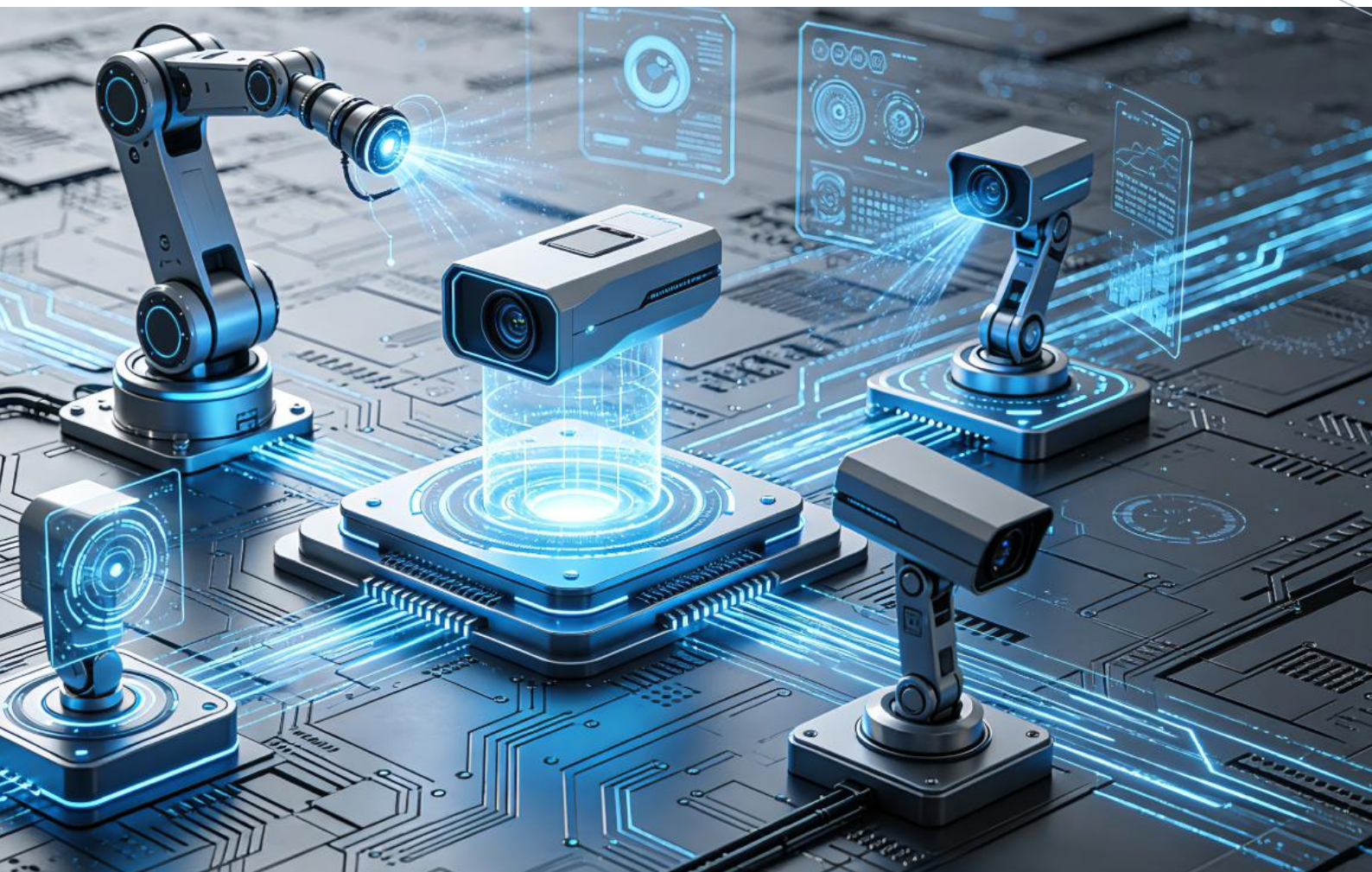


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Global Intelligent Robot Visual Perception Technology Industry Report

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Executive Summary

The global intelligent robot market is experiencing massive expansion driven by advancements in AGI and supportive global policies, while its critical foundation, visual perception technology, is rapidly evolving from basic data collection into advanced intelligent decision-making to power large-scale deployment across service and industrial sectors.

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1. Market Overview

1.1 Market Definition

Analysis of Intelligent Robot Market

Advancements in AGI are fueling rapid growth in the robotics industry by significantly enhancing robots' perception and decision-making capabilities. Equipped with advanced environmental awareness, these intelligent robots can navigate unstructured environments, execute complex tasks, and collaborate seamlessly with humans. As a core application of AI, they are driving widespread adoption across diverse industries while fundamentally reshaping global production systems and human-technology interaction.

Analysis of Intelligent Robot Visual Perception Technology Market

Intelligent robot perception technology is a system that enables robots to acquire, analyze and interact with environmental information in real time. As the key link between the physical world and robots, it underpins their autonomous decision-making and actions, and is divided into visual, auditory, tactile, force perception and other categories.

Different perception technologies serve differentiated needs across

scenarios: household and commercial service robots use visual and auditory perception, industrial collaborative robots rely on force perception, and humanoid robots adopt multi-modal sensors. Among these systems, visual perception is the most critical, serving as the “eyes” of intelligent robots to detect, locate, and analyze environments through advanced sensors and AI algorithms to guide autonomous behavior.

1.2 Market Size and Growth

Market Size of Intelligent Robot

The global intelligent robot market has expanded robustly, growing from RMB158.3 billion in 2020 to RMB369.0 billion in 2024 (CAGR 23.6%). It is projected to maintain this growth trajectory and surpass RMB1.0 trillion by 2029 (CAGR 22.2%), driven by multifactorial catalysts including diversifying application scenarios and rising customization demand, hardware and software technological breakthroughs, AIoT and large model advancements, as well as policy and capital support.

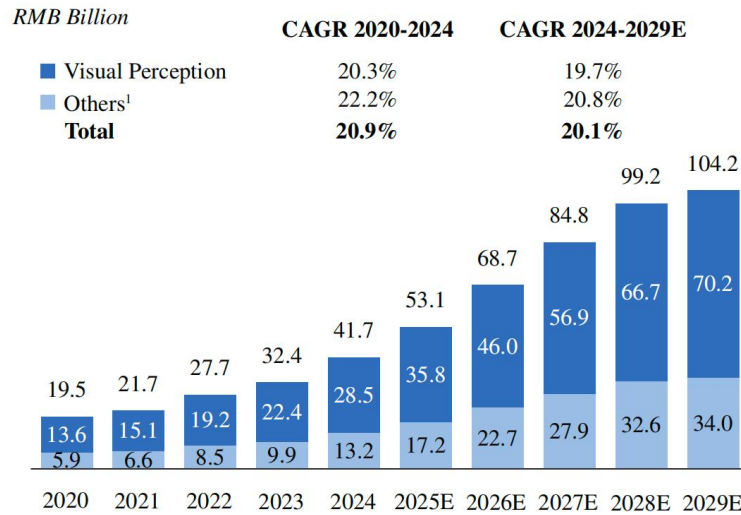
Driven by surging consumer demand for smart living, household service robots have become a critical segment of the intelligent robotics market. The global household service robot market grew

from RMB39.5 billion in 2020 to RMB91.3 billion in 2024 and is projected to reach RMB297.3 billion by 2029. Meanwhile, the professional service and industrial robot segment also shows strong demand and is expected to reach RMB708.5 billion by 2029. China, Europe and North America are the major markets for both segments.

Market Size of Intelligent Robot Visual Perception Technology

The global intelligent robot perception technology market is experiencing rapid expansion, with visual perception technology emerging as the most widely adopted and highest-penetration modality. The market increased from RMB13.6 billion in 2020 to RMB28.5 billion in 2024, and is projected to continue growing to RMB70.2 billion in 2029, which is the main growth driver of the overall perception technology market.

Global intelligent robot perception technology market size, in terms of sales revenue, by perception categories, 2020-2029E



Note: Others mainly include auditory perception, tactile perception, force perception etc.

Source: IFR, Annual Reports, CIC Reports

2. Key Growth Drivers and Trends

2.1 Key Drivers and Trends

Synergistic Hardware-Software Breakthroughs.

Advancements in AI technologies have significantly enhanced the dynamic resolution accuracy of intelligent robot visual perception systems in complex environments, thereby optimizing motion control and path planning. Technical optimizations in high-performance image sensors and LiDAR have met the demands for high efficiency and stable perception across diverse application scenarios.

Multi-Modal Perception Collaboration.

Visual perception technology in intelligent robots is evolving from single-modality sensing to multi-modal integration. By integrating visual data with auditory, tactile, and other sensory inputs, this approach significantly enhances perception accuracy, decision-making reliability, and operational flexibility in complex and dynamic environments.

AGI-Driven Evolution.

The continuous development of AGI is enabling intelligent robots to transition from performing routine tasks to understanding complex

semantics and adapting to unstructured environments. Visual perception technology, as the starting point of the cognitive loop in intelligent robots, is evolving from basic data collection to advanced information integration and intelligent decision-making.

Heightened Robotic Intelligence Brings Higher Requirements.

As robots continue to advance in intelligence, visual perception is required to meet increasingly stringent demands for environmental understanding, object recognition and dynamic adaptability. For example, in household service robots such as robot vacuums, visual perception is increasingly essential for identifying furniture, cables, and small household items, distinguishing between floor types (such as carpet and hardwood), and dynamically adjusting cleaning routes to avoid entanglement or collisions.

Rapid and Large-Scale Application of Intelligent Robots across Various Fields.

In 2024, the shipment volume of intelligent robots exceeded 27.0 million units. With the widespread adoption of intelligent robots across manufacturing, logistics, medical, security, home and other sectors, end-market market demand is rising rapidly, propelling the

industry into a phase of large-scale deployment. The visual perception system has become the core support for the performance enhancement and application expansion of intelligent robots.

2.2 Future Outlook

Driven by advancements in AGI, AIoT, and supportive policies, the global intelligent robot market is experiencing massive expansion, fueled primarily by the service and industrial segments. Visual perception serves as the industry's critical foundation, driving the field forward as technology shifts from basic data collection toward advanced, integrated intelligent decision-making.

Looking forward, long-term industry leadership will increasingly favor comprehensive incumbents over new entrants due to intensifying market barriers. These include high technical and product hurdles requiring rapid multi-disciplinary R&D and versatile end-to-end solutions, alongside steep implementation and scale barriers that demand mature real-world field delivery and established supply chain cost controls.



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CIC helps enterprises refine scalable business models and craft compelling capital narratives to enable seamless access to global capital markets, while serving as a trusted due diligence partner to investment institutions. It delivers granular industry insights and direct access to subject matter experts, empowering clients to identify high-value opportunities and mitigate critical risks effectively.

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CIC Reports & Industry Overview

At CIC, we employ a rigorous, multi-method research framework, combining primary and secondary sources to underpin our analysis. Primary research involves in-depth engagements with industry thought leaders and practitioners, particularly in supply chain finance. Secondary research synthesizes publicly available datasets from authoritative bodies, including the National Bureau of Statistics of the People's Republic of China, the State Administration of Financial Regulation (SAFR, formerly the China Banking and Insurance Regulatory Commission), the China Securities Regulatory Commission (CSRC), and public company filings. We apply proprietary data analytics frameworks to process collected information, validating findings through cross-referencing data from multiple research streams to ensure analytical rigor and reliability.

All statistical data presented is verifiable and grounded in information available as of the date of this report.



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Extracts are refined summaries of in-depth CIC industry research reports, highlighting supply and demand trends, key growth drivers, R&D trends and future outlook, etc. of various segmented fields, integrating multi-dimensional insights such as expert interviews, market surveys and industry data analysis.

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