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Medical Instruction of Traditional Chinese Medicine Based on VisualGLM-6B Fine-Tuning Training

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Abstract. Traditional Chinese medicine as an important component of traditional Chinese medicine, has a wide range of application value. Because the traditional Chinese medicine plays an important role in the treatment of diseases, it is necessary to conduct in-depth research and analysis to guide clinical application. The accuracy of traditional Chinese medicine research methods is relatively low because of the influence of human factors and the small number of samples. In order to solve this problem, in recent years, deep learning-based traditional Chinese medicine research methods have gradually emerged. Among them, VisualGLM-6B fine-tuning training is a Chinese medicine research method based on deep learning method, which can improve the accuracy of the model through fine-tuning training of Chinese medicine, and provide more accurate support for the medical guidance of Chinese medicine. Therefore, this paper will be based on VisualGLM-6B fine-tuning training, to study its application effect in Chinese medicine guidance, in order to improve the effect and quality of clinical application of Chinese medicine, to make greater contributions to human health.

Keywords: deep learning;chinese medicine;artificial intelligence;healthcare

1. Introduction

Chinese medicines have been widely used in traditional Chinese medicine culture for the treatment and prevention of diseases[1]. The complexity and diversity of Chinese herbal medicines make them have a wide range of biological activities that can produce therapeutic effects against a wide range of diseases and symptoms[2]. Chinese medicines have become one of the research priorities in recent years, and their development and application have a wide range of application prospects and market value. With the aging of the population and changes in lifestyle, the incidence and impact of chronic diseases and other illnesses are increasing. Traditional drug therapies are widely used in clinical treatment, among which Chinese medicine is an ancient and effective treatment method[3]. Chinese medicines have been shown to be effective in the treatment of several clinical areas, such as cardiovascular, liver and cancer diseases. The active ingredients in Chinese medicines are the key to their therapeutic effects; however, the content and stability of the active ingredients in Chinese medicines are usually difficult to be guaranteed, which limits their application in clinical treatment. Traditional methods of TCM research are mainly based on experience and empirical adjustments, and the drawbacks of such methods are the high cost of time, the difficulty in explaining the underlying mechanisms behind TCM, and the problems of producing stable therapeutic efficacy under different therapeutic conditions. In addition, as scientific research on Chinese herbal medicines continues to deepen and develop, more and more problems surface. For example, the fluctuation of the content of pharmacodynamic substances, the complexity of chemical composition, and the quality of Chinese herbal medicines have brought difficulties and challenges to the research and use of Chinese herbal medicines. Unlike chemical drugs, Chinese medicines require strict information about their quality, efficacy and dosage during use. However, the current market of Chinese herbal medicines is characterized by problems such as filling inferior herbs, confusion of varieties and inconsistent quality of herbs, which seriously affect the quality and efficacy of Chinese herbal medicines. Against this background, how to scientifically evaluate the therapeutic effects of herbs and guide clinical practice has become an important issue in the field of Chinese medicine.

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In recent years, the rapid development of deep learning techniques has provided new opportunities to address these issues. Deep learning techniques are able to analyze and understand the information behind the input data to provide a more accurate assessment of the active ingredients of their medicines[4]. Currently, deep learning techniques have achieved impressive results in areas such as image recognition and natural language processing. However, the application of deep learning techniques has not yet received widespread attention in the field of traditional Chinese medicine research and applications. Therefore, applying deep learning to the research and application of traditional Chinese medicine has also become a new hotspot for research.

In order to conduct research and find solutions to these problems in herbal medicine, scientists around the world are committed to developing methods that can more accurately evaluate and guide the efficacy of herbal medicines. Fine-tuning training is a highly promising method in machine learning, which has been widely used in a variety of research areas. Fine-tuning training-based methods for guiding herbal medicines have been proposed and accepted for use, and are moving towards greater accuracy and portability[5].

VisualGLM-6B is a deep learning based image classification model that has been widely used in several fields[6]. The model utilizes the powerful computational capabilities of neural networks to efficiently and accurately recognize and classify images. Compared with other models, VisualGLM-6B has stronger fine-tuning training function, which can be more carefully adjusted and optimized according to different datasets, thus improving the classification accuracy[7]. Using the VisualGLM-6B model, we can analyze and classify traditional Chinese medicines with deep learning, and provide accurate guidance and reference based on scientific evidence for Chinese medicine clinics. In this study, we utilize the VisualGLM-6B model to perform deep learning analysis and classification of traditional Chinese medicines and combine it with medical guidance to provide reliable guidance and reference for Chinese medicine clinics. By effectively categorizing and identifying Chinese medicines, a large amount of basic data and information can be provided to the Chinese medicine community, which can help the development and clinical research of Chinese medicines. Compared with the traditional methods of TCM quality testing, the classification and identification of TCM using deep learning techniques has higher accuracy and efficiency, and is expected to become one of the main means of TCM quality regulation and efficacy evaluation in the future. In addition, we can match the image data of traditional Chinese medicines with disease data to realize the prediction and analysis of the effect and effectiveness of traditional Chinese medicines in treating specific diseases. This matching technology can not only improve the effectiveness of Chinese medicine treatment, but also provide a more scientific basis for the application of Chinese medicine in the medical field.

This study is mainly based on the technique of VisualGLM -6B fine-tuning training, which combines the advantages of deep learning and the special needs of Chinese medicine treatment. Deep learning techniques are used to analyze the content and quality of active ingredients in traditional Chinese medicine to help TCM practitioners formulate treatment plans more accurately. This study utilizes deep learning technology to analyze and classify traditional Chinese medicines, providing a new, scientific way of evaluation and guidance for the clinical aspects of Chinese medicine. In the future, the accuracy and efficiency of analyzing and classifying Chinese medicines will be further improved in the context of the continuous development of deep learning technology, which will further promote the development and clinical application of Chinese medicines.

The structure of this paper is as follows: the first part is the relevant background and current research status, including the historical background of traditional Chinese medicine research, the clinical application of traditional Chinese medicine, and the development of deep learning technology; the second part is the TCM medical guidance method based on VisualGLM-6B fine-tuning training, which mainly includes the challenges of traditional Chinese medicine research methods, the principles of deep learning technology, and the contribution of deep learning technology to the development of traditional Chinese medicine; the third part is the experimental

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method and result analysis, including the source of dataset, experimental design, and experimental results; the fourth part is the discussion and summary, which mainly discusses and summarizes the innovativeness, practicability, limitations, and future research direction of the proposed method in this study.

2. A Method for Instructing Traditional Chinese Medicine Based on VisualGLM-6B Fine-Tuning Training

2.1 Challenges of Traditional Chinese Medicine Research Methods

Traditional Chinese medicine research is an ancient Chinese medical tradition with a long history. Although the methods of traditional Chinese medicine research appeared to be very advanced and effective for a long time, however, with the development of science and technology, many problems have been exposed[8].

The quality of Chinese herbal medicines is one of the prerequisites for the formulation of prescriptions and the study of the composition of Chinese medicines. Chinese herbal medicines are extremely difficult to store and preserve due to their wide range of sources, complex morphology and high physiological activity. During the storage of traditional Chinese herbal medicines, the chemical composition and physiological activity of Chinese herbal medicines may change due to environmental changes, insect pests, and air pollution, thus affecting the results of the composition and efficacy of the Chinese herbal medicines under study. For example: Astragalus is one of the important traditional Chinese medicinal herbs in China, which has a variety of effects such as tonifying qi and nourishing blood, anti-fatigue and anti-cancer. However, since Astragalus belongs to the common raw herbs, it is susceptible to erosion by factors such as insect pests and molds due to environmental changes during harvesting, transportation and storage, and the effective drug components in Astragalus will undergo obvious changes.

Traditional Chinese medicine often employs the therapy of Chinese medicine compounding, whereby Chinese medicines with different efficacies are used in combination to achieve synergistic effects and improve therapeutic efficacy. However, there are some problems in the practical application of Chinese medicine compounding, such as the source of herbs and the proportion of compounding, etc. If the compounding is not done correctly, it is likely to have serious effects on the composition and efficacy of the Chinese medicines, and may even produce toxic side effects. For example, Chinese wolfberry plus Chinese herbal medicine in excess. Excessive amounts of Chinese herbal medicine can lead to poisoning, while goji berries grow in an air-dried environment and are more likely to absorb mold.

In traditional Chinese medicine research, the most common way to observe the efficacy of herbal medicines is through the extraction of the prevalent compounds of the herbs and the study of their constituents. However, there are many challenges in the extraction process. Firstly, different extraction methods and conditions for different herbs can cause differences in the herbal constituents of similar herbs. Secondly, using traditional manual extraction exists work is easily affected by human factors, the extraction effect is easy to fluctuate, and the extraction is also easy to mix other substances, which affects the extraction effect.

Quality control is also a particularly important issue in Chinese medicine research. Because Chinese medicines are affected by many external factors throughout the entire process from harvesting to incorporation into the medicine, each process must be considered in conjunction with the other in quality control. Specifically, the evaluation criteria for the quality of Chinese medicines need to take into account a variety of factors such as their source, picking location, depth of picking, and hygienic conditions. However, in traditional Chinese medicine research, the quality control procedure is relatively single, and it is easy to ignore the influence of each of these factors, resulting in a decline in the quality of the drug.

With the progress of science and technology, traditional Chinese medicine research is facing many problems and challenges. In today's modern Chinese medicine research, it is necessary to take

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into account the actual situation and adopt new technologies and research methods in order to improve the efficiency of Chinese medicine research, ensure the quality control of Chinese medicines, and promote the process of modernization of Chinese medicines.

2.2 Principles of Deep Learning Techniques

Deep learning is a machine learning approach to training and prediction of complex nonlinear models through multilayer neural networks[9]. Its core idea is to learn feature extraction and representation of input data by combining and connecting multiple layers of neurons to achieve modeling and prediction of complex patterns and relationships.

The advantage of deep learning technology is that it automatically learns features and patterns from data, eliminating the need to manually engineer features. This has led to the great success of deep learning in areas such as computer vision, natural language processing, and speech recognition[10]. Compared to traditional machine learning methods, deep learning has higher prediction accuracy and robustness[11]. However, deep learning also has some challenges and limitations. First, deep learning models usually require a large amount of training data and computational resources to achieve better performance. Second, the training process of deep learning models is more complex, and it is easy to fall into local optimal solutions and overfitting problems. In addition, deep learning models are poorly interpreted, making it difficult to understand and explain the model's decision-making process.

To overcome these challenges, researchers are continuously proposing new deep learning algorithms and techniques. For example, model compression and acceleration techniques can reduce the computational and storage overhead of deep learning models and improve the efficiency and utility of the models. Cross-modal learning techniques can fuse and integrate different types of data to improve the predictive and generalization capabilities of deep learning.

2.3 Deep Learning Technology for the Development of Traditional Chinese Medicine

Deep learning is of great help in the development of traditional Chinese medicine, mainly in the following two aspects. First, deep learning can improve the quality control and research and development efficiency of traditional Chinese medicine, thus accelerating the modernization of traditional Chinese medicine. Traditional quality control and research and development of traditional Chinese medicine often require a lot of manpower and time, and the results are not satisfactory. Deep learning technology, on the other hand, can analyze a large amount of traditional Chinese medicine data to quickly discover the active ingredients, efficacy, side effects and other relevant information of traditional Chinese medicine, avoiding the inefficiency and time-consuming traditional experimental methods. At the same time, deep learning can also improve the accuracy and safety of traditional Chinese medicine, making it more able to meet the needs and health standards of modern people. Second, the combination of deep learning and TCM medicine can better guide clinical practice. Deep learning technology can tap into the mechanism of action of traditional Chinese medicine in the human body with faster speed and higher accuracy, and play an important role in disease prevention, treatment and rehabilitation. At the same time, it can also discover the association between TCM and diseases by analyzing a large amount of clinical data in medical databases, provide more accurate medical guidance, and provide a more scientific basis for the application of TCM in clinical practice.

2.4 Role of the VisualGLM-6B Model for TCM Development

First of all, VisualGLM-6B model is a neural network model based on deep learning, which is able to automatically recognize and extract the features of traditional Chinese medicine through large-scale training data, so as to classify, predict and medically guide traditional Chinese medicine. This model can avoid some human errors and biases generated by errors in traditional experimental research, and has higher accuracy and reliability.

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Secondly, VisualGLM-6B model is highly interpretable. It not only outputs classification results, but also explains the features, laws and reasons behind each classification result, enabling doctors and patients to better understand the medical effects of TCM and provide more scientific medical guidance.

Finally, the VisualGLM-6B model has good expandability. If you want to study the effect of a Chinese herbal medicine on reducing the symptoms of diabetes mellitus. In traditional methods, we need to conduct a large number of literature research and expert interviews to obtain relevant information about the herbal medicine. However, such research methods are time-consuming and laborious, and are susceptible to subjective factors. By using the method based on VisualGLM-6B, we can get more comprehensive and accurate information by inputting the name and description of Chinese herbal medicine, including its chemical composition, pharmacological effect, dosage guidance and so on. This information can provide doctors and patients with more scientific and personalized choice of Chinese herbal medicine and usage guidance, so as to improve the efficacy and reduce side effects. In addition, the fine-tuning training method based on VisualGLM-6B can help researchers more quickly discover the active ingredients that may be present in Chinese herbs, thus revealing their mechanisms for treating diseases. The mechanism information is of great significance for the further development and optimization of Chinese herbal medicine. The model can also be quickly adapted to provide scientific medical guidance in the case of the emergence of new viruses, new diseases, and so on.

3. Experimental Methodology and Analysis of Results

3.1 Datasets

With the help of publicly available data as well as Chatgpt[12], a multimodal dataset of Chinese-Medicine-Guidance-Report pairs of Chinese medicines was created. The dataset for this experiment was derived from the Chinese-Medicine-163 dataset, which includes 10 types of Chinese medicines with 16,200 photos. As shown in Figure 1. This picture shows the proportion of different types of traditional Chinese medicine. Each category of Chinese medicine has 1620 images each, and the number of photos are all equal. As shown in Table 1. The pictures all are 299 × 299-pixel images in jpg format.

Table 1 Type and number of dataset

serial number	Chinese Medicine English name	Number of pictures
1	donkey-hide gelatin	1620
2	folium artemisiae argyi	1620
3	Morinda officinalis	1620
4	white hyacinth Bean	1620
5	Oldenlandia diffusa	1620
6	white cardamom	1620
7	radix paeoniae alba	1620
8	biota seed	1620
9	Amomum tsao-ko	1620
10	worm grass	1620

In order to achieve the goal of VisualGLM-6B fine-tuning training on the feasibility and effectiveness of Chinese herbal medicine, this experiment adopts a specific data format, namely the form of a question and answer, in order to better understand the properties and application of Chinese herbal medicine. In the training data, each question revolves around a variety of Chinese medicines, designed to answer questions about their name, efficacy and dosage. The next example is the data set format of the picture-report pair. Each image has a corresponding prompt and label. For example, for a class of donkey-hide gelatin Chinese medicine pictures, the prompt is "What is

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the effect of this traditional Chinese medicine"? The corresponding label is "nourishing blood, tonifying the kidney and nourishing yin, nourishing the face and beauty, moistening the lungs and relieving cough, regulating menstruation". The design of this dataset allows us to provide targeted answers based on different categories of TCM. Through this method, we can better understand the characteristics and efficacy of traditional Chinese medicine, and then provide more accurate and specific guidance for medical practitioners.

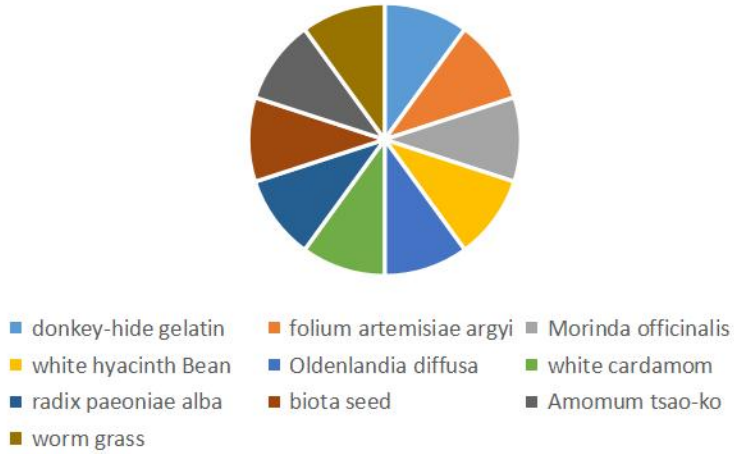

Fig. 1 Dataset class ratio and its percentage

3.2 VisualGLM-6B Methodology

VisualGLM-6B is designed based on the idea of Visual Turing Machine (Visual Turing Machine), which is mainly composed of three parts: encoder, decoder and controller. Its main principle is to simulate the visual attention and memory mechanism of human beings in processing image tasks.

In VisualGLM-6B, the input image is decomposed into multiple parts and encoded. The model then applies different attentional weights on each part to enable the model to focus on important

visual features while ignoring unimportant information. Next, the model uses the encoded information to reason about the answer and generate a new image on the image that is similar to the original image. Finally, the model feeds back into the controller based on the new image, updating the parameters of the encoder and decoder based on the feedback to improve the accuracy and reasoning of the model.

VisualGLM-6B employs a deep learning approach, using the structure of Convolutional Neural Network (CNN) in the encoding and decoding process, while combining it with Recurrent Neural Network (RNN) to process the sequence data. In this way, the model can learn more efficient and accurate feature representations with stronger generalization capabilities when processing large amounts of image data.

The deep learning technology applied to the TCM medical guidance method based on VisualGLM-6B fine-tuning training has been used to great advantage in the identification, screening, and evaluation of TCM. The main advantages are described as follows. First, the Chinese medicine guidance method based on VisualGLM-6B fine-tuning training solves the problem of cumbersome traditional Chinese medicine research methods, automates the processing of a large amount of data, and greatly improves the research efficiency. Second, high-precision prediction and retrieval. Deep learning technology has strong learning ability and data processing ability, which can accurately predict and retrieve the associated Chinese medicine information through a large amount of data. Third, structured data presentation. Deep learning technology can structure the data well, making the information of traditional Chinese medicine more clear and intuitive.

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3.3 Experimental Process

This experiment was conducted by renting a GPU cloud server through Featurize (https://featurize.cn/), a deep learning cloud platform, and fine-tuning the model on the TCM dataset. The hardware environment is Intel(R) Celeron(R) N4100 CPU @1.10GHz, NVIDIA GeForce RTX 3090. The software environment is Windows 11, Docker 20.10.10, CUDA 11.2, Python 3.7, PyTorch 1.10.

The following steps are required for the TCM medical guidance method based on VisualGLM-6B fine-tuning training. First, it is necessary to determine that the goal of the experiment is to medically instruct traditional Chinese medicine using VisualGLM-6B fine-tuning training. Before conducting the experiment collect a certain amount of data on Chinese medicines to ensure model accuracy and obtain pictures and information of Chinese medicines. It was determined that the attributes to be collected include the name of the herbal medicine, dosage range, efficacy and so on. Also pre-process the images such as resizing, cropping, etc. At the same time, the collected attributes are labeled, and the categories of Chinese medicines are set as labels. Second, the VisualGLM-6B model is built using the existing deep learning framework PyTorch. Third, the processed data is partitioned into a training set and a validation set. The training set is used for model training and the validation set is used for model validation. The model was fine-tuned by VisualGLM-6B to extract the TCM category features in order to allow the model to recognize different TCM attributes and make predictions in specific medical practices. Finally, once the model validation is completed, the model can be applied in TCM medical guidance. In the application process, it is necessary to input the information related to the Chinese medicine, and the model will retrieve the Chinese medicine associated with the information based on the input, providing medicinal methods and medication suggestions.

3.4 Experimental Results

In this study, we successfully realized the application of medical guidance for herbal medicine based on VisualGLM-6B fine-tuning training. As shown in Figure 2. From this diagram, you can see that some questions were asked of the application and some answers were received, which correspond to the answers. This research is based on the popular image classification model VisualGLM-6B, through fine-tuning training to adapt to the characteristics of Chinese herbal medicine, so as to achieve the classification and recognition of Chinese herbal medicine.

In addition, by analyzing the training process of the model, we found that our model can achieve better performance on both the training and validation sets while maintaining a good generalization performance. After using 3000 epochs for fine-tuning training, the loss of our model on the validation set gradually decreases and finally converges to 0.562. As shown in Figure 3. It can also be found that in later fine-tuning training, the loss curve drops slowly, but after 2500 epochs, the error is around 0.5. This shows that the experimental model has reached a relatively stable state, and has good performance and reliability.

The experiment proves that the method based on VisualGLM-6B fine-tuning training can be used as an effective tool for medical guidance of Chinese herbal medicine. The results of this study are expected to provide an efficient, accurate and convenient solution for the classification and identification of Chinese herbal medicine, thereby promoting the further development of Chinese herbal medicine research.

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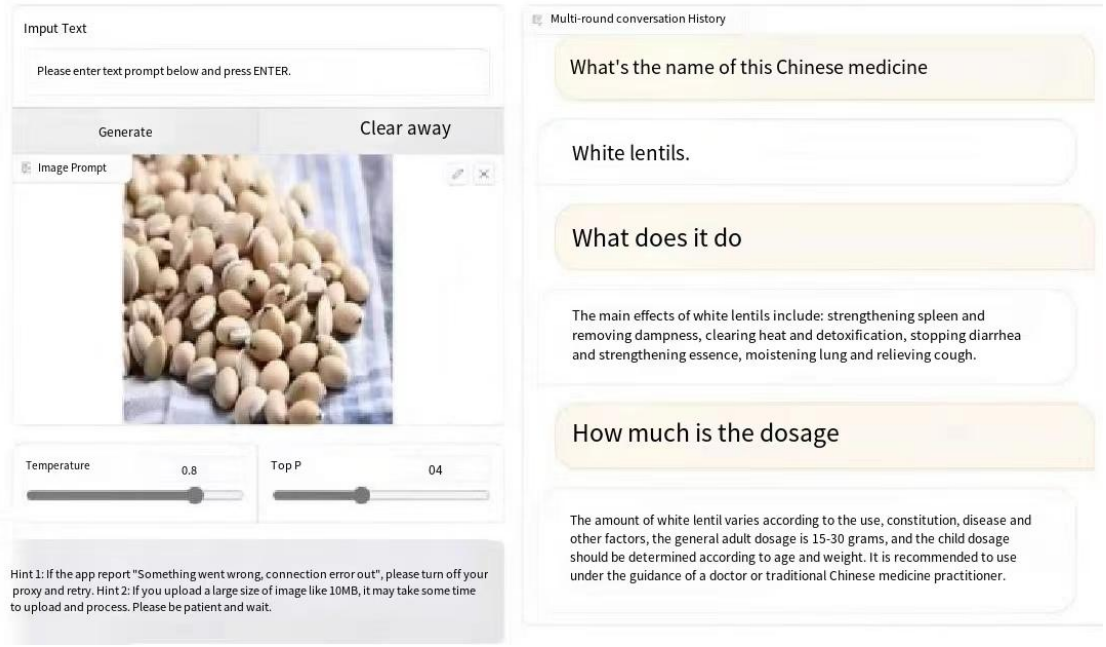

Fig. 2 Application Demonstration

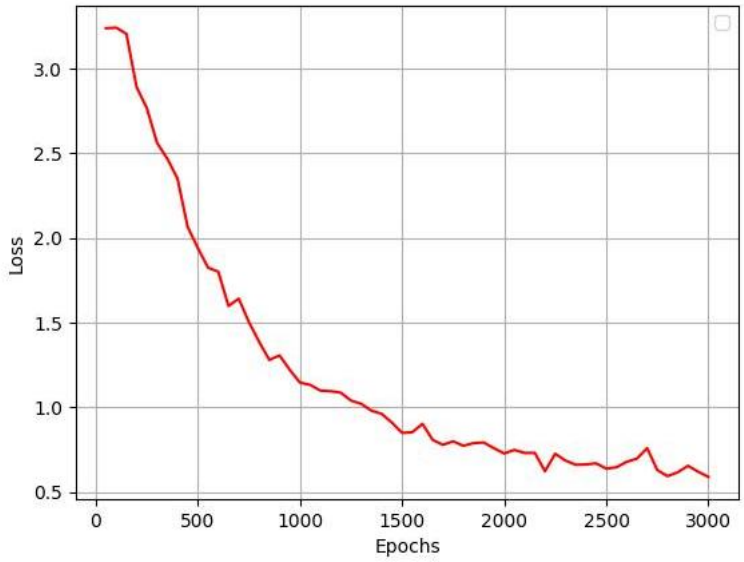

Fig. 3 Variation of loss with epoch

4. Discussion and Conclusions

4.1 Discussion

The study of medical guidance of Chinese herbal medicines based on VisualGLM-6B fine-tuning training provides new methods and tools for the clinical application of Chinese herbal medicines. Through fine-tuning the model, the classification and attribute prediction of traditional Chinese medicine can be more accurate, so as to provide doctors with more comprehensive and accurate recommendations for the selection of traditional Chinese medicine. However, further discussion and reflection on this approach is also needed

First, there are some challenges and limitations that need to be considered for the application of the fine-tuned VisualGLM-6B model in TCM medical guidance. Although the fine-tuned model showed good performance in the experiments, there are still some errors and uncertainties. This may be due to the limitation of the dataset, the subjectivity of labeling, and the limitations of the model. Therefore, in practical applications, we need to interpret and use the results of the model

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with caution and make comprehensive judgments by combining clinical experience and professional knowledge.

Second, the medical guidance of Chinese medicines is a complex field involving multiple aspects of Chinese medicines, such as efficacy, pharmacological properties, and side effects. Although the fine-tuned model showed good performance on the attribute prediction and similarity calculation tasks, further research is needed to refine the model's understanding and prediction ability for these aspects. In addition, more datasets and annotations are needed to support the training and validation of the model to improve its accuracy and reliability.

In addition, medical guidance for TCM needs to take into account factors such as individual differences and disease characteristics. Each patient's situation is unique, so factors such as individual differences, disease characteristics, and therapeutic goals need to be taken into account when selecting herbal medicines for patients. The fine-tuned VisualGLM-6B model can provide reference and assistance to doctors, but the final decision should also be based on doctors' professional judgment and patients' specific conditions.

Finally, medical guidance of TCM is a constantly developing and evolving field. With the advancement of science and technology and the deepening of medical research, our knowledge and understanding of TCM will continue to improve. Therefore, we need to continuously update and improve the methodology based on VisualGLM-6B fine-tuning training to adapt to the latest needs and challenges of medical instruction in Chinese medicine.

In summary, the study of medical guidance of TCM based on VisualGLM-6B fine-tuning training provides new methods and tools for the clinical application of TCM. However, in practical application, we need to recognize the limitations of the method and make comprehensive judgments by combining clinical experience and professional knowledge. Future studies should further refine the performance and application scope of the model and continuously update and improve the method of medical guidance of TCM to better meet clinical needs.

4.2 Conclusion

The VisualGLM-6B model is a powerful natural language processing model with excellent semantic understanding and generation capabilities. By fine-tuning the training of this model, we are able to apply it to the field of medical instruction of traditional Chinese medicine.

Secondly, traditional Chinese medicine has a wide range of applications in traditional medicine, but due to its complex composition and mechanism of action, it requires high accuracy and reliability for medical guidance. By using the VisualGLM-6B model, we are able to utilize its deep learning algorithms and large-scale corpus to comprehensively analyze and understand traditional Chinese medicine, thus providing more accurate and reliable medical guidance.

In addition, by fine-tuning the training, we can personalize and optimize the VisualGLM-6B model according to specific medical needs and background knowledge to better adapt it to the task of medical guidance on TCM. This personalized optimization can improve the predictive accuracy and usefulness of the model, thus better meeting the needs of medical professionals and patients.

Finally, the fine-tuning training based on VisualGLM-6B is of great practical significance for medical guidance of traditional Chinese medicine. It can help medical professionals better understand the efficacy, side effects, and indications of TCM so that they can apply TCM more scientifically for treatment. At the same time, it can also provide patients with more accurate suggestions for the selection and use of Chinese medicines, and improve the treatment effect and patient satisfaction.

In summary, the fine-tuning training based on VisualGLM-6B for medical guidance of traditional Chinese medicine is a promising research direction with a broad application prospect. Future research can further optimize the performance of the model and extend its application scope to better meet the needs for medical guidance of Chinese medicine in the medical field.

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