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Research on Artificial Intelligence Large-model Optimization Algorithms for New Energy and Petroleum Engineering

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Abstract: *With the rapid development of the fields of new energy and petroleum engineering, it is difficult for traditional optimization algorithms to meet the needs of complex systems. The purpose of this research is to explore artificial intelligence large-model optimization algorithms for new energy and petroleum engineering. Convolutional neural networks are used to design and train optimization algorithm models. In the process of model training, we used a high-performance computing platform to accelerate the convergence and optimization process of the algorithm. The performance and effect of the proposed algorithm in the field of new energy and petroleum engineering are evaluated through experiments and comparative analysis. The experimental results show that the efficiency of the algorithm in this paper is between 89% and 98%, and the algorithm shows high optimization ability on large-scale data sets. Artificial intelligence large-model optimization algorithms for new energy and petroleum engineering have the potential to play an important role in this field, and provide a valuable reference for future research and application.*

Keywords: *optimization algorithm, artificial intelligence model, new energy, petroleum engineering*

1. Introduction

With the continuous growth of global energy demand and the urgent need for sustainable development, the fields of new energy and petroleum engineering are facing huge challenges and opportunities. In order to improve the efficiency of energy extraction, reduce environmental pollution, and realize the sustainable use of energy resources, people have put forward higher requirements for the optimization of new energy and petroleum engineering. Traditional optimization algorithms face limitations in efficiency and accuracy in the face of complex systems and large-scale data. Therefore, the introduction of artificial intelligence technology to optimize and improve traditional algorithms has become a hot topic in research.

The purpose of this article is to explore artificial intelligence large-model optimization algorithms for new energy and petroleum engineering to meet the challenges of complex systems and large-scale data. The optimization algorithm using artificial intelligence technology has stronger adaptability and robustness, and can be accurately modeled and optimized in complex environments. By introducing technologies such as deep learning and reinforcement learning, we can use large-scale data sets and high-performance computing platforms to train and optimize models, thereby improving the efficiency and accuracy of optimization algorithms. The research method of this paper has important practical significance and application value for solving complex optimization problems in the field of new energy and petroleum engineering.

The main contribution of this paper is to fill the gap in the research of artificial intelligence large-model optimization algorithms in the field of new energy and petroleum engineering, and to provide new ideas and methods for engineering practice and decision-making in related fields. First of all, this paper provides the basis for follow-up research through data collection and construction of large-scale data sets in the fields of new energy and petroleum engineering. Secondly, this paper uses a variety of artificial intelligence technologies to design and train the optimization algorithm model, and evaluates its performance and effect through experiments and comparative analysis. Finally, this paper summarizes the research results, discusses the application prospects of algorithms in the field of new energy and petroleum engineering, and points out the direction and challenges of future research. The

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structure of this article is arranged as follows: introduction, research background, significance of the research methods of this article, contribution of this article and organization of the paper, research methods, experimental results and analysis, conclusions and prospects and other parts. Through this arrangement, this article aims to comprehensively elaborate on the research content and results of artificial intelligence large-model optimization algorithms for new energy and petroleum engineering, and provide useful reference and inspiration for researchers and practitioners in related fields.

2. Related work

Many scholars have conducted research on petroleum and new energy sources. Among them, Yue et al. [1] believes that the green transformation of European oil companies is more radical, shrinking the oil and gas business to expand the new energy business, and implementing absolute emission reductions; the transformation of American oil companies is relatively conservative; the green and low-carbon development goals and paths of our country's oil companies are relatively “stable”, and it is necessary to stabilize oil and increase gas, follow the development policy of oil and gas and new energy at the same time, and make new contributions to ensuring national energy security, reducing the external dependence of oil and gas, and achieving the goal of “double carbon”. Li and Li [2] believes that in the context of carbon peak and carbon neutrality to deal with global climate change, oil and natural gas will still play an important role in the energy family in the 21st century. The development and utilization of three types of renewable energy sources, such as hydropower, wind energy and solar energy, are the basic guarantees for achieving the dual-carbon goal. Geothermal energy, biomass energy and marine energy are important drivers. Wang et al. [3] proposed that the low-carbon transformation of international petroleum companies has entered the strategic implementation period from the strategic wait-and-see period. Specific manifestations include that international petroleum companies have implemented a significant increase in investment in low-carbon and new energy businesses, relying on mergers and acquisitions and direct investment to quickly layout low-carbon and new energy businesses, and holding groups to carry out practical measures such as low-carbon and new energy technology research and development. On the basis of analyzing the development trend of new energy of international petroleum companies, Ding et al. [4] discussed the development direction and strategy of Petro China's overseas new energy business, and put forward development ideas for classification and implementation according to local conditions, as well as development strategies for pilot and step-by-step promotion. Sun et al. [5] believes that international oil companies develop new energy sources in accordance with pure business logic based on the attributes of energy companies. Due to the significant differences between our country's petroleum companies and international petroleum companies in terms of corporate attributes, responsibilities, management systems, etc., our country's petroleum companies should carry out new energy business under the premise of obeying the layout of our country's state-owned economy, and should give priority to the integration and development of alternative new energy sources for oil and gas based on the main oil and gas industry, and develop alternative new energy sources for electricity in a differentiated manner. However, there is relatively little research on artificial intelligence large-model optimization algorithms for new energy and petroleum engineering, and the research in this article will fill this gap.

3. New energy and petroleum engineering with artificial intelligence optimization algorithms

3.1 Large model of artificial intelligence

The large-scale artificial intelligence model refers to the large-scale neural network model applied in the field of machine learning and natural language processing. These models are usually composed of billions to hundreds of billions of parameters, have powerful computational and representation capabilities, and can handle complex natural language understanding and generation tasks [6-7].In recent years, with the rapid development of deep learning technology, especially through pre-training and fine-tuning methods, large artificial intelligence models such as GPT (Generative Pre-trained Transformer) series, BERT (Bidirectional Encoder Representations from Transformers), etc. have made significant breakthroughs and are widely used. Artificial intelligence large-scale models can learn and analyze a large amount of geological data, exploration data, and production data to predict the nature of reservoirs and the distribution of reserves, and help petroleum engineers more accurately assess the potential of oil fields [8-9].In addition, the large model can also optimize reservoir development strategies, including water injection schemes, well network layout, etc., in order to improve the development efficiency and production of oil fields. By analyzing the sensor data,

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production data and equipment operating status of the oil well, the oil well optimization and fault diagnosis are carried out. Through pattern recognition and anomaly detection of data, large models can help predict the production of oil wells, identify anomalies, and provide corresponding optimization suggestions and troubleshooting solutions.

3.2 Application of convolutional neural network in optimization

Seismic data in petroleum engineering is essential for the exploration and development of oil reservoirs. Applied to the processing and analysis of seismic data, such as denoising, feature extraction, and image reconstruction of seismic data, CNN (Convolutional Neural Networks) can learn geological features and patterns in seismic data to help seismic scientists and geological engineers better understand the geological structure and properties of oil reservoirs. Petroleum engineering involves a large amount of reservoir image data, including drilling images, logging images, core images, etc. [10-11].It is applied to the analysis and interpretation of these images, such as rock classification, porosity prediction, pore connectivity analysis, etc. Through convolution and feature extraction of image data, it provides more accurate and comprehensive image analysis results to help petroleum engineers make decisions and optimize reservoir development plans. It can be applied to the prediction and optimization of oil well production. By analyzing historical oil well production data and related influencing factors, such as water injection volume, oil production pressure, etc., the complex relationship between oil well production and these factors is learned. In this way, given new input parameters, CNN can predict the output of the well and help petroleum engineers make production adjustments and optimize control [12-13].Table 1 shows the CNN parameter settings.

Table 1: CNN parameter settings

Parameter	Value
Input Size	224x224x3
Kernel Size	3x3
Number of Kernels	32
Stride	1
Padding	1
Activation Function	ReLU
Pooling Size	2x2
Pooling Type	Max Pooling
Batch Normalization	Yes
Dropout	0.5
Fully Connected Layer Size	256

3.3 Model structure design

Considering that there are multiple related tasks in new energy and petroleum engineering, a multi-task learning model structure can be designed so that the model can learn and optimize multiple tasks at the same time. This can improve the overall performance and generalization ability of the model. For example, tasks such as solar power generation prediction, wind turbine blade defect detection, and oil well yield prediction can be used as multiple subtasks of the model, and the shared representation can be learned by sharing a portion of the network layer. In large artificial intelligence models, a stacked architecture can be used to increase the depth and complexity of the model [14-15]. By stacking multiple hidden layers, the model can extract higher-level features and representations layer by layer, thereby improving the model's modeling ability for complex problems. In new energy and petroleum engineering, a deep convolutional neural network or recurrent neural network structure can be designed to extract richer characteristic information through multiple stacked convolutional or cyclic layers.

4. Results and discussion

4.1 Experimental design

Design experiments to verify the performance and feasibility of artificial intelligence large-model optimization algorithms for new energy and petroleum engineering in improving energy development efficiency and algorithm stability. Based on real new energy and petroleum engineering data, the

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reliability and practicality of the experimental results are ensured, and the experimental design fully considers the efficiency, accuracy and interpretability of the algorithm. Firstly, this study collects and prepares relevant datasets for new energy or petroleum engineering, including resource exploration data, production process data, and energy supply chain data, to ensure sufficient computing resources to support the training and optimization of large-scale models. The experimental group applied the artificial intelligence large-model optimization algorithm for new energy and petroleum engineering to optimize energy development, and the control group used traditional methods to optimize energy development as the benchmark for the comparative experimental group. This study uses a dataset for experimental simulation, simulating different energy development scenarios and plans, and recording the experimental process and results. This study conducted comparative analysis with the control group to ensure the reliability and validity of the experimental results, and conducted multiple experimental simulations, averaging, or statistical analysis to reduce the impact of random errors.

4.2 Energy development efficiency

The efficiency of energy development can reflect the degree of utilization of energy resources, the efficiency of the production process, the optimization of the energy supply chain, and the level of sustainable development, and provide guidance and improvement directions for energy development. Figure 1 shows the results of the energy development efficiency test in this article. I represents the experimental group and II represents the control group.

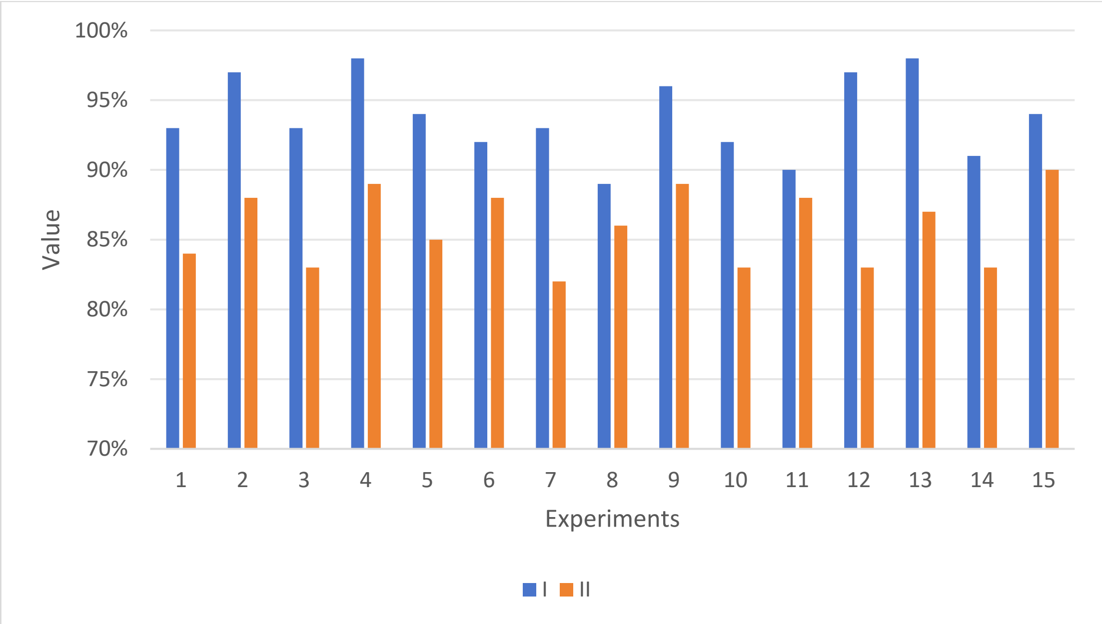

Figure 1: Energy development efficiency

In Figure 2, the energy development efficiency test was carried out, and 15 tests were carried out on the energy development efficiency. The test results showed that the efficiency of the algorithm in this article was between 89% and 98%, while the efficiency of the traditional algorithm was between 82% and 91%.The efficiency of the algorithm in this paper is better than that of traditional methods, because the artificial intelligence large-model optimization algorithm can handle and solve more complex problems. In the field of new energy and petroleum engineering, there are many nonlinear, multivariate and coupling problems. Traditional algorithms may not fully take into account these complexities, while artificial intelligence large-model optimization algorithms can better capture the details and relevance of the problem, so as to achieve higher energy development efficiency. Algorithms rely on large-scale data sets and deep learning techniques, and can learn from the data and unearth hidden patterns and laws. Through the analysis and modeling of large amounts of data, large artificial intelligence models can provide more accurate energy development decisions, optimize the utilization of energy resources and the efficiency of the production process, so as to achieve higher energy development efficiency.

4.3 Stability

Stability indicators can be used to evaluate the controllability of algorithms to the system. Energy development involves complex energy supply chains, production processes and other systems. Stability indicators can help evaluate the algorithm's ability to control the system, judge the stability and controllability of the algorithm during the operation of the system, and thus provide decision support and optimization direction. Figure 2 shows the stability test results.

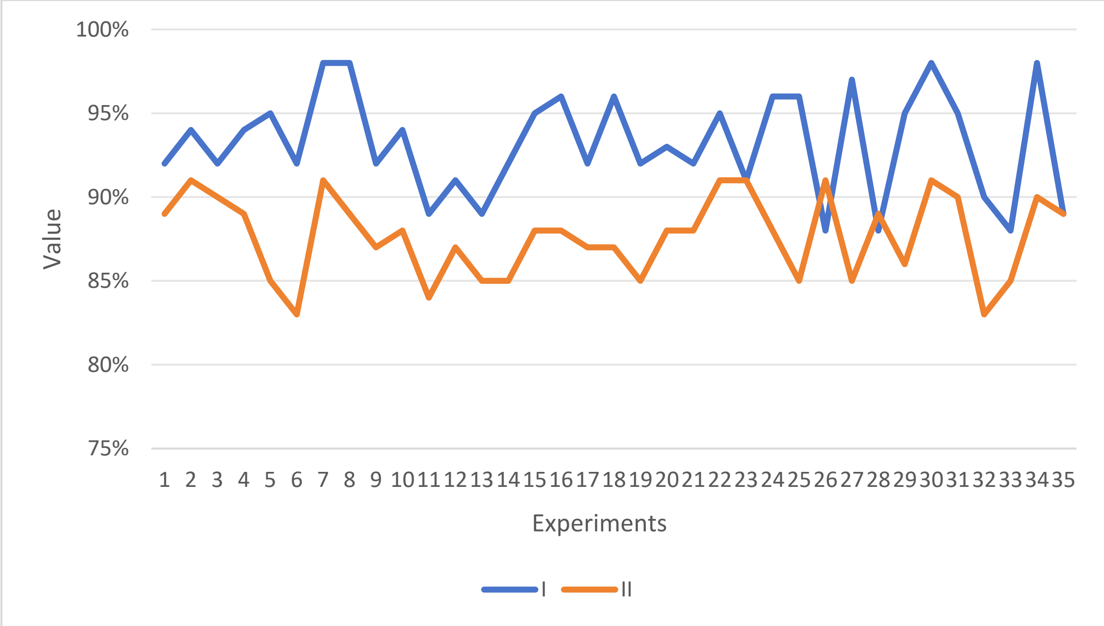

Figure 2: Stability

In the stability test, the stability of the algorithm in this paper is between 88% and 98%, while the stability of the traditional algorithm is between 83% and 91%.The stability of the algorithm in this paper is obviously much higher, because the artificial intelligence large-model optimization algorithm shows better robustness and adaptability when dealing with energy development problems. In the face of complex environments and changing conditions, traditional algorithms may be susceptible to noise, interference, and abnormal conditions, resulting in unstable results. The artificial intelligence large-model optimization algorithm can be more adaptable and robust through large-scale data learning and pattern recognition, and can better cope with uncertainty and changes, thereby improving the stability of the algorithm.

5. Conclusion

Through experimental testing, we found that the artificial intelligence large-model optimization algorithm for new energy and petroleum engineering has the potential to achieve significant improvement in optimization ability and accuracy in complex systems and large-scale data environments. Compared with traditional optimization algorithms, algorithms using artificial intelligence technology can better adapt to uncertainty and nonlinear characteristics, thereby improving the optimization effect. By introducing artificial intelligence technologies such as deep learning and reinforcement learning, we can use large-scale data sets and high-performance computing platforms to train and optimize models. This method exhibits high adaptability and robustness in the field of new energy and petroleum engineering, and can achieve accurate modeling and optimization. At the same time, the support of high-performance computing platforms can significantly improve the training speed and efficiency of algorithms.

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