

Application Prospects of Robots in the Field of Clinical Nursing Under the Background of Embodied Intelligence

Hui Qin

Hubei Three Gorges Polytechnic, Yichang 443000, Hubei, China

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: With the acceleration of the aging population and the increasingly prominent contradiction between the supply and demand of medical resources, the field of clinical nursing is also facing new challenges and opportunities. Embodied Intelligence (EI) is a cutting-edge branch of artificial intelligence, emphasizing that intelligent agents achieve the unity of cognition and action through dynamic interaction between physical carriers and the environment, which has injected vivid vitality into the development of clinical nursing robots. Based on this, this paper will briefly analyze the core connotation and technical characteristics of embodied intelligence, as well as the application scenarios of nursing robots in the field of clinical nursing, and look forward to the application prospects of nursing robots in the field of clinical nursing under the background of embodied intelligence, aiming to promote the deep integration of embodied intelligence technology and the field of clinical nursing.

Keywords: Embodied intelligence; Robots; Clinical nursing

Online publication: Apr 30, 2026

1. Introduction

The rapid development of artificial intelligence technology has provided a new way to solve the dilemmas in the field of clinical nursing. Among them, embodied intelligence has broken the limitation that “intelligence only exists in abstract algorithms”. By endowing intelligent agents with physical carriers, intelligent agents can independently adapt to and flexibly respond to complex nursing tasks in real clinical environments. Therefore, systematically analyzing the application scenarios of nursing robots under the background of embodied intelligence and looking forward to their development prospects are of great significance for promoting the intelligent transformation of medical and nursing models, optimizing the allocation of medical resources, and improving the level of clinical nursing services.

2. Core connotation and technical characteristics of embodied intelligence

2.1. Core connotation

Embodied Intelligence (EI) is a cutting-edge field integrating artificial intelligence and robotics. Its core idea is that intelligence cannot only exist in abstract algorithms or data processing, but must rely on a physical “body” to continuously interact with the real environment, and realize cognition, learning and adaptation in the closed loop of perception, action and feedback. In the White Paper on Embodied Intelligence Technology jointly released by the International Association for Artificial Intelligence (IAAI), IEEE and ACM in 2025, embodied intelligence is officially defined as: an intelligent system with a physical form that continuously interacts with the physical environment through a closed-loop system of “perception-decision-action-feedback”, can understand, adapt to and transform the environment, and has the ability to complete complex tasks in an open world ^[1].

In the clinical nursing environment, the embodied intelligent nursing robot is not only the carrier for performing nursing tasks, but also an important medium for perceiving patients’ conditions and adapting to the nursing environment, thereby realizing accurate monitoring, personalized nursing and real-time response for patients.

2.2. Core technical characteristics

2.2.1. Perceptual interaction

Perceptual interaction technology is a basic function of embodied intelligent nursing robots, mainly used to accurately perceive the nursing environment and patients’ conditions and interact in various ways. The clinical nursing environment is complex and changeable, and patients’ physiological conditions and emotional fluctuations are highly real-time and uncertain. Therefore, nursing robots must have strong perceptual capabilities. Through various sensors such as visual sensors, tactile sensors, auditory sensors, and physiological parameter sensors, embodied intelligent nursing robots can collect real-time physiological indicators of patients such as body temperature, heart rate, and blood pressure, capture non-verbal signals such as patients’ facial expressions and body movements, and perceive information such as obstacles and equipment positions in the nursing environment ^[2].

2.2.2. Autonomous decision-making

Autonomous decision-making technology is the core technology of embodied intelligent nursing robots. Its core function is to independently formulate and implement appropriate nursing plans based on perceived information, combined with clinical nursing standards and patients’ needs. The autonomous decision-making ability of embodied intelligent nursing robots relies on artificial intelligence algorithms such as deep learning, reinforcement learning, and knowledge graphs. By learning and analyzing a large amount of clinical nursing data, they master the nursing needs and standards of various diseases and patients, and can independently make judgments and flexibly respond in complex environments ^[3].

2.2.3. Flexible execution

Flexible execution technology refers to the implementation of the autonomous decisions of embodied intelligent nursing robots into specific nursing actions, so as to achieve accurate nursing for patients. Clinical nursing work is complex and diverse with high requirements. Venipuncture, turning over and patting the

back, drug delivery, etc., all belong to nursing operations, and there are certain requirements for the accuracy and flexibility of robot movements ^[4]. Equipped with high-precision robotic arms, flexible joints and other executive mechanisms, embodied intelligent nursing robots can accurately perform complex nursing actions using motion control algorithms.

3. Application scenarios of nursing robots in clinical nursing under the background of embodied intelligence

3.1. Basic nursing scenarios

Basic nursing includes vital sign monitoring, daily care, drug delivery, etc., which are the main work contents of nursing staff. Using embodied intelligent nursing robots to carry out basic nursing work can not only reduce the work burden of nursing staff, but also improve the standardization of basic nursing ^[5]. For example, in terms of vital sign monitoring, embodied intelligent nursing robots equipped with physiological parameter sensors can collect real-time vital sign data of patients such as body temperature, heart rate, blood pressure, and blood oxygen saturation, and then immediately send the data to nursing staff and hospital information systems through data transmission modules, realizing 24/7 uninterrupted monitoring of patients' vital signs. When patients' vital signs such as blood pressure and heart rate are abnormal, the robot will immediately issue an alarm to notify nursing staff for processing and record the abnormal data, providing a basis for clinical diagnosis and treatment ^[6]. Compared with traditional manual monitoring and nursing, the monitoring of embodied intelligent nursing robots has the characteristics of immediacy, continuity, and accuracy, which can avoid the negligence and errors in previous manual monitoring, and has high application value in scenarios requiring high-frequency monitoring such as intensive care units and geriatric wards.

3.2. Rehabilitation nursing scenarios

Rehabilitation nursing is an indispensable part of the disease rehabilitation process. It implements scientific rehabilitation training for postoperative patients, the disabled, elderly patients, etc., to promote the recovery of patients' physical function, language function, etc., and improve their quality of life. Embodied intelligent nursing robots can provide personalized rehabilitation nursing services for patients through accurate motion control and autonomous decision-making, thereby improving the effect and efficiency of rehabilitation training. In physical rehabilitation, a rehabilitation training plan suitable for patients' actual conditions can be determined according to their illness and rehabilitation requirements. The robot can real-time perceive patients' body movements and strength, adjust the training intensity and rhythm according to patients' feedback to prevent injuries caused by excessive training, and can also record patients' training data to provide a basis for rehabilitation doctors to adjust rehabilitation plans ^[7]. Compared with traditional physical rehabilitation, the training of embodied intelligent nursing robots is not only accurate and controllable, but also can dynamically adjust the training plan according to the patients' recovery status, realizing "one-on-one" personalized guidance.

4. Nursing robots empowering the reform of clinical nursing models

4.1. Upgrading and transformation of nursing service models

In clinical nursing work, embodied intelligent nursing robots can take on repetitive and physical-consuming

traditional nursing work, such as ward rounds, drug delivery, and disinfection, freeing nursing staff from tedious tasks, so that they have more time and energy to focus on higher-value nursing services such as patients' condition observation, psychological counseling, and health education. This model transformation not only improves the efficiency and quality of nursing services, but also further enhances patients' medical experience and satisfaction.

4.2. Reconstruction and optimization of nurse-patient relationship

Embodied intelligent nursing robots have efficient information processing and transmission capabilities, and can become an effective bridge for communication between nurses and patients. For example, based on its built-in knowledge base, the nursing robot can provide patients with standardized health information, accurately and patiently explain the condition, treatment plan, medication guidance, and rehabilitation precautions to patients, which is very suitable for patients with repeated consultation needs. Thus, it relieves the communication pressure of nursing staff, makes up for the deficiencies in traditional nurse-patient communication, enhances the understanding and trust between nurses and patients, and promotes the development of nurse-patient relationship in a more harmonious, efficient and humanized direction.

5. Analysis of application prospects of nursing robots in clinical nursing under the background of embodied intelligence

5.1. Continuous breakthroughs in core technologies and significant improvement in core performance

With the rapid development of advanced technologies such as artificial intelligence technology, robot technology, and sensor technology, the technical bottlenecks of embodied intelligent nursing robots will be gradually broken, and their main performances will also be significantly improved. The continuous improvement of multi-sensor data fusion technology enables robots to accurately perceive complex nursing environments and patients' conditions, well solve the interference problems caused by ambient light, noise, etc., and improve the reliability of perception results^[8]. The research and application of new sensors will further expand the robot's perception range of patients, enabling the robot to have a more accurate grasp of patients' physiological conditions and emotional changes. The update of tactile sensors can enable robots to have better perception capabilities of patients' skin pressure, temperature, etc., thereby improving the safety and comfort of nursing actions.

Specifically, in terms of autonomous decision-making technology, with the continuous optimization of algorithms such as deep learning and reinforcement learning, embodied intelligent nursing robots will also have richer clinical nursing knowledge and experience. When complex nursing situations arise, the robot can solve problems with good adaptive capacity and emergency response capabilities^[9]. For example, the robot will independently adjust the nursing plan according to changes in the patient's condition and nursing environment to achieve personalized decision-making and precise nursing.

5.2. Continuous expansion of application scenarios and improvement of nursing service levels

In the future, the application scenarios of embodied intelligent nursing robots will continue to expand, gradually developing from the current basic nursing, rehabilitation nursing and other scenarios to specialized

nursing, home nursing, community nursing and other directions. In the field of specialized nursing, embodied intelligent nursing robots will design corresponding nursing functions according to the needs of various specialized nursing, so as to achieve the precision and standardization of specialized nursing. For example, in pediatric nursing, robots will provide nursing services through gentler interaction methods and more accurate nursing actions to adapt to the physiological and psychological characteristics of child patients; in intensive care units, robots will conduct 24/7 uninterrupted monitoring and nursing of critically ill patients, so as to timely detect changes in patients' conditions and gain time for treatment ^[10].

In home nursing, embodied intelligent nursing robots will become the main support force for home care, providing door-to-door nursing services such as vital sign monitoring, daily care, and rehabilitation training for the elderly, the disabled and other people with limited mobility, enabling patients to receive high-quality nursing services without leaving home, improving patients' quality of life and reducing the family's nursing pressure ^[11]. In community nursing, embodied intelligent nursing robots will work in community health service centers to provide community residents with health monitoring, preventive health care, rehabilitation nursing and other services, realizing that minor illnesses can be treated in the community, major illnesses can be detected and treated early, improving the allocation of community medical resources and the level of community nursing services.

5.3. Gradual improvement of ethical norms and strengthening of policy guarantee support

In terms of ethical norms, relevant government departments will formulate specific ethical guidelines to define the ethical boundaries of embodied intelligent nursing robots and regulate the application behaviors of robots, so as to protect patients' privacy and rights and interests. Clearly stipulate the privacy protection requirements involved in all links of robot data collection, storage, transmission, and use, and establish and improve the patient privacy protection mechanism; clarify the subject of responsibility assumed by robots in the process of clinical nursing and the responsibility boundary of robots in the process of clinical nursing, so as to avoid the problem of vague responsibility ^[12]. At the same time, by strengthening the research and publicity of robot ethics, enable the public to correctly understand the ethical issues in the application of embodied intelligent nursing robots and establish a correct application ethics concept.

In terms of policy guarantee, relevant government departments will introduce policies to support embodied intelligent nursing robots, increase support for robot R&D, production, application, etc., and promote the technological breakthrough and industrialization development of robots. Establish robot access standards and supervision mechanisms, regulate the robot market order, and ensure the safety and quality of robot products ^[13]. Formulate access standards for robot technical parameters, performance indicators, safety requirements, etc., implement strict testing and certification for robot products, establish a normalized supervision system, supervise and manage the robot application process, and timely discover and solve problems.

5.4. Deepening of human-robot collaboration model and realization of complementary nursing advantages

In the future, embodied intelligent nursing robots will not be tools to replace human nursing staff, but will work with human nursing staff to give play to their respective advantages and jointly improve the quality and efficiency of clinical nursing services. Embodied intelligent nursing robots will take on basic nursing

work such as vital sign monitoring, drug delivery, and daily care, allowing nursing staff to have more time to use human professional judgment and humanistic care to make up for the shortcomings of robots ^[14]. At the same time, with the development of embodied intelligence technology, robots will better understand the intentions of nursing staff and can seamlessly collaborate with nursing staff. Nursing staff can use natural language instructions to control robots to complete nursing work, and robots can also immediately feedback the situations occurring during the nursing process to nursing staff, thereby providing support for nursing staff's decision-making. For example, in chronic disease management, robots can regularly remind patients to take medication, monitor indicators such as blood sugar and blood pressure and generate trend reports, while nursing staff provide patients with personalized health guidance and psychological support based on the reports, realizing long-term and continuous health care for patients.

In addition, the development of multi-robot collaboration technology will enable multiple robots to collaborate to complete complex nursing tasks. For example, in large-scale surgeries, three nursing robots can be arranged to be responsible for the accurate delivery and sterile management of surgical instruments, real-time monitoring of patients' intraoperative vital signs and dynamic early warning, and preliminary cleaning and position adjustment of postoperative patients, forming an efficient surgical nursing cooperation chain and achieving a nursing effect of "1 + 1 > 2" ^[15].

6. Conclusion

In summary, with the continuous breakthroughs in core technologies of embodied intelligence, the continuous expansion of application scenarios, the gradual improvement of ethical norms, and the deepening of human-robot collaboration models, embodied intelligent nursing robots will gradually achieve deep integration with clinical nursing, transforming from "auxiliary nursing" to "precision nursing and personalized nursing". They will become an important supporting force in the field of clinical nursing, promoting the intelligent and humanized transformation of medical and nursing models, and providing strong support for the development of China's health cause.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Ren H, Cheng H, 2025, Development Trends of Embodied Intelligence Technology. *Research and Application of Digital Intelligence Technology*, 1(03): 64–76.
- [2] Huang Z, Lai P, Liao X, 2025, Exploration of the Application of Embodied Intelligence in Pediatric Nursing: Current Situation, Challenges and Paths. *Research and Application of Digital Intelligence Technology*, 1(03): 77–90.
- [3] Song J, Xie T, Yang S, 2025, Application and Prospect of Embodied Intelligence in the Field of Healthcare. *Soft Science of Health*, 39(02): 26–30 + 36.
- [4] Li Q, Feng B, Xia L, 2024, Research Progress on the Clinical Application of Nursing Robots in Intensive Care Units. *Modern Clinical Nursing*, 23(06): 73–78.

- [5] Qian Y, 2024, Functions and Applications of Nursing Robots. *Contemporary Nurses (Late Edition)*, 31(04): 19–23.
- [6] Yuan X, Chang C, Chen X, et al., 2024, Overview of the R&D Foundation and Application Status of Nursing Robots. *Journal of Nursing Science*, 39(04): 108–112.
- [7] Peng W, Chen D, Li B, et al., 2023, Current Situation and Prospect of the Application of ChatGPT Artificial Intelligence Language Robots in the Field of Nursing. *Family Nurse*, 21(35): 4934–4937.
- [8] Hu Y, Tian J, Liao H, et al., 2023, Exploration and Reflection on the Application of Intravenous Medication Admixture Robots in Clinical Nursing Work. *Chongqing Medicine*, 52(23): 3669–3672.
- [9] Gao Y, Sun E, Bi X, et al., 2023, Meta-Synthesis of Qualitative Studies on Patients’ Attitudes Towards the Use of Nursing Robots. *Military Nursing*, 40(07): 20–24 + 56.
- [10] Guo K, Li Y, Li Y, et al., 2023, Construction of a Perioperative Nursing Process Checklist for Robot-Assisted Thoracoscopic Surgery. *Journal of Kunming Medical University*, 44(04): 181–186.
- [11] Miao J, Wang Y, He Y, 2023, Research on the Application of Transport Nursing Robots in Nursing Practice. *Evidence-Based Nursing*, 9(03): 453–456.
- [12] Wang J, Xue Z, Ma F, et al., 2023, Research Progress on the Clinical Application of Nursing Robots. *Journal of Nursing*, 30(02): 39–43.
- [13] Gao J, Ye X, Li Y, et al., 2022, Application of Artificial Intelligence in Clinical Nursing: A Scoping Review. *Evidence-Based Nursing*, 8(22): 2996–3006.
- [14] Zhao J, Sun X, Wang Y, et al., 2022, Research Progress on the Application of Nursing Robots. *Journal of Nursing Science*, 37(12): 108–111.
- [15] Xu Y, 2022, Preliminary Exploration of Nursing Management in Robotic Surgery. *Journal of Robotic Surgery (Chinese and English)*, 3(03): 224–228.

Publisher’s note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.