Research on Image Recognition Technology Optimization based on Deep Learning

Li Li

Department of Information Engineering, College of Humanities and Information Changchun University of Technology, Changchun, Jilin, 130000, China

Keywords: Deep Learning, Image Recognition, Optimization and Application

Abstract: Accurate recognition of images has very important research significance. Image recognition technology plays an important role in many fields such as medicine, aerospace, military, industry and agriculture. Most of the current image recognition methods use manual extraction features, which is not only time-consuming and laborious, but also difficult to extract. Deep learning is an unsupervised learning. The label value of the sample can be unknown during the learning process. The whole process can be extracted without manual intervention. feature. In recent years, the use of deep learning for image recognition has become a research hotspot in the field of image recognition. It has achieved good results and has a broad research space. Image recognition technology is an important field of artificial intelligence. Traditional image recognition methods require artificial design features, while deep learning belongs to neural network structure. It can automatically learn features from big data, which greatly improves recognition accuracy and efficiency. Therefore, this paper focuses on image recognition methods based on deep learning, and discusses the basic models and principles of convolutional neural networks and deep belief networks.

1. Introduction

Image recognition is a large area of image processing. For images, there must be different degrees of information association between different regions. For such characteristics, the deep learning model has strong learning ability, which can extract images better. The global feature combines the connections between the units to truly discover and characterize the complex structural features within the problem. An image often contains a wealth of information. The amount of data in an image set is very large. The deep learning algorithm is universally applicable. It can make full use of the advantages of big data, solve problems through learning, and automatically build models based on problems. The more data used for training, the stronger the robustness and generalization ability of the algorithm, and the more accurate the extracted features, which can effectively distinguish different expressions of the same type and achieve global optimality. Moreover, the depth model adjustment is also very convenient. It is only necessary to modify the parameters to change the model, which can meet different input and classification requirements, and has strong flexibility and growth. Therefore, applying a deep learning algorithm to image recognition improves recognition accuracy and efficiency.

Deep learning can be said to be a major breakthrough in the field of artificial intelligence. The most influential breakthrough in deep learning in computer vision occurred in 2012, when Hinton's research team won the ImageNet Image Classification Competition with deep learning. Closely related to advances in image recognition, deep learning techniques are increasingly used in a variety of visual arts tasks. At the same time, major companies such as Baidu, Facebook and Google have successively established deep learning institutes or laboratories to conduct related research. Deep learning has also achieved great success in face recognition. The highest recognition rate achieved in non-deep learning algorithms is 96.33%, while the current deep learning can reach 99.47% recognition rate.

  DOI: 10.25236/mmmce.2019.027

2. Image recognition based on convolutional neural network

The human central nervous system includes billions of neurons. The artificial neural network is an algorithm that simulates the human brain. However, the computer hardware resources are limited. The neural network can only be an Abstract simplified model that simulates the human brain, and the creature. There is still a clear gap in the way the system works. Even so, artificial neural networks still have many characteristics of biological systems, such as robustness, high parallelism, non-linearity, fault tolerance, and good learning ability. Artificial neural networks can learn discrete, continuous or vector form functions from a large number of samples. In many neural network models, backpropagation algorithms are simple in structure, sTable in working state, and widely used. Currently, backpropagation algorithms are widely used in Pattern recognition, classification problems, image processing, and function fitting. The neural network is a directed acyclic network structure, which is formed by layering and interconnecting many perceptrons; including input layer, hidden layer and output layer. The input layer directly accepts the data of the sample, passes through one or more hidden layers, and then propagates forward to the output layer.

3. Image recognition based on deep belief network

In the 1990s, the rapid development of machine learning made it a leader in artificial intelligence, so people often think that artificial intelligence is machine learning. Machine learning, as its name implies, is to let the machine imitate the human brain, learn the statistical rules from a large number of input samples, and then make judgments. Machine learning has gone through the process of learning from shallow to deep learning in the development process. These two models have played a very important role in the development of machine learning. The earliest model of machine learning was the shallow learning structure, which later produced a deep learning structure. The division of machine learning into shallow learning and deep learning is determined by the hierarchical structure of the learning network. The network structure of shallow learning has no deep learning level, and the relationship between the levels is different. Machine learning can be well known and widely used in daily life and industrial production and other fields, thanks in large part to the emergence and rise of artificial neural network back propagation algorithms. Backpropagation began in 1986. Once the method was launched, it immediately attracted wide attention in the world. It was found that backpropagation allows the program to learn statistical rules from a large amount of sample data, thus making a judgment on the test sample. Compared with the traditional manual selection feature, backpropagation is based on statistical laws, eliminating the artificial influence, so it has great advantages. The backpropagation model is actually a 3-layer network structure, including the input layer, the middle layer and the output layer, the middle layer is also called the hidden layer. In the case of back propagation, there is only one hidden layer. It is a structure with few network structure levels. Therefore, the neural network is actually a shallow model. After the backpropagation algorithm model is proposed, more and more people are beginning to study in the shallow learning field, and have proposed various shallow models, such as the well-known support vector machine (SVM). In the 1990s, there were also methods such as Boosting and maximum entropy. SVM and Boosting contain an implicit layer, and the maximum entropy is without hidden layers, so these models belong to shallow learning. The shallow learning model theory is mature and is increasingly used in real life and production. At the same time, the neural network model lacks depth in theory, training time is long, and the parameters rely heavily on experience and skill. Therefore, many people have abandoned the research of artificial neural networks, and the whole neural network field is relatively silent.

4. Real-time face recognition based on convolutional neural network and its application

The earliest David and Torsten worked to study how the mammalian visual nervous system works, so they did an in-depth study of the cat's optic nerve and documented the working phenomenon of a single visual neuron in cats. The primary visual cortical neurons in the system are

most responsive to some light with significant direction and color, but have little response to some light with no significant features, and the deeper the depth of the visual network as the depth of the visual network increases. The number of neurons that respond strongly is less and less, and the information passed into the visual system is greatly reduced compared to an image. Their findings have significantly influenced and inspired the development of modern convolutional neural networks. From the perspective of deep learning, the main purpose is to apply the working principle of the primary visual cortex to the convolutional neural network to achieve bionics, and the images are transmitted to the retina through light. Therefore, the neurons in the retina perform simple processing on the image, and different neurons have different functions, and the light intensity of different colors is different, and then the image information is encoded in the form of pulses through the optic nerve and the visual cortex, and in the brain. Internal manifestation. This process is primarily to transmit visual signals from the eye to the visual cortical area at the back of the head. Therefore, the convolutional network layer is designed to describe the three properties of the primary visual cortex:

The primary visual cortical area is capable of reconstructing a three-dimensional map. It actually has a two-dimensional structure to reflect the image structure in the retina, and different visual neurons have different local receptive fields. For example, light reaching the lower half of the retina affects only half of the primary visual cortex. The convolutional network represents this feature by means of two-dimensional mapping. The primary visual cortex contains many simple cells. The function of these simple cells is to acquire the local receptive field function, which can be described to some extent as a linear function of the image in the local spatial position perception domain. The convolutional neural network simulates the characteristics of such simple cells by defining the size of the local receptive field by using different sizes of convolution kernels. The primary visual cortex also includes many complex cells. The amount of information after complex cell processing is greatly reduced, and for simple cell-extracted features, complex cells can ignore this effect when the feature has a small displacement, and the information obtained is unchanged. This feature corresponds to the pooling operation in the convolutional neural network. These invariants have spurred some cross-channel pooling strategies in convolutional networks, such as the maxout unit. From the above three characteristics, the basic structure diagram of the convolutional neural network can be simulated. The input is a two-dimensional tensor. The convolution kernel feature is extracted to the C1 and C1 layers to obtain the corresponding feature map. The extracted feature map is used as a pool. The operation results in a feature map S2, which is then convolved to obtain a C3 layer. This cycle performs both convolution and pooling operations. Finally, these pixel values are rasterized and concatenated into a vector input to a traditional neural network to get the output. The C1 layer is a feature extraction layer. The convolution kernel is used to slide the effective features on the original image, including some image edges. This reduces the network connection and reduces the amount of intermediate parameter storage, reducing the amount of calculation. In the full connection mode, the median parameter of a 100*100 picture is up to 100 million. If a 5*5 convolution kernel is used to extract features, the connection is thinned; in addition, the convolutional neural network has the feature of weight sharing makes the intermediate parameter further reduced. The so-called weight sharing is to share the local connection weight of one neuron in the hidden layer with the original image to the neurons of other hidden layers. Reduce the computational complexity of training.

5. Conclusion

In the face recognition application, by improving the convolutional neural network, the neurons are changed from ReLU to MFM neurons, and the network structure introduces the NIN network structure, so that the network model can extract compact low-dimensional features, thereby maintaining network accuracy. At the same time, reduce the amount of calculation. The test accuracy is 98.13% on the LFW dataset. In order to apply it to the embedded device, the card computer Raspberry Pi is used, plus the USB camera, the face recognition can run smoothly, with real-time face recognition and offline people. Face recognition and other functions. In general, the

pulsed neural network-based deep learning application proposed in this paper combines the high-precision characteristics of deep learning with the fastness and low-power characteristics of pulsed neural networks, and is applied on the Raspberry Pi, thus making the future Intelligent devices can be more compact, more flexible, and more power efficient, reducing the reliance on cloud computing in the context of big data.

References

[1] Zhang Xueqin, Chen Jiahao, Zhuge Jingjing. Fast Plant Image Recognition Based on Deep Learning [J]. Journal of East China University of Science and Technology, 2018, 44(06): 105-113.

[2] Yin Qilin, Wang Jinwei. A Review of the Application of Deep Learning in the Field of Image Processing [J]. Journal of Higher Education, 2018(9): 72-74.

[3] Liu Han, He Lin, Li Jun. Progress in Deep Learning and Its Application in Image Processing [J]. ZTE Technologies, 2017(4).

[4] Ma Xiaoqing, Sang Qingbing. Handwritten signature recognition algorithm based on LBP and deep learning [J]. Chinese Journal of Quantum Electronics, 2017(1): 23-31.

[5] Sun Yuyang. Review of Deep Learning and Its Research in Image Classification and Recognition [J]. Information Technology and Informatization, 2018.