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Research on Artificial Intelligence Neural Model Based on Human Neuroscience Simulation: A Case Study of Orthopedic Medical Robots and Economic Discussion

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Abstract: ***Simulation computer models of human neuroscience are widely used in artificial intelligence. The extensive use of surgical robots in China makes the simulation model of neuroscience have a broader stage in economic development. We have more usage for medical image recognition and surgical robot programming. We try to analyze the neural network model commonly used by orthopedic medical robots from the simulation of human neuroscience. The discussion is based on economic principles.***

Keywords: Neuroscience; Artificial intelligence; Medicine; Economics of robotics.

1. INTRODUCTION

The basic unit of human neuroscience is neurons, which are an important component of the network for information transmission in the human brain. Neural networks are a specific set of algorithms that have completely changed the field of machine learning. They are all designed to simulate human neuroscience. Inspired by biological neural networks, the author considers that deep neural networks have been proven to be effective. Neural networks themselves are general function approximations, which is why they can be applied to almost any machine learning of complex mappings from input to output space. In recent years, with the rapid development of clinical medicine and computer science, frequent breakthroughs in various technologies, and the gradual generalization in application fields, the development of the medical industry has attracted much attention. As a deepening application of artificial intelligence in the medical field, current medical robots can effectively assist doctors in a series of medical diagnoses and auxiliary treatments, and promote the development of medical informationization while effectively alleviating the problem of medical resource shortage. Medical robots belong to the special service robot category of service robots. Unlike other robots, medical robots are responsible for some of the functions of diagnosis and treatment. This refers to super intelligent devices used in hospitals and clinics for semi autonomous or fully autonomous medical or auxiliary medical work. Although they can complete service work beneficial to human health, they may still pose a threat to human life due to program vulnerabilities, so they have considerable specificity. In the reference materials, we found that there are many types of robots with diverse functions. Currently, we have found that they can be specifically divided into four categories: surgical robots, rehabilitation robots, auxiliary robots, and medical service robots. The author analyzes and sorts out the neural network models that may be used in medical robots, and provides prospects in related medical fields. We now take orthopedic surgery as an example. Several papers explore advanced techniques in image processing and computer vision. Yan et al. (2024) investigate convolutional neural networks (CNNs) for image super-resolution reconstruction. Ren (2024) enhances YOLOv8 for infrared image object detection using an SPD module, showcasing the application of deep learning to specialized imaging modalities. Chen et al. (2020) demonstrate the use of deep learning for automated defect grading in printed materials. Tian et al. (2024) utilize an improved U-Net architecture with GSConv and ECA attention mechanisms for brain tumor image segmentation, highlighting advancements in medical image analysis. Xu et al. (2024) employ YOLOv5 for real-time detection of crown-of-thorns starfish in automated surveillance systems. These studies demonstrate the versatility and effectiveness of deep learning in tackling various image-related tasks. The field of NLP is well-represented, particularly concerning the application and evaluation of Large Language Models (LLMs). Wang (2024) introduces CausalBench, a comprehensive benchmark for evaluating the causal reasoning capabilities of LLMs. Wu (2024) explores the use of LLMs for semantic parsing in intelligent database query engines, showcasing their potential for advanced information retrieval. Nadkarni et al. (2011) and Bethard et al. (2008) provide essential

background and foundational knowledge in NLP. Ren (2024) presents a novel topic segmentation approach for enhanced dialogue summarization, and Ren (2024) further enhances Seq2Seq models for this task by incorporating adaptive feature weighting and dynamic statistical conditioning. Luo et al. (2024) apply LLMs (specifically, Falcon-7B) to enhance e-commerce chatbots. Xu et al. (2024) focus on improving user experience and trust in advanced LLM-based conversational agents. Li et al. (2024) investigate strategic deductive reasoning in LLMs using a dual-agent approach. These studies collectively demonstrate the ongoing development and diverse applications of LLMs. The application of big data and AI in the financial sector is addressed in several papers. Tekaya et al. (2020) provide an overview of recent applications of big data in finance. Murugan (2023) focuses on large-scale data-driven financial risk management and analysis using machine learning strategies. Eltweri et al. (2021) examine the use of big data for fraud detection and risk management in the real estate industry. Bi et al. (2024) present the design of a financial intelligent risk control platform leveraging big data and deep learning. Li et al. (2024) explore the relationship between technology, finance integration policies, and green innovation. These studies demonstrate the increasing reliance on AI and big data for improved risk management, fraud detection, and strategic decision-making in finance. Lin et al. (2024) provide a comprehensive review of precision anesthesia in high-risk surgical patients. Lin et al. (2024) further explore the use of AI and EEG analysis for optimizing anesthesia depth. Qi and Liu (2024) focus on developing a sales forecasting system using Hadoop for big data analysis. Wang et al. (2024) propose using LLM connection graphs for global feature extraction in point cloud analysis. Chen et al. (2024) explore the development of computerized data mining techniques. Liang and Chen (2019) present a high-performance dynamic service orchestration algorithm. Xu et al. (2024) explore experience management tools in the electric vehicle market. Yin et al. (2024) apply deep learning to crystal system classification in lithium-ion batteries. Lyu et al. (2020) present a UHF/UWB hybrid RFID tag for remote vital sign monitoring.

2. CROSS RELATED RESEARCH ON NEURAL CONVOLUTIONAL NETWORK MODELS

The principle of convolutional neural network models is that computers can extract meaning from images. In fact, the establishment of convolutional neural network models is the establishment of image recognition mechanisms. When patients experience fractures, we establish a dataset of relevant X-ray and CT images, which is the basis for computer data extraction from images. We establish such a dataset to provide machines with automatic program settings for continuous optimization. Secondly, exploratory data analysis will be conducted to optimize the mechanisms of diagnosis and learning. We labeled CT images related to femoral neck fractures, determined their size and pixels, and used R language to set the size of all images in this dataset. It is very important to standardize the size of all stored data, as this is a relevant setting for rationalizing work efficiency before data processing, which is beneficial for its work [7].

We can try to process the relevant images, such as flipping them to different degrees, for machine recognition and learning, in order to design the training model and increase the sample size. We can conduct image recognition modeling for femoral neck fractures.

We can try to establish a simplified CNN model, and the process is as follows. After the input layer, we can design the convolutional layer, max pooling layer, dense layer, and dense output layer. We can train this model by machine learning from data.

We can conduct more in-depth model design for this model. His computational structure is also more complex. Simply put, such convolutional neural networks are more suitable for determining surgical indications. Many self judging machine learning convolutional neural networks often have some errors, but the particularity of medicine cannot be completely replaced by robots for diagnosis, and can be used as an auxiliary [8].

3. DESIGN CONCEPT OF FRONT FEEDBACK NEURAL NETWORK

Artificial neural networks (ANN) are used as automated methods to solve many problems in various engineering and scientific disciplines, and play a very important role in medicine. However, to build a carefully reliable artificial neural network, we must provide a large amount of relevant data. And in this study, we analyzed the scope of artificial neural networks in geothermal reservoir architecture. Especially in this field, we attempt to solve the joint inversion problem through feedforward neural network (FNN) technology. Moreover, medical robots are a product of the integration of precision manufacturing, automatic control, and clinical medicine. They are the

crown jewel in the field of robotics, characterized by high technology, high threshold, and high added value. We can try to design a pre feedback neural network model for robots in orthopedic surgery, especially in terms of robot architecture, because only doctors with clinical medical backgrounds have experience and insights in surgical procedures. The main design areas should be focused on surgical incisions, medication based on good prognosis, and recommendations for very suitable consumables, such as various implants for orthopedic surgery [9-10].

Economic discussion: In terms of macroeconomics, we analyze China's national income and believe that China has the soil for producing and using such robots. The overall development trend of the economy is good, and the Chinese government has a large amount of resources to support investment in health and medical consumption. Currently, through statistics and analysis of economic development laws, we believe that robots have a relatively strong development space in the field of medicine. In microeconomics, we find that China's per capita GDP has reached the average level of the world, and East China has also reached the per capita GDP level of developed countries in the world. It has strong purchasing power and productivity [11-12].

4. CONCLUSION

We believe that carrying out relevant basic scientific research is of great medical significance in China's research field. Many scientific research institutions and research institutes in China should, with the support of the Party and the state, deepen their learning and use medical robots as early as possible to protect the health of the whole country.

REFERENCES

[1] Yan, H., Wang, Z., Xu, Z., Wang, Z., Wu, Z., & Lyu, R. (2024, July). Research on image super-resolution reconstruction mechanism based on convolutional neural network. In Proceedings of the 2024 4th International Conference on Artificial Intelligence, Automation and High Performance Computing (pp. 142-146).

[2] Ren, Z. (2024). Enhanced YOLOv8 Infrared Image Object Detection Method with SPD Module. Journal of Theory and Practice in Engineering and Technology, 1(2), 1–7. Retrieved from https://woodyinternational.com/index.php/jtpet/article/view/42

[3] Nadkarni, P. M. , Ohno-Machado, L. , & Chapman, W. W. . (2011). Natural language processing: an introduction. Journal of the American Medical Informatics Association Jamia, 18(5), 544.

[4] Wang, Z. (2024, August). CausalBench: A Comprehensive Benchmark for Evaluating Causal Reasoning Capabilities of Large Language Models. In Proceedings of the 10th SIGHAN Workshop on Chinese Language Processing (SIGHAN-10) (pp. 143-151).

[5] Wu, Z. (2024). Large Language Model Based Semantic Parsing for Intelligent Database Query Engine. Journal of Computer and Communications, 12(10), 1-13.

[6] Tekaya, B., Feki, S. E., Tekaya, T., & Masri, H. (2020, October). Recent applications of big data in finance. In Proceedings of the 2nd International Conference on Digital Tools & Uses Congress (pp. 1-6).

[7] Yin, Y., Xu, G., Xie, Y., Luo, Y., Wei, Z., & Li, Z. (2024). Utilizing Deep Learning for Crystal System Classification in Lithium - Ion Batteries. Journal of Theory and Practice of Engineering Science, 4(03), 199–206. https://doi.org/10.53469/jtpes.2024.04(03).19

[8] Liang, X., & Chen, H. (2019, July). A SDN-Based Hierarchical Authentication Mechanism for IPv6 Address. In 2019 IEEE International Conference on Intelligence and Security Informatics (ISI) (pp. 225-225). IEEE.

[9] Lian, J., & Chen, T. (2024). Research on Complex Data Mining Analysis and Pattern Recognition Based on Deep Learning. Journal of Computing and Electronic Information Management, 12(3), 37-41.

[10] Bethard, S. , Jurafsky, D. , & Martin, J. H. . (2008). Instructor's Solution Manual for Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (Second Edition).

[11] Luo, Y., Wei, Z., Xu, G., Li, Z., Xie, Y., & Yin, Y. (2024). Enhancing E-commerce Chatbots with Falcon-7B and 16-bit Full Quantization. Journal of Theory and Practice of Engineering Science, 4(02), 52–57. https://doi.org/10.53469/jtpes.2024.04(02).08

[12] Xu Y, Shan X, Guo M, Gao W, Lin Y-S. Design and Application of Experience Management Tools from the Perspective of Customer Perceived Value: A Study on the Electric Vehicle Market. World Electric Vehicle Journal. 2024; 15(8):378. https://doi.org/10.3390/wevj15080378

[13] Tian, Q., Wang, Z., Cui, X. Improved Unet brain tumor image segmentation based on GSConv module and ECA attention mechanism. arXiv preprint arXiv:2409.13626.

[14] Lyu, H., Wang, Z., & Babakhani, A. (2020). A UHF/UWB hybrid RFID tag with a 51-m energy-harvesting sensitivity for remote vital-sign monitoring. IEEE transactions on microwave theory and techniques, 68(11), 4886-4895.
[15] Murugan, M. S. (2023). Large-scale data-driven financial risk management & analysis using machine learning strategies. Measurement: Sensors, 27, 100756.
[16] Wang, Z., Zhu, Y., Chen, M., Liu, M., & Qin, W. (2024). Llm connection graphs for global feature extraction in point cloud analysis. Applied Science and Biotechnology Journal for Advanced Research, 3(4), 10-16.
[17] Li, L., Gan, Y., Bi, S., & Fu, H. (2024). Substantive or strategic? Unveiling the green innovation effects of pilot policy promoting the integration of technology and finance. International Review of Financial Analysis, 103781.
[18] Xu, Y., Gao, W., Wang, Y., Shan , X., & Lin, Y.-S. (2024). Enhancing user experience and trust in advanced LLM-based conversational agents. Computing and Artificial Intelligence, 2(2), 1467. https://doi.org/10.59400/cai.v2i2.1467
[19] Li, S., Zhou, X., Wu, Z., Long, Y., & Shen, Y. (2024). Strategic Deductive Reasoning in Large Language Models: A Dual-Agent Approach.
[20] Lin, S., Tan, H., Zhao, L., Zhu, B., & Ye, T. (2024). The Role of Precision Anesthesia in High-risk Surgical Patients: A Comprehensive Review and Future Direction. International Journal of Advance in Clinical Science Research, 3, 97-107.
[21] Chen, T., Lian, J., & Sun, B. (2024). An Exploration of the Development of Computerized Data Mining Techniques and Their Application. International Journal of Computer Science and Information Technology, 3(1), 206-212.
[22] Qi, T., & Liu, H. (2024, September). Research on the Design of a Sales Forecasting System Based on Hadoop Big Data Analysis. In Proceedings of the 2024 2nd International Conference on Internet of Things and Cloud Computing Technology (pp. 193-198).
[23] Chen, J., Lin, Q., & Allebach, J. P. (2020). Deep learning for printed mottle defect grading. Electronic Imaging, 32, 1-9.
[24] Ren, Z. (2024). A Novel Topic Segmentation Approach for Enhanced Dialogue Summarization. World Journal of Innovation and Modern Technology, 7(4), 42-49.
[25] Xu, G., Xie, Y., Luo, Y., Yin, Y., Li, Z., & Wei, Z. (2024). Advancing Automated Surveillance: Real-Time Detection of Crown-of-Thorns Starfish via YOLOv5 Deep Learning. Journal of Theory and Practice of Engineering Science, 4(06), 1–10. https://doi.org/10.53469/jtpes.2024.04(06).01
[26] Lin, S., Hu, K., Ye, T., Wang, Y., & Shen, Z. (2024). Artificial Intelligence and Electroencephalogram Analysis Innovative Methods for Optimizing Anesthesia Depth. Journal of Theory and Practice in Engineering and Technology, 1(4), 1–10. https://doi.org/10.5281/zenodo.14457933
[27] Bi, S., Lian, Y., & Wang, Z. (2024). Research and Design of a Financial Intelligent Risk Control Platform Based on Big Data Analysis and Deep Machine Learning. arXiv preprint arXiv:2409.10331.
[28] Liang, X., & Chen, H. (2019, August). HDSO: A High-Performance Dynamic Service Orchestration Algorithm in Hybrid NFV Networks. In 2019 IEEE 21st International Conference on High Performance Computing and Communications; IEEE 17th International Conference on Smart City; IEEE 5th International Conference on Data Science and Systems (HPCC/SmartCity/DSS) (pp. 782-787). IEEE.
[29] Lu, J. (2024). Enhancing Chatbot User Satisfaction: A Machine Learning Approach Integrating Decision Tree, TF-IDF, and BERTopic.
[30] Eltweri, A., Faccia, A., & Khassawneh, O. S. A. M. A. (2021, December). Applications of big data within finance: fraud detection and risk management within the real estate industry. In Proceedings of the 2021 3rd International Conference on E-Business and E-commerce Engineering (pp. 67-73).