Research on a Convolutional Neural Network Based Digestive Tumor Diagnosis System and Software Supply Chain Design

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Abstract. The research team uses convolutional neural networks to recognize images of gastrointestinal endoscopy and classify them according to their pathological prediction types. This allows clinical doctors to predict their pathological classification in advance through convolutional neural networks when obtaining images of gastrointestinal endoscopy. The research team conducted supply and demand simulations for this algorithm and studied the design of its e-commerce system using information technology. The team reported on the above results.

Keywords: Computer, Neural network, Biomedical Engineer, Supply Chain, Intelligence.

1. Introduction

Computer Vision refers to the simulation of biological vision using computers and related devices. By processing the collected images and videos, corresponding information can be obtained to achieve object recognition, shape and orientation confirmation, motion judgment, and other functions, in order to adapt to and understand the external environment and control one's own movement. In short, computer vision aims to study how to make machines learn to "see" and is an extension of biological vision on machines. Computer vision integrates multiple disciplines such as computer science and engineering, signal processing, physics, applied mathematics, and statistics, involving multiple technologies such as image processing, pattern recognition, artificial intelligence, and signal processing. Especially with the assistance of deep learning, computer vision technology has made significant breakthroughs in performance, becoming one of the fundamental application technologies of artificial intelligence and a necessary means to achieve automation and intelligence. Computer vision technology is derived from image processing and machine vision technology, but the three are not entirely the same. Image processing is mainly based on the basic characteristics of digital images such as color, shape, size, etc. Machine vision uses machine vision products instead of human eyes to measure and judge target shape information. Computer vision typically involves image processing and additional features such as pattern recognition. Compared to machine vision, which focuses on precise geometric measurement calculations, computer vision focuses on perception and recognition. The model we have implemented this time is a CNN based model for recognizing images under gastrointestinal endoscopy. We report on the details and running results of the model [1-5].

We have proposed more optimization concepts for the parameters and optimization methods of this neural network in the early stage of the model. Through meetings, we hope that more relevant professional teams can cooperate with us [6].

2. Result

Identification task: Classification of gastric fundus gland polyps, proliferative polyps, inflammatory polyps, normal picture, and adenomatous polyps. Use MATLAB to train.

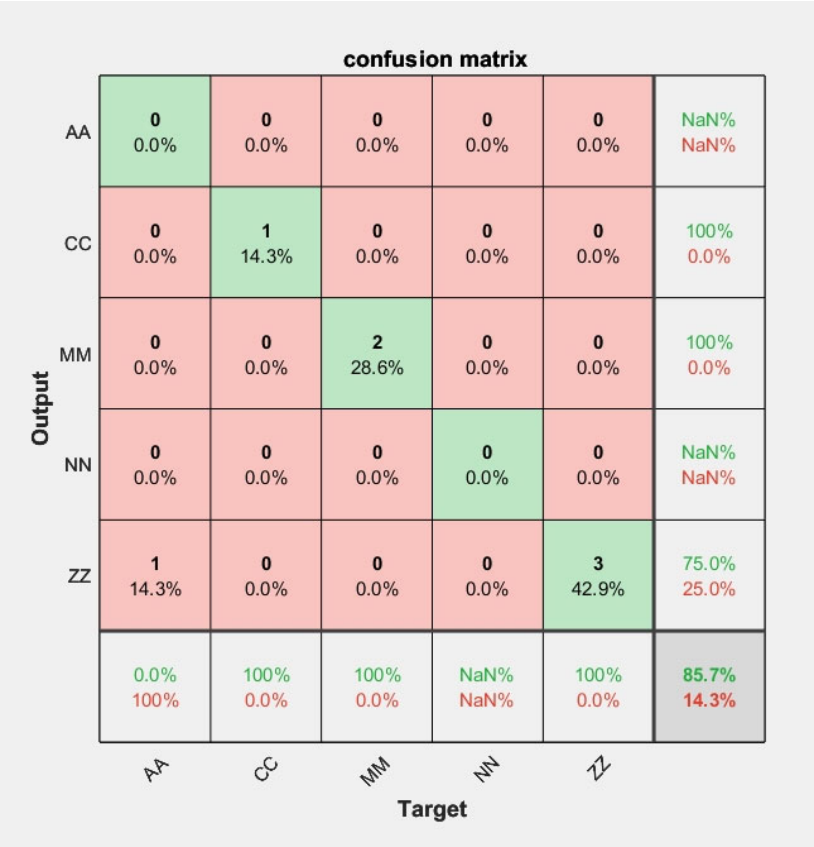


Figure 1. Confusion matrix

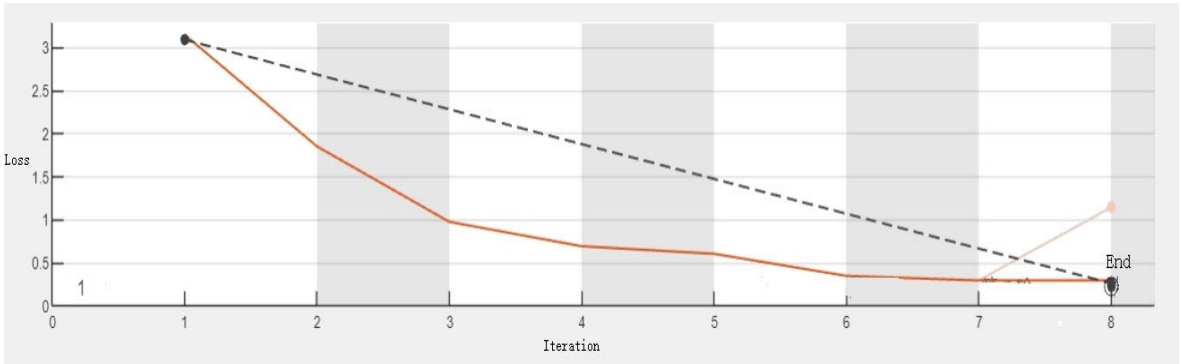


Figure 2. loss function

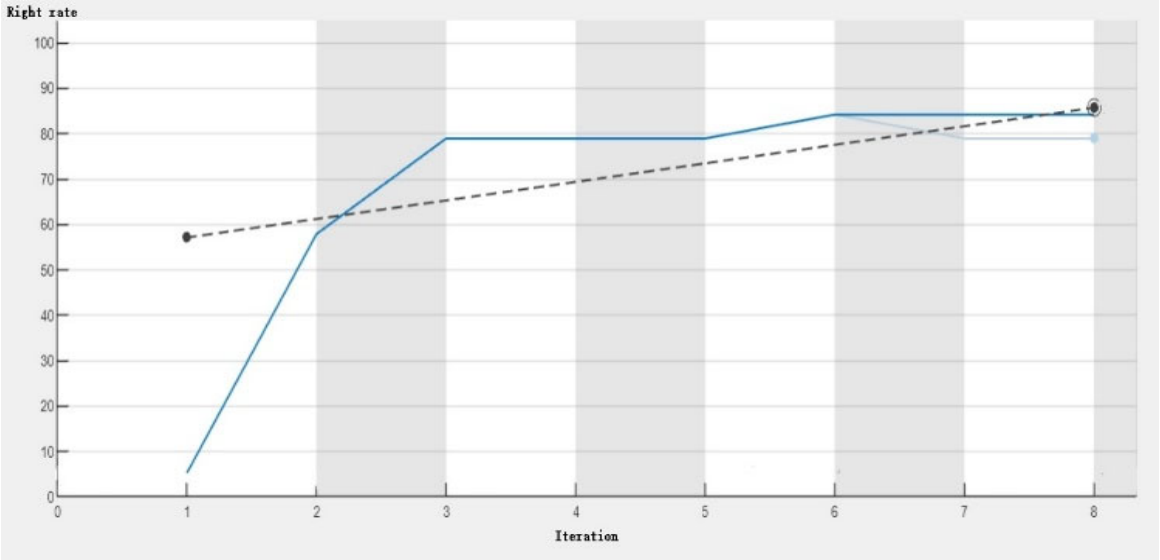


Figure 3. Training process

The five types of confusion matrix represent the order in which we classify them, as mentioned earlier for different input data in the five different orders.

Parameter details of neural networks is as follows

a. Layer 1 (nnet. cnn. layer. ImageInputLayer): output size = [768 768 3]
b. Layer 2 (nnet. cnn. layer. Convolution2DLayer): Output size = [753 753 4]
c. Layer 3 (nnet. cnn.layer. BatchNormalizationLayer): Output size = [753 753 4]
d. Layer 4 (nnet. cnn.layer. ReLULayer): Output size = [753 753 4]
e. Layer 5 (nnet. cnn. layer. MaxPooling2DLayer): Output size = [357 357 4]
f. Layer 6 (nnet. cnn. layer. Convolution2DLayer): Output size = [342 342 8]
g. Layer 7 (nnet. cnn. layer. BatchNormalizationLayer): Output size = [342 342 8]
h. Layer 8 (nnet. cnn. layer. ReLULayer): Output size = [342 342 8]
i. Layer 9 (nnet. cnn. layer. MaxPooling2DLayer): Output size = [152 152 8]
j. Layer 10 (nnet. cnn.l ayer.Convolution2DLayer): Output size = [137 137 16]
k. Layer 11 (nnet. cnn. layer. BatchNormalizationLayer): Output size = [137 137 16]
l. Layer 12 (nnet. cnn. layer. ReLULayer): Output size = [137 137 16]
m. Layer 13 (nnet. cnn. layer. MaxPooling2DLayer): Output size = [49 49 16]
n. Layer 14 (nnet. cnn. layer. FullyConnectedLayer): Output size = [1 1 5]
o. Layer 15 (nnet. cnn. layer. SoftmaxLayer): Output size = [1 1 5]
p. Layer 16 (nnet. cnn. layer. ClassificationOutputLayer): Output size = [1 5]

Right rate: 0.85714

3. Model design

The algorithm program actually has two parts, one is the algorithm program for image processing, and the other is the algorithm program for image recognition. In image processing, considering the large matrix of the image, applying a separate noise comparison method has low processing efficiency and high requirements for hardware facilities. The method proposed in this article is to complete the image segmentation work, decompose the remaining images in the same video, and compare these segmented images horizontally. The number of decomposition parameters can be set based on the accuracy of the images to reduce the operating load of hardware equipment. After processing, compare this image with other graphics in the same video segment, and if it is found that there are still noise points in the processed image, independently complete the noise removal work in the segmented image. In super pixel generation, it is also necessary to complete the programming work according to the designed algorithm to improve the overall performance and quality of the system.

The above working mechanism is shown in detail in Figure 4.

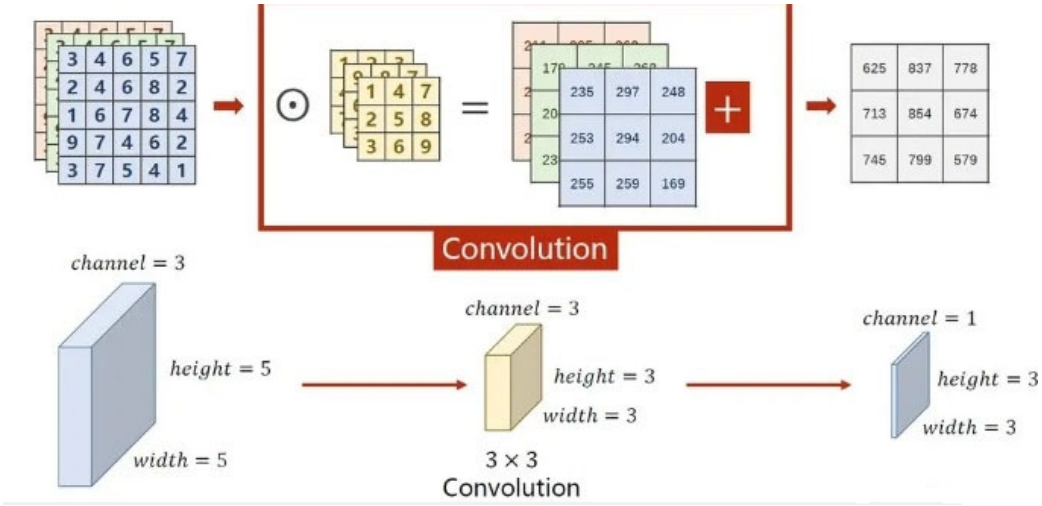


Figure 4. The working principle of convolutional neural networks

Neural network recognition is the process of using neural Convolutional neural networks are a new type of unsupervised learning algorithm that has made significant progress in recent years. Its main idea is to use inter layer node competition to generate hidden functions for processing nonlinear systems. In terms of processing non-stationary signals, its advantages mainly lie in the ability to utilize all hidden layers in the network to maintain a certain relationship between the original data and the newly generated parameters, thereby achieving nonlinear function approximation; Reduce the high requirements of algorithm time and computational complexity for output vectors by using simple and effective methods.

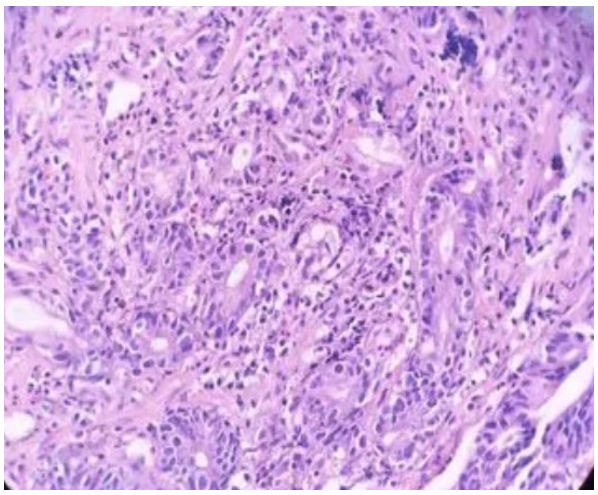


Figure 5. Pathological data as a traceability pathway for gastrointestinal endoscopic images

We believe that the pathological images in this algorithm are only directional and not the ones that need to be recognized at present. Therefore, we trace the data from patients who have already been diagnosed with pathology to their gastrointestinal endoscopy.

However, we chose to process the images under the digestive endoscopy using qupath as the object to be recognized, and use convolutional neural networks to recognize the features of this type of data. The lesion has been delineated using qupath.

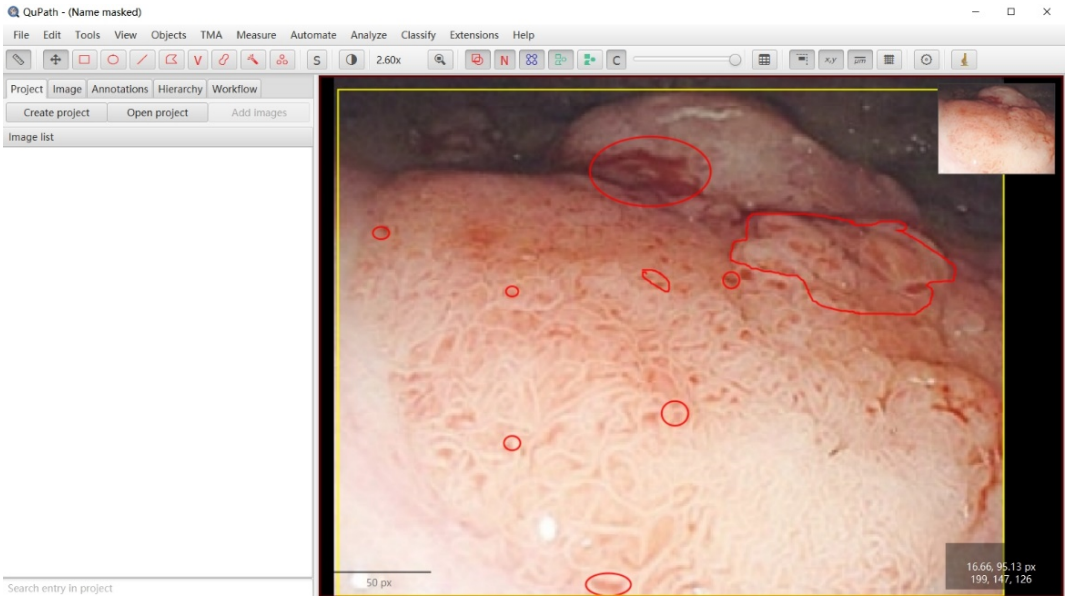


Figure 6. Example of lesion labeling in suspicious areas

We use qupath because of its convenient labeling method, and we do not advocate using this software for cell exploration because we believe it is difficult to observe similar cellular tissues under endoscopy.



Figure 7. Using image segmentation can expand data capacity

We consider adjusting the image format uniformly after image segmentation for analysis, as the initial data volume is relatively low. This can obtain more accurate data when the initial data volume is relatively small.

4. Related computer codes

```
options. solverName = 'sgdm';
options. MaxEpochs = 8;
options. InitialLearnRate = 0.03;
options. Plots = 'training-progress';
options. Validation Frequency = 10;
options. LearnRateSchedule = 'piecewise';
options. LearnRateDropFactor = 0.9;
options. LearnRateDropPeriod = 100;
options. Plots = 'training-progress';
options. Gradient Threshold = 1;
```

The above code is the core parameter for outputting this set of data. Due to hardware issues, we did not attempt more iterations, but the feasibility of this code has been verified.

5. Discussion

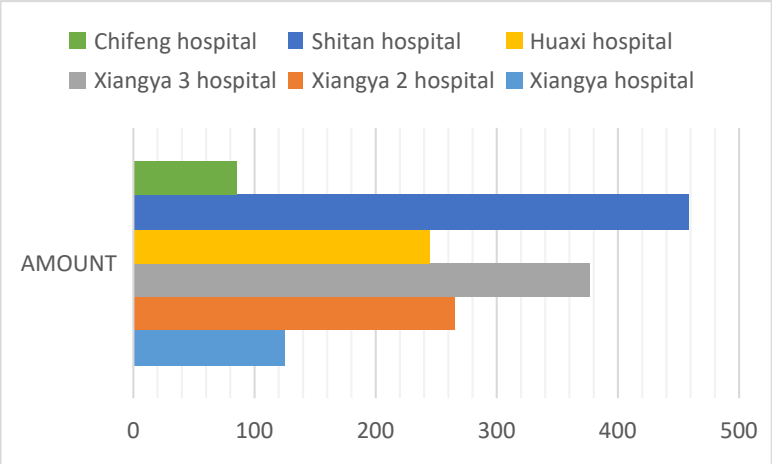


Figure 8. The Data analysis of support chain

As shown in Figure 8, we analyzed and visualized the software requirements at the aforementioned hospital.

We have had discussions on the product supply chain and believe that software product service providers should enhance their awareness of security responsibility, treat security as a fundamental attribute of the product, and strictly control the safety and quality of the product. Strengthen one's own network security construction, enhance the security of one's information system and the ability to respond to attacks from different perspectives such as physical security, network security, and data security. Strictly control the quality of self-developed code, and it is recommended to use software source code security analysis tools that can be integrated into the software development process to continuously detect and fix security defects and vulnerabilities in the software source code. Establish a comprehensive product vulnerability response mechanism, including the collection of product vulnerability information, establishment and maintenance of vulnerability reporting channels, development and release of vulnerability patches, customer side vulnerability emergency response and repair support, etc. Suppliers should also strictly control software upstream service providers, with a particular focus on controlling the use of open-source software. It is recommended to use open-source security governance tools that can be integrated into the software development process, and continuously monitor and reduce the security risks of the open-source software used. Strengthen the collaborative management mechanism of software supply chain security ecosystem. Enhance the unified management capability and technical means for managing software supply chain risks,

including software suppliers at all levels of the software supply chain and various channels. Promote the construction of a secure and reliable software supply chain trusted component resource platform, achieving controllable software supply chain resources. Using professional tools and services to implement code review and defect detection of software products, and strengthening the exploration of new code protection methods and technologies. Enhance the ability of auditing tools for software source code and strengthen in-depth testing of software security; Improve the security detection capability of open-source components by addressing the most difficult vulnerability assessments and verifications in open source. Strengthen the application of artificial intelligence technology in software code vulnerability mining and defect detection.

6. Conclusion

With the continuous development and increasing popularity of computer technology, artificial intelligence technologies represented by machine learning have been widely applied in image processing, speech processing, and natural language understanding. The algorithm we designed can be used to predict pathological classification through images of the digestive tract endoscope, providing a favorable tool for clinical medicine.

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Qin Yi: Leader. Guide all work
Experimental data can be obtained from QIN YI
This experiment has passed the ethical approval of Chifeng Cancer Hospital, with the hospital approval code CNY782
There are no clinical trials in this study.

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