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China's humanoid robots speed into reality

By 2045, nation to have over 100m such machines deployed across industries, with total value of some 10 trillion yuan

BEIJING — An evolution driven by data is quietly unfolding within China's robotics landscape, one that is expected to transform the fabric of daily life.

At a busy training facility in the western suburbs of Beijing, 1.66-meter-tall humanoid robots were using virtual reality and motion capture systems to learn practical skills like warehouse tasks, material sorting and product packaging.

This scene, far from a mere tech showcase, captured a critical evolution in China's robotics sector — the transition of humanoid robots from executing laboratory stunts to learning practical skills in "vocational schools".

The robots, which are named Kuavo — developed by Leju Robotics — are fast learners. They have already achieved success rates of over 95 percent in practical tasks such as returning empty crates, sorting materials, as well as weighing, packing and boxing wares.

This pragmatic approach is key to unlocking these robots' effective use in real-world applications — from auto manufacturing to logistics — and accessing a trillion-dollar market.

A think tank report forecasts that by 2045, China will have over 100 million humanoid robots deployed across industries, creating a total market value of approximately 10 trillion yuan ($1.4 trillion).

Competing in this massive market, however, still faces technical hurdles. While viral videos of robots performing acrobatics or intricate dances have captivated the public over the past year, such a display of technical mastery obscures the underlying challenge of deploying robots in unstructured, unpredictable everyday settings.

To bridge the data shortage, Chinese robot makers are getting their machines into internships in automotive plants, warehouses, elder-care facilities and even a theater school.

"A robot becomes intelligent through repeated practice in different environments, much like a child needs to constantly practice learning how to walk," said the project's lead Wang Qiang.

Spanning over 10,000 square meters and capable of generating more than six million data entries annually, the newly inaugurated facility replicates 16 intricate scenarios across industrial, home, healthcare and 5G applications. This makes it not only the largest testing environment in China, but also one of the most comprehensive and realistic in the country.

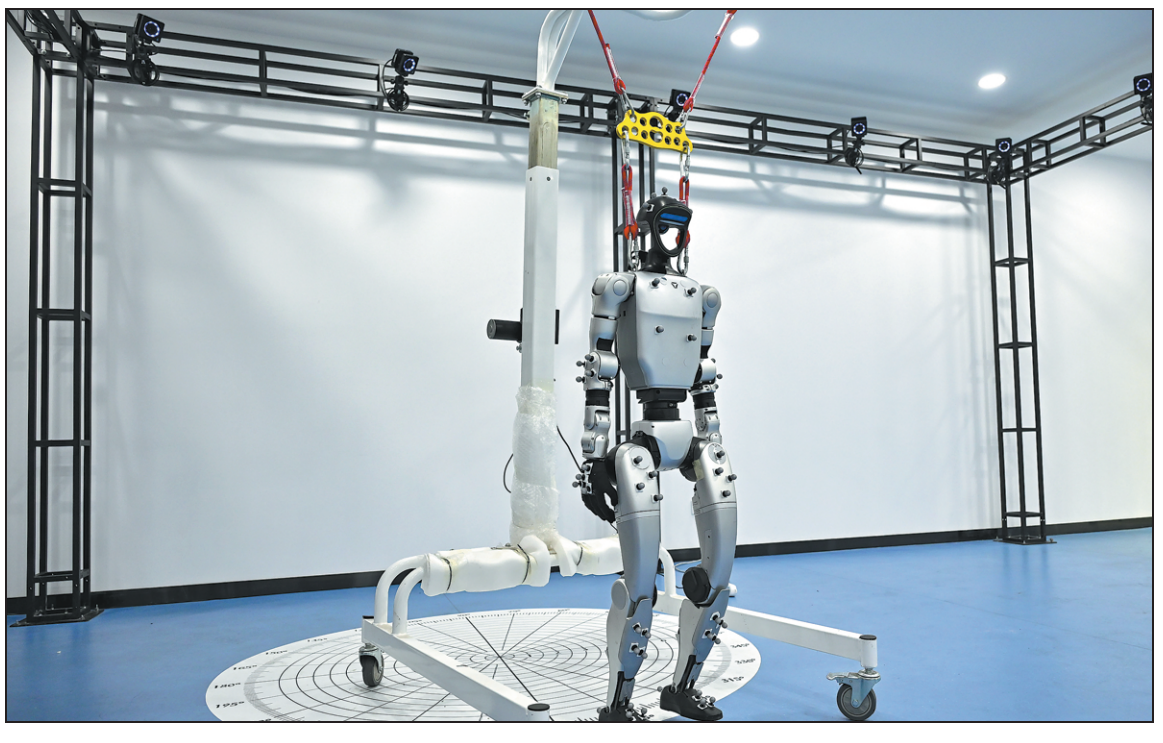
By collecting increasing data from the training school, the robot developers can refine algorithms, enhance perception systems and improve decisionmaking capabilities.

A race is underway among China's major cities to position humanoid robots as the next key engine for economic growth. The priority for many local governments is attracting robotics startups and promising research labs with strong commercial potential to set up operations in their regions.



Above: People watch Unitree Robotics's humanoid robots compete in a boxing match in Hangzhou, Zhejiang province, on Sept 25. XU YU / XINHUA

Below: A humanoid robot trains with the assistance of motion capture equipment at Anhui Efort Intelligent Equipment Co Ltd in Wuhu, Anhui province, on July 3. ZHANG CHENG / XINHUA



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>
> **Ren Guanghui,** researcher from AgiBot

Donning VR headsets and holding controllers, hundreds of data collectors at a 4,000-square-meter facility of Shanghai startup AgiBot are manually teaching robots how to do chores like folding clothes, clearing tables, pouring tea and checkout operations.

This July, AgiBot and its partners livestreamed an unscripted, real-world stress test for their dual-armed, wheeled robots at a car parts factory in Mianyang, Sichuan province, for three uninterrupted hours.

Also in Mianyang, a robotic training ground kicked off in July as part of the region's strategy to build a competitive embodied artificial intelligence robotics cluster.

In September, another similar education facility started operating in Foshan, Guangdong province, hatched by a research institute affiliated with the Chinese Academy of Sciences. As part of its expansion, the institute has set the headquarters of its new general-purpose multimodal AI platform, Taichu, in Wuhan, Hubei province, and plans to build a new robotics training place there this year.

The inter-city rivalry is fueling faster innovation in robotics and this competitive dynamism does not hinder a unified national market.

The Beijing training ground, to be linked to facilities in eastern and central Chinese cities, is projected to generate 5,000 hours of data monthly.

Unitree Robotics, a prominent Chinese robotics firm known for its eye-catching robot demos, announced the open-sourcing of its robotic learning architecture recently. This move follows China's championing of open-source ecosystems in AI-generated large models, with the same strategy now being replicated in intelligent robotics.

Unitree's AI engine allows humanoid robots to learn without repeatedly stumbling in the real world. Using a single snapshot and a handful of planned future motions, it can simulate and steer outcomes in real time.

Earlier this year, Shanghai-based robot maker Fourier unveiled N1, an open-source humanoid robot. Alibaba DAMO Academy soon followed by open-sourcing its self-developed vision-language-action model and a robot context protocol.

Also, AgiBot launched an open-source model GO-1. "Training a robot to pour water previously required collecting over 10,000 high-quality data samples," said Ren Guanghui, a researcher from AgiBot. "Our new open-source model will help cut that to only 1,000 pieces."

At a Shanghai tech meeting in August, Unitree CEO Wang Xingxing said some top universities have built many open-source algorithms on Unitree robots.

"The industry's progress is a collective effort, not the work of any single company or lab," Wang said.

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German firms collaborate with local Chinese partners to stay competitive

JINAN — In an automated facility in Shanghai's Chongming district, empty trays glide along a conveyor belt, receiving a layer of soil, a scatter of seeds and a fine mist of water before being neatly stacked by a robotic arm.

This high-speed, intelligent rice seedling production line, a joint project by German industrial automation company Festo Group and its Chinese partner Hangzhou Fengzhu Agricultural Technology Co Ltd, represents a new frontier where industrial technology is applied to the soil of Chinese agriculture.

"The combination of agriculture and industry creates a new quality productive force that will greatly push forward automation in Chinese farming," said Wu Jianping, general manager of Hangzhou Fengzhu.

By incorporating Festo's sensors, controllers and digital monitoring, the smart production line has shortened the seedling process to just 48 hours indoors, boosting the efficiency of seedling supply by more than 10 times.

Since entering the Chinese market in 1985, Festo has established its largest global production center in Jinan, capital of Shandong province. Today, the site has evolved into a comprehensive hub for manufacturing, research and development, and logistics.

"China's robust demand for hydrogen, semiconductors and robotics is complemented by new quality productive forces, creating vast applications for artificial intelligence and green technologies," said Chen Feng, head of the global production center.

China is Festo's second-largest market. The company is now actively weaving AI into its own operations in Jinan, applying AI to production planning, supply chains and automated assembly lines, often with solutions from local Chinese firms.

This shift is taking place against the backdrop of a national strategy. China's recent "AI Plus" action plan, calling for the technology's integration across the economy and for global cooperation, is seen by many German executives as a positive signal that opens new opportunities for multinationals operating in China.

"We are committed to increasing our investment," Chen said, citing China's clear advantages in talent, innovation, application and local supply chains. He added that Festo is crafting a 2030 roadmap to better integrate German and Chinese strengths, accelerating the deployment of AI and automation in more sectors.

Eric Angue, vice-president of product development for Festo's Greater China region, noted that as more local customers emerge, some of them even become leading companies in the industry. "Festo cooperates with these brands and joins their supply chains."



A view of the high-end intelligent home appliance electronic control panel production line of Diehl Controls in Qingdao, Shandong province, on Oct 1. XINHUA

The trend is not limited to Festo alone. A recent survey by the German Chamber of Commerce in China found that more than half of German companies believe their Chinese competitors will become innovation leaders within five years, with about half planning to collaborate with local partners to stay competitive.

One such company is the century-old Diehl Group. Its controls division, Diehl Controls, a key supplier of control systems in the global home appliance industry, set up in 2022 a new subsidiary in Qingdao, Shandong province, a major hub for advanced manufacturing in the home appliance industry.

Qingdao's semiconductor and integrated circuit, smart screen and other industries are developing rapidly, and the city's smart home appliance industry is highly concentrated and delivery is convenient, said Dirk Fricke, a member of the corporate division board at Diehl Controls.

Official figures highlight China's strength in AI. A report from the China Internet Network Information Center reveals that China's AI sector surpassed 700 billion yuan ($98.19 billion) in scale in 2024, maintaining over 20 percent annual growth. China has remained the world's largest market for industrial robots for 12 straight years.

"China has become the most active country in the development of AI technology, with new products and technology iterations coming out all the time," Fricke said, adding that the company plans to expand its R&D team of smart home appliance controllers in China in the hope of making China the global R&D center in this field.

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