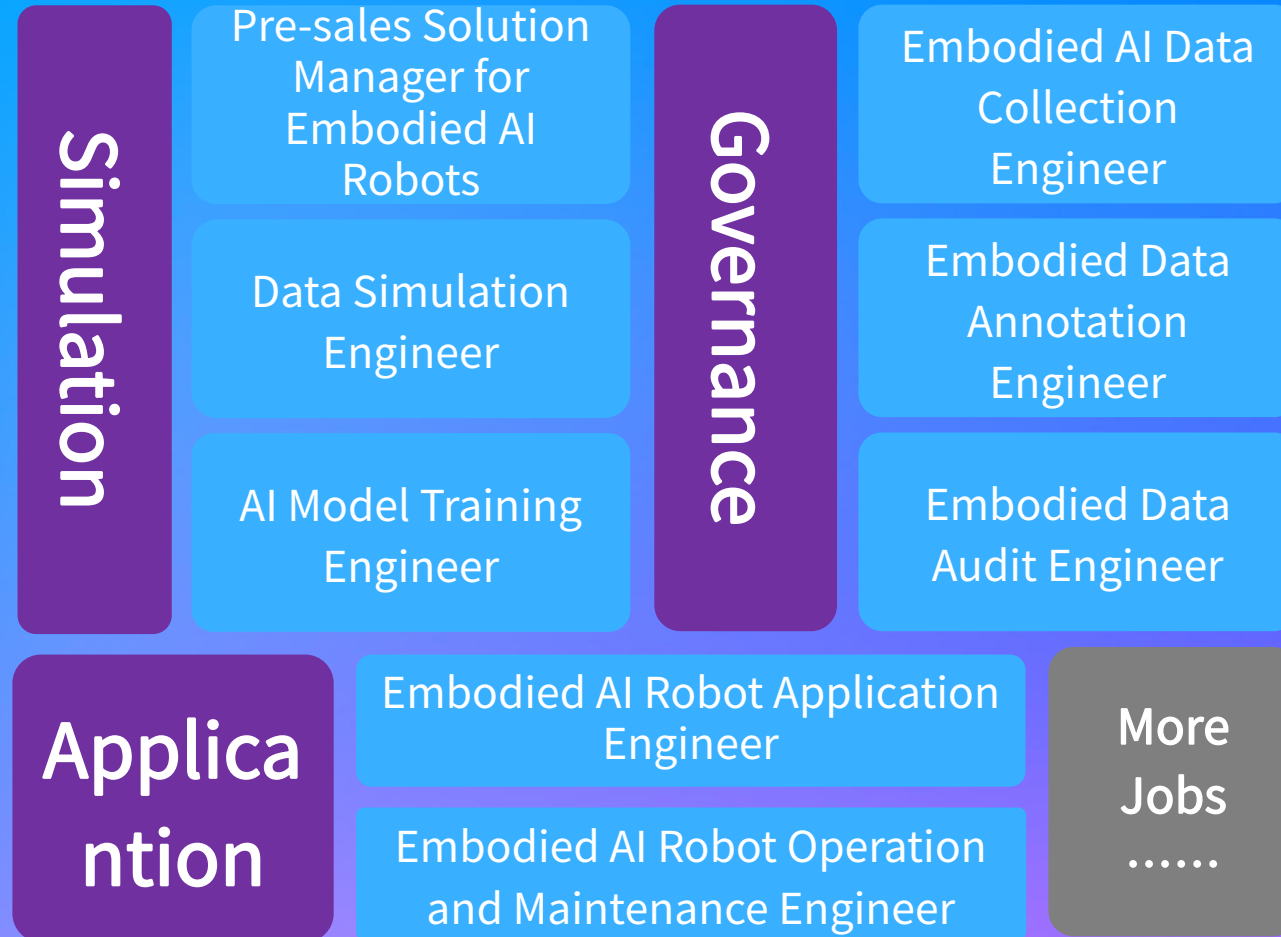
每年采集不少于
100万条多模态数据

垂域小模型库

每年训练不少于
100种小模型技能

100台人形工业数采中心

In the Implementation of Industrial Scenarios, Data Collection Tasks Have Spurred the Emergence of Numerous Emerging Jobs



Humanoid robots are going to the stage of industrialization and implementation



Industrial Manufacturing

Commercial Services

household Services

Limited and Known Tasks in
Structured or Semi-Structured
Environments

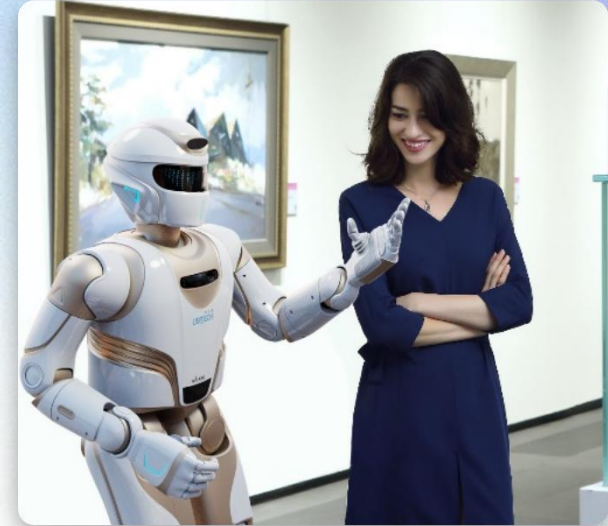


Needs for Companion and
Conversation



Complex Dynamic Scenarios
Involving Physical Contact with
Humans

The commercial service scenario is the fastest market for humanoid robots.





2025年日本大阪世博会中国馆唯一人形机器人合作伙伴

The Only Partner of Humanoid Robot of China Pavilion at Expo 2025 Osaka, Kansai, Japan

2025年大阪万博中国館唯一のヒューマノイドロボットパートナー

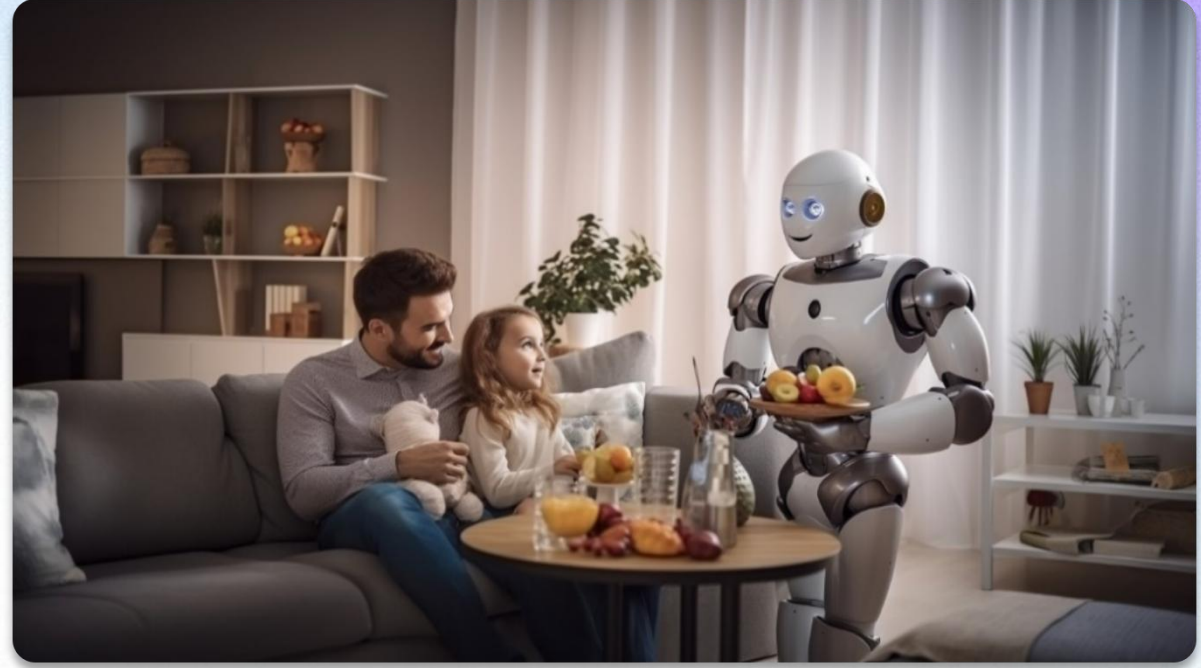
The household service scenario is the most promising application market for humanoid robots



Humanoid robots will enter households in two phases



Companion Scenario



Service Scenario

Dream with Robots

Mission

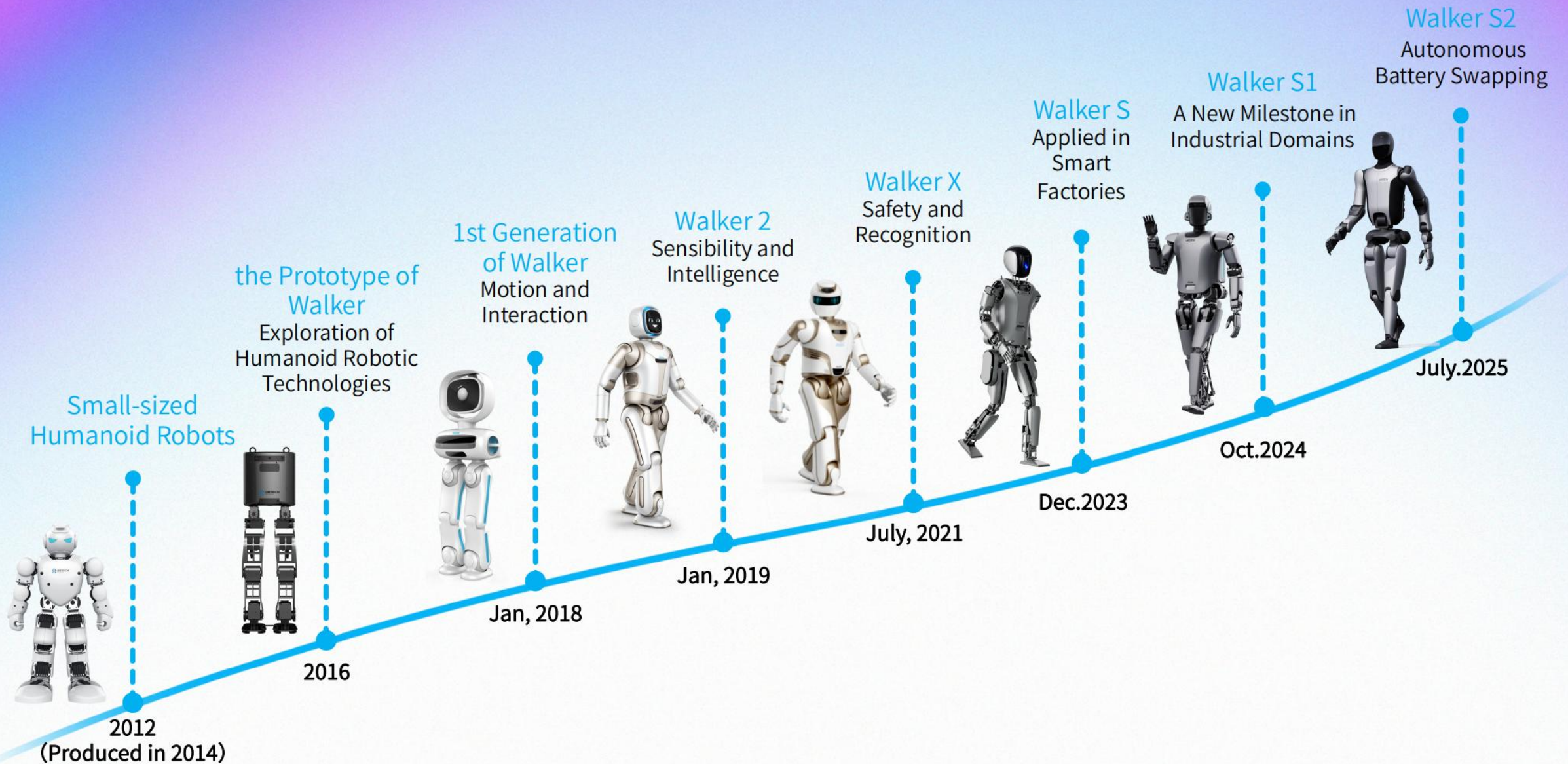
To bring intelligent robots into every family to make everyday life more convenient and intelligent.

Vision

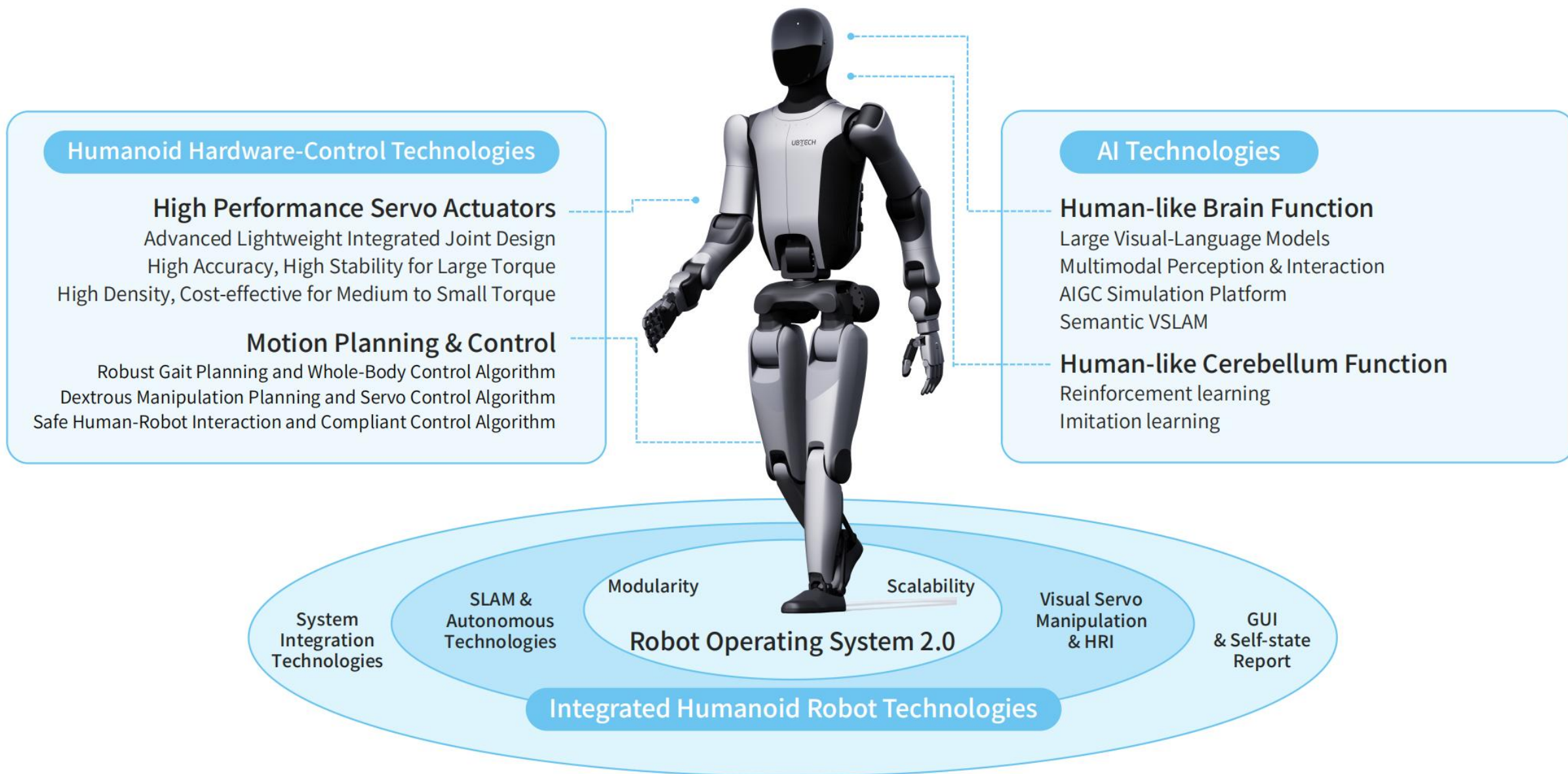
To build an intelligent ecosystem integrating hardware, software, services, and operations using intelligent robots as carriers and AI technology as the core.



Development of UBTECH Humanoid Robots



UBTECH's Self-Developed Full-Stack Humanoid Robot Technologies



Commercialization in Various Industries Based on Our Full-stack Humanoid Robotic Technologies

AI Education
Robotic Products
and Solutions



Smart Logistics
Robotic Products
and Solutions



Smart Elderly Care
Solutions



Service Smart
Robotic Products
and Solutions



Consumer-level
Robotic Products
and Solutions



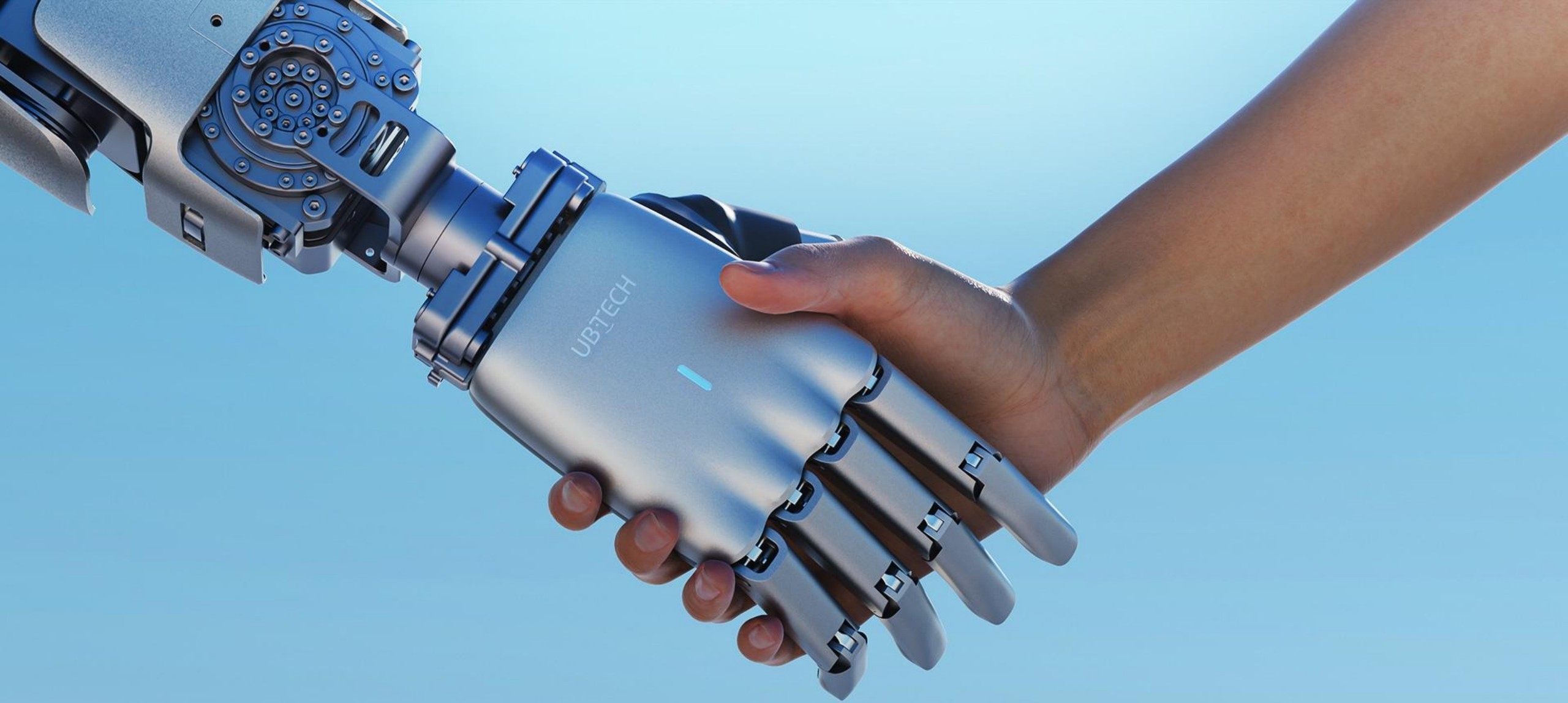


Flexible Assembly

Torque Tightening

Material Handling

In the future, **humanoid robots** will collaborate with traditional automated equipment to solve the flexible unmanned problem in complex scenarios and will **redefine the workers by AI.**



Dream with Robots