Application of Deep Learning Algorithm in Cervical Cancer MRI Image Segmentation Based on Wireless Sensor

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Abstract

With the development of medical technology in China, new difficulties are gradually emerging in traditional medicine. Cervical cancer MRI image segmentation technology based on wireless network is one of the most famous means. But the traditional technology is not strong enough for information processing and analysis. Manual data processing alone may lead to errors in data processing and so on. Therefore, this research was aimed at the MRI image segmentation technology of cervical cancer based on wireless network, using depth learning algorithm to calculate and analyze. Through this kind of wireless network and the computer algorithm form, the data processing ability can be improved and increase the data processing ability be increased.

Keywords Wireless network · Cervical cancer · MRI image segmentation technology · Degree learning algorithm

Introduction

Cervical cancer has always been a disease affecting the life and health of women in China. Women's life safety has been seriously affected for thousands of years. But with the discovery of science and technology, medical technology has also risen with the progress of science and technology (Cai et al. 2016) [1]. Cervical cancer MRI image segmentation technology based on wireless network is now a new technology for cervical cancer. Through this technology, the patient's condition and the time of onset can be effectively judged, which is of great significance for the treatment of cervical cancer (Gong et al. 2017) [2]. But the traditional segmentation technology of cervical cancer MRI image based on wireless network is not strong enough for data processing. The efficiency of research and analysis is not high. But the calculation of

deep learning algorithm is combined to solve this drawback from the root. Thus, the information processing capability of the technology can be enhanced.

For this research, there are two research focuses, one is wireless network, the other is deep learning algorithm. The research is based on the wireless network, so the research is calculated under the background of wireless network, and the calculation of the algorithm is based on the wireless network (El-Hihi et al. 2016) [3]. So first of all, wireless network and wireless sensor are researched and analyzed, then deep learning algorithm is calculated based on this. And in the context of wireless network, the calculation formula and calculation model of deep learning algorithm are set up. Finally, an application research model of deep learning algorithm for cervical cancer MRI image segmentation based on wireless sensor is established (Gong et al. 2016) [4]. This research enhances the information processing ability of cervical cancer MRI image segmentation technology, and provides a new guarantee for the life and health of women.

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State of the art

The research of wireless network and wireless sensor is very popular abroad. As early as the end of last century, the research of wireless network was gradually rising. This form of wireless network is a form of contact formed through computer networks, first developed in the United States and then

gradually developed into the whole world (Zhu et al. 2017) [5]. The application of wireless network has brought convenience to many fields, especially in computer and medical fields. In addition, the form of deep learning algorithm is also rising at the end of last century (Prahs et al. 2017) [6]. This algorithm can learn some technologies in depth, and can replace human resources to process some data and information and facilitate them (Brzezicki et al. 2017) [7].

China's research on wireless networks and wireless sensors basically started in the early part of this century. Wireless network is popular all over the world. At the same time, wireless network technology has been introduced in China (Anitha et al. 2017) [8]. In the early part of this century, computer technology in China has gradually developed and can be applied to some new technologies and computer algorithms. So deep learning algorithm and other computer algorithms were introduced into China in the same period (Gulshan et al. 2016) [9]. The application of line sensor in cervical cancer MRI image segmentation has been studied long ago. However, few studies have been done on cervical cancer MRI image segmentation using deep learning algorithm. This interdisciplinary technology is difficult to study (Ibragimov et al. 2016) [10].

Methodology

The background of wireless network and wireless network technology

The development of computer technology has brought infinite possibilities for the development of new technologies. Especially the application of wireless communication technology has brought great changes to our life. The application of wireless network can be used not only in communications and other fields. The application in medicine is also very extensive. The application of wireless network can greatly reduce waiting time and treatment time for patients. In addition, there are some technologies such as network appointment registration. The application of these technologies is only the most basic use of wireless network applications. The wireless network studied is a technology aiming at higher requirements. The use of this technology can improve the information processing ability and information transmission ability of cervical cancer MRI image segmentation technology. This is only one aspect of the application of wireless networks in medicine, which is also the focus. Wireless network has become one of the most widely used Internet infrastructure support facilities. However, the current wireless network usually uses the traditional network-oriented routing and the storage of a forwarding mode for data transmission, making the wireless network transmission performance fish to be improved. Compared with traditional routing, opportunistic routing can make full use of the characteristics of broadcast communication in wireless networks. Thus, effectively improve the transmission performance of the network. However, due to the lack of global control information, nodes participating in opportunistic routing cannot know that other nodes have received packets. Therefore, inevitably, different nodes will transmit the same message, thus wasting network resources.

In order to solve this technical problem, the industry has summed up a new message transmission form through a long period of research. That is, first of all, appropriate network coding can be carried out. The problem of too large files can be solved through this form of coding, so as to effectively enhance the speed of information transmission. This form of network coding cannot only improve the speed of information transmission in wireless networks, but also effectively improve the accuracy of information transmission in wireless networks. This research will be carefully analyzed as the optimization point and design center of traditional wireless network. But the wireless network has some shortcomings, although the information transmission speed of wireless network is fast, and the transmission information is more accurate. The data processing ability of wireless network is relatively poor, so it is difficult to calculate and process large scale data. This is the biggest flaw in the wireless network. And the node computing power of the wireless network is limited. However, the research is to combine wireless network with deep learning algorithm for computing research. Wireless network service is responsible for encoding, decoding and information transmission of information. The deep learning algorithm is responsible for data processing and computation, as well as the calculation of network nodes. The two complement each other and establish a new transmission mechanism for wireless network information transmission. In view of the above problems, some solutions are also given. The block code can be used to solve the problem. According to this theory, the optimization of the form of computation can solve the problem of wireless network as stated above. And the calculation of combines the calculation of deep learning algorithm. The computing performance is further improved and the computing power is enhanced.

The empirical rank distribution of transfer matrix is an important parameter in the design of BATS codes. It determines the maximum coding rate that can be achieved by external encoding, and designs an external code which is close to the optimal performance through empirical rank distribution. Before analyzing its function, the definition of empirical rank distribution of transfer matrix is given:

$$\frac{\sum_{j=1}^{n} rk\left(T_j = i\right)}{n} \xrightarrow{P} t_i \tag{1}$$

BATS codes combine the characteristics of fountain codes, and their performance depends directly on whether there is a

good degree distribution. The block generated by sampling an optimal degree distribution can be decoded by linear complexity using the BP algorithm.

Through this study, the accuracy of data transmission will be greatly improved. Opportunistic routing improves the success rate of message transmission as shown in Fig. 1.

Research on deep learning algorithm based on wireless network

The wireless network used is studied and based on previous research experience, the improvement and optimization of wireless network are studied. The wireless network used is calculated by combining the deep learning algorithm. The deep learning algorithm based on wireless network background is also needed to study and optimize.

Before studying the deep learning algorithm, the medical image processing technology is needed to know about. The application of medical imaging technology is very extensive, and has made great contributions to the diagnosis and recognition of tumors and various mental diseases as well as cardiovascular diseases. Medical image generation technology is different, but for data post-processing technology is similar. Deep learning algorithm is one of the most important data processing computer algorithms. This algorithm derives from the computation form of neural network algorithm, but the form of computation is quite different.

The application of medical images is mainly to observe the image of the doctor to judge whether the patient is sick or not. This is the simplest and most widely used form of medical images. The other is positioning and testing. Many times, it is difficult for us to judge where the crux of a patient's lesion is. This requires the analytical ability of medical images. According to the environment of the normal person, the

medical image of the patient is analyzed, and the specific location is found to facilitate the treatment of the doctor. The accuracy of this positioning directly affects the treatment effect of patients, so the data analysis of medical images is very important. Another point is the medical image segmentation task. It is a key task of clinical operation image navigation and image guided tumor radiotherapy. It is a complex medical image analysis task. Classification, detection and segmentation are often integrated, and classification results are finally classified. For the visual classification task of medical images, the classical framework research is carried out in the following Table 1.

For the traditional deep learning algorithm, the moderate optimization research has been carried on. And the optimization study is carried out through the optimization of the following calculation formula.

The encoding process is a mapping from x to h, and nonlinear activation functions are generally used to calculate latent features.
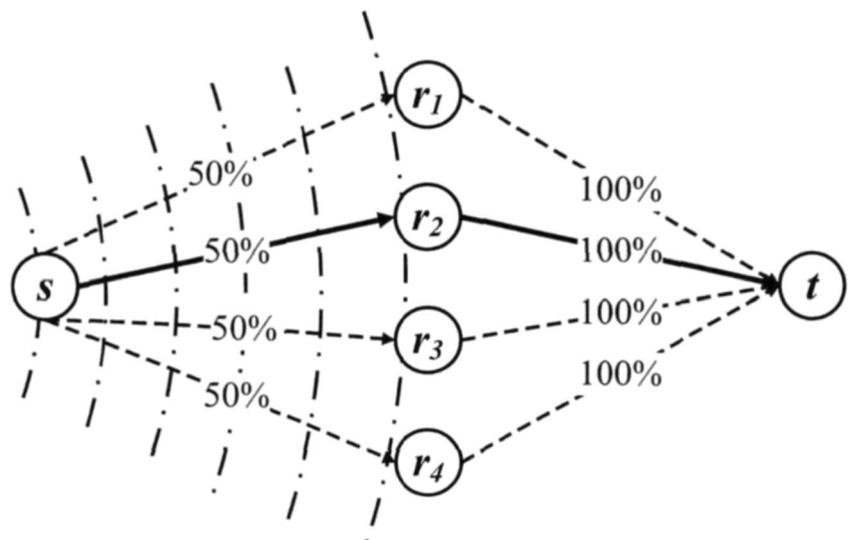
$$h = \sigma\left(W_{x,h}x + b_{x,h}\right) \qquad (2)$$

If the visible and hidden nodes obey the Bernoulli distribution, the energy function of state (v, h) can be defined as:

$$E(v,h) = \sum_{i=1}^{n} \sum_{j=1}^{m} W_{ij}h_i v_j \qquad (3)$$

The joint distribution of the visible node and the hidden node is P (v, h), which can be given by the energy function E (v, h):

$$P(v,h) = \frac{\exp(-E(v,h))}{Z} \qquad (4)$$

Fig. 1 Opportunity routing improves the success rate of message transmission

Table 1   Research on the classic framework of visual classification tasks of medical images

Network structure	Features	Note
Le Net	Multiple convolutional layers and subsampling layers	American handwriting recognition
Alex Net	Presented ReLU and Dropout	Updated the world record for the 2012 ImageNet ILSVRC Object Classification Competition
VGG Net	Proposed to use small convolutional kernels for deeper networks and multi-scale integration	Winner of ILSVRC 2014 Positioning Task Champion, Classification Task
Google Net	22-layer network, multiple Inception structure cascades	Received ILSVRC 2014 classification and testing mission champion
Res Net	A residual network was proposed and a jump connection was introduced, 152 layers deep	2015 ILSVRC Object Detection and Object Recognition Championship

The conditional probability of the model is as follows:

$$p(h_i = 1|v) = \sigma\left(\sum_{j=1}^{m} W_{ij}v_j + b_j\right) \tag{5}$$

$$p(v_j = 1|v) = \sigma\left(\sum_{i=1}^{n} W_{ij}h_i + c_i\right) \tag{6}$$

In recent years, the deep learning method has shown excellent performance in the computer vision task of natural image processing.

In order to more accurately analyze the calculation steps and calculation forms of the deep learning algorithm used. The calculation steps of the depth learning algorithm are also analyzed, as shown in Fig. 2 below.

This research is an application of deep learning algorithm based on wireless sensor in cervical cancer MRI image segmentation technology. In the above, not only the algorithm and wireless network are studied, but also a research model was established.

Fig. 2 Calculation procedure of deep learning algorithm
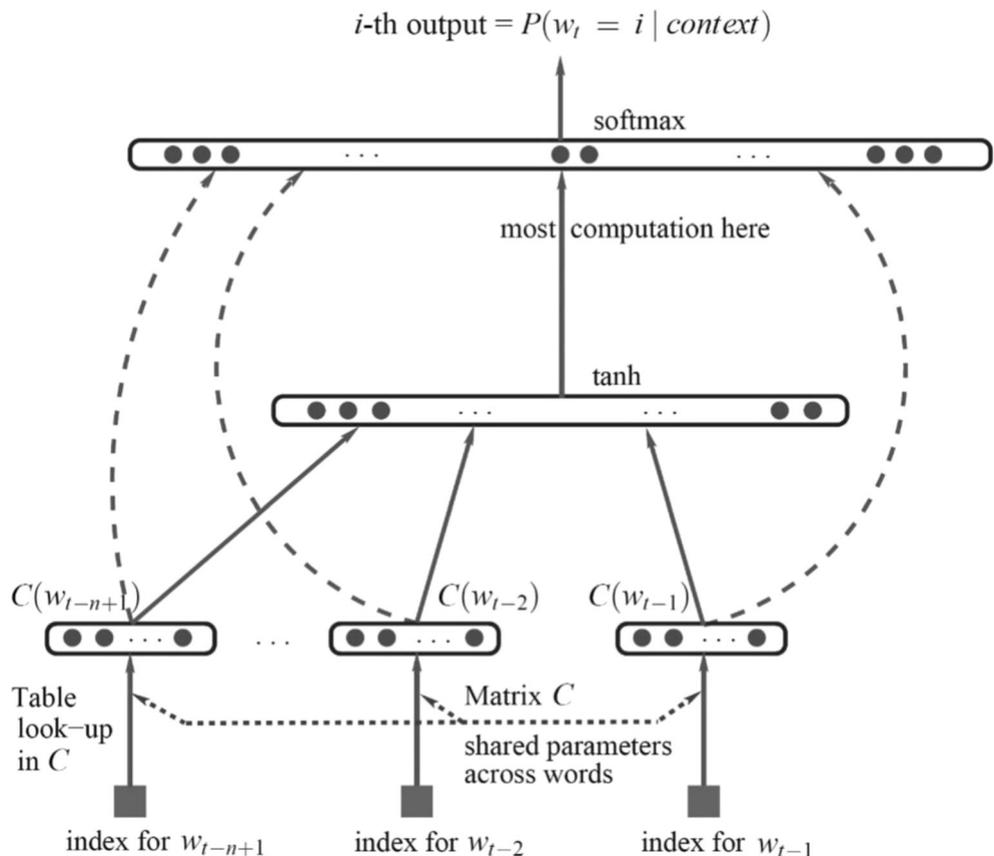
Table 2 Test results analysis table

Groups	Feature	Control group	Test group
Easy to identify groups	CSC features	0.78	0.99
	Traditional features	0.87	0.98
	Fusion features	0.67	0.98
Hard to identify groups	CSC features	0.45	0.99
	Traditional features	0.67	0.99
	Fusion features	0.78	0.99
Very difficult to identify groups	CSC features	0.88	0.99
	Traditional features	0.88	1.0
	Fusion features	0.75	1.0

# Result analysis and discussion

In the above research, we set up a computational model of deep learning algorithm based on wireless network. The optimized deep learning algorithm and the new wireless network technology are adopted. The combination of the two new technologies needs to be tested appropriately before they can be put into use. This is also determined by the content of this article. Calculation of clockwise MRI image segmentation technology for cervical cancer. The accuracy of calculation is related to the safety of human life. The test research must be carried out before it can be put into use. Next, the analysis is started.

The CT images of 11 patients with cervical cancer were used in this experiment. In each patient's CT image sequence, 3 CT images were selected manually.

The computational power of computing results is first tested, and the feasibility of the algorithm is proved by testing. The test is in the form of controlled experiment, and the traditional deep learning algorithm is used as the control group. The wireless network background is used to optimize the deep learning algorithm as the

Fig. 3 Comparison of the test results of two kinds of deep learning algorithm calculation time
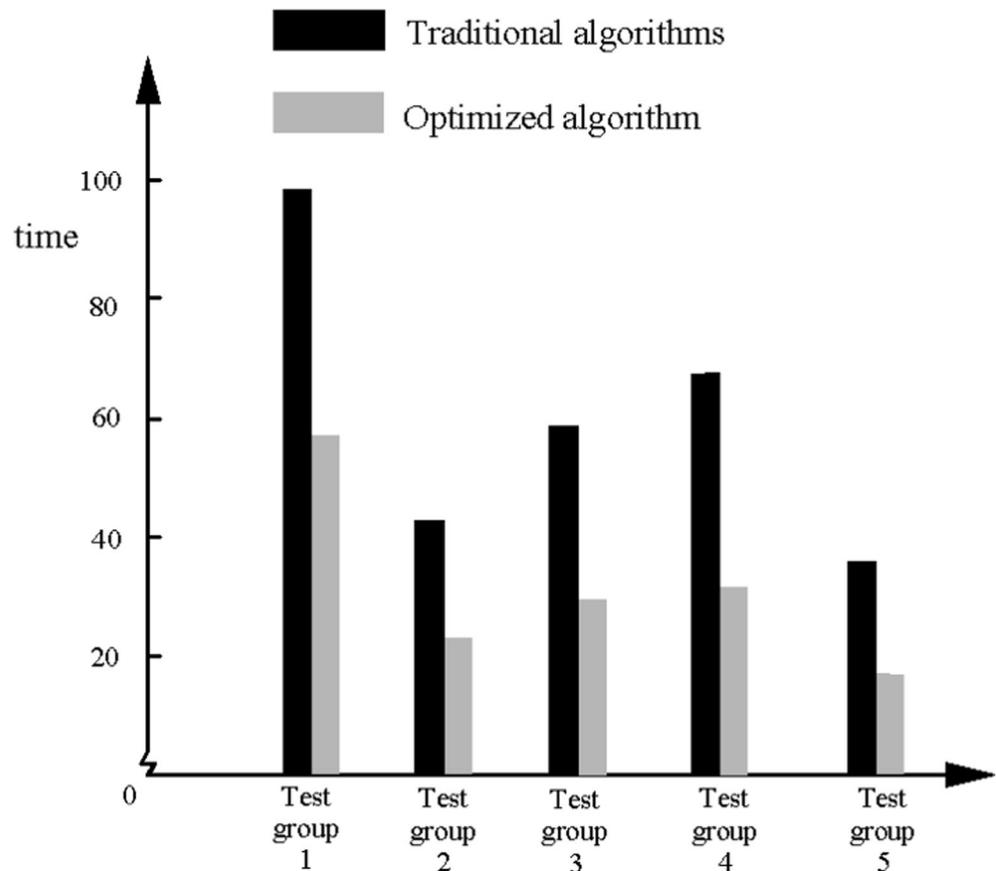
Fig. 4 Discrete situation analysis diagram of optimization algorithm
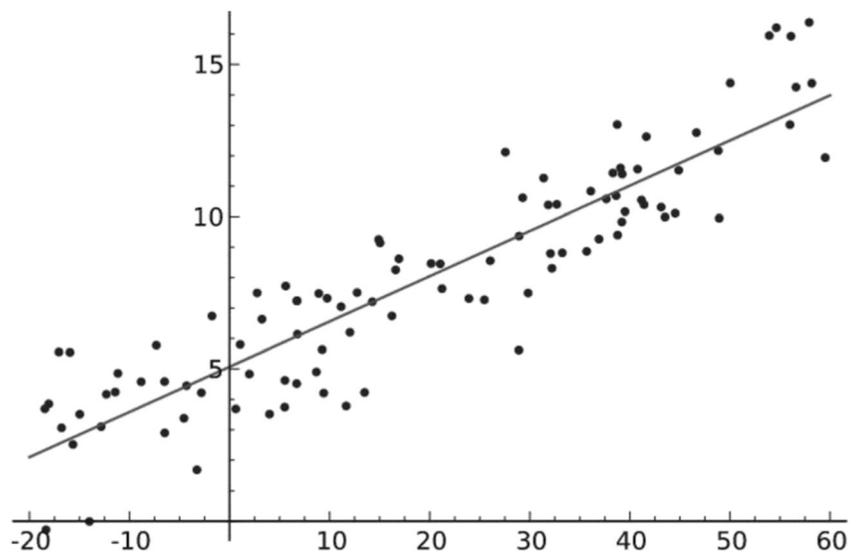
experimental group. The test results are shown in Table 2 as shown below.

It is found through comparison of the test data above. The traditional deep learning algorithm is not ideal in the calculation. The total accuracy is low, and none of the data exceeds 90%. Moreover, even the lowest computation accuracy has been less than 50%. This shows that the traditional deep learning algorithm is not applicable to the calculation. It is difficult to calculate accurately the MRI image segmentation technology of cervical cancer. But after our optimization and the use of wireless network as the background calculation, the accuracy of the algorithm has been improved unprecedentedly, and the accuracy of data processing results is up to 98%. This accuracy is not affected by the difficulty of handling problems. This shows that in the calculation of cervical cancer MRI image segmentation technology, the optimized deep learning algorithm based on wireless network can be competent for computing tasks. And the calculation results are excellent, which can completely meet the application in cervical cancer MRI image segmentation technology.

It is far from the calculation test of deep learning algorithm. The efficiency of the algorithm and the overall calculation accuracy of the algorithm are also tested. This is because the feasibility of the algorithm in the above is only tested. Far from achieving the goal of efficient calculation of accurate results after the optimization of the depth learning algorithm. So, a separate test on the accuracy and efficiency of the algorithm is needed to do.

The first test is the calculation of the efficiency of the test. The computational efficiency of the algorithm is also compared with the form of the contrast experiment. The same five sets of data are tested by two algorithms respectively. The test variables only have different computing algorithms, and the computing environment and calculation data are exactly the

same. The computation efficiency is tested in the form of test time. The test results are shown in Fig. 3 below.

The analysis of the above picture can be seen. By optimizing the algorithm, the computation time of the algorithm has been reduced steadily, and the overall computation time has been reduced by half compared with the traditional depth learning algorithm. This means that the computational efficiency of the whole algorithm is doubled through our optimization.

In addition, the accuracy of the algorithm is tested. For the accuracy test, the discretization of the algorithm results is used for analysis. The test results are shown in Fig. 4 below.

The data shown above show that the discretization of the calculated results of the improved depth learning algorithm is in accordance with the requirements, and the results are in a stable discrete range. The above algorithm tests prove the feasibility of the algorithm after optimization.

Conclusion

With the continuous progress of modern technology and the progress of medical technology, cervical cancer MRI image segmentation technology has been widely understood and used. This has brought hope to the vast majority of cervical cancer patients. But the traditional form of application is difficult to diagnose the patient's condition quickly and accurately. Therefore, this research combines the concept of wireless network and uses the optimized depth learning algorithm to calculate and analyze the data produced by the MRI image segmentation technique of cervical cancer. In addition, the accuracy of the optimized depth learning algorithm is tested. Through optimization, the algorithm fully meets the requirements, and can accurately calculate the calculation results. In addition, the computational efficiency of the algorithm is

tested. The test results show that the efficiency of the algorithm is twice as high as that of the traditional deep learning algorithm. And the discretization of the calculation results also meets the requirements, which achieves the accuracy requirement of our whole calculation. This shows that the data processing ability of cervical cancer MRI image segmentation technology is greatly improved through our optimization. The wireless network and the optimized deep learning algorithm have achieved good results.

Compliance with ethical standards

All the authors of this article are aware of the content.

Conflict of interest   There is no conflict of interest in this article.

Human and animal studies   This article does not cover human participants and/or animal studies.

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