Research on Application of Deep Learning Algorithm in Image Classification

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Abstract—Image classification is an important research direction in the field of computer vision. Image classification algorithm can distinguish different kinds of pictures by classifying the features extracted from the original pictures. In essence, deep learning is actually the technology of simulating and analyzing the human brain through the construction of deep neural network, or learning and interpreting related data by simulating the human brain. As an important information carrier, image has become an important form for people to acquire and transmit information. For massive images, the number of images that each user really needs is very small, so it is of great significance to find the images that users need within the effective time. Based on this, this paper analyzes the research and application of deep learning in image recognition, hoping to further enhance the application effect of deep learning and make it play a greater role in the field of image recognition.

Keywords—Image classification, Computer vision, Deep learning

I. INTRODUCTION

With the increasing types of image acquisition equipment and the continuous maturity of image processing technology, a large number of images are generated in every field every day, which makes the images exist in a massive form [1]. Image classification is an important research direction in the field of computer vision. Image classification algorithm classifies the features extracted from the original image to achieve the purpose of distinguishing different categories of images. Artificial intelligence is widely used in various fields of society, which not only improves the development level of industry modernization and intelligence, but also brings great convenience to people's life [2]. With the development of Internet technology, a large number of unlabeled image data flow onto the network, and deep learning algorithm can extract abstract feature representation from these unlabeled data by using multi-layer nonlinear transformation for image classification [3]. As a key component of machine learning, deep learning plays an important role in the development of modern artificial intelligence [4]. The application of deep learning greatly improves the accuracy of image classification, and its performance even surpasses that of human beings in some fields [5]. The improvement of the accuracy is based on the huge amount of calculation. With the increase of the number of layers and the number of nodes in each layer, the amount of calculation required by the training network also increases sharply.

In the field of image recognition, deep learning is a very important technical means, which has a broad application prospect, and strengthening the research on image recognition technology plays a vital role in the development of artificial intelligence and computer vision [6]. In essence, deep learning is actually a technology to simulate and analyze the human brain through the construction of deep neural network, or to learn and interpret the relevant data by simulating the human brain [7]. Image recognition is a technology to recognize objects and targets of various patterns after analyzing, understanding and processing related images [8]. Traditional image classification algorithms, such as image classification based on manual marking and key point description, are not only cumbersome and time-consuming, but also greatly affected by human subjective factors, and the classification accuracy is not high. The image classification algorithm based on multi feature fusion and deep learning can get more efficient image classification effect. As an important information carrier, image has become an important form for people to obtain and transmit information. For massive images, the number of images that each user really needs is very small, so it is very important to find the images that users need in the effective time [9]. For complex image semantic features, efficient deep learning algorithm has important research significance for fast and effective extraction and analysis of image semantic information [10]. This paper analyzes the research and application of deep learning in image recognition, hoping to further improve the application effect of deep learning, so that it can play a greater role in the field of image recognition.

II. DEEP LEARNING IN IMAGE RECOGNITION

Deep learning originates from artificial neural network, which is a network structure with multiple hidden layers. It usually uses CNN (Convolutional Neural Network Model) to classify static images. With the further development of social science and technology, scientists' research on artificial neural network has gradually entered a bottleneck period, and back propagation algorithm has been born. Through this technology, artificial neural network can adapt to more complex data calculation, which makes the learning level of artificial neural network gradually deepen. Neurons in the same feature plane can share weights, and the shared weights are convolution kernels. Convolution kernel can obtain reasonable weights through learning during network training, and at the same time, sharing weights can reduce the connections between networks at all levels, thus effectively reducing the fitting risk [11]. In the task of image classification, database plays an important role, especially in today's era dominated by deep learning. The quality of database often directly determines the quality of the trained

Dalian, China
April 14-16, 2021

model to a great extent. Ideally, the pictures in the training set and the test set should be adjusted to a unified posture. However, after carefully observing the database, we find that this is impossible, because the different shooting angles and different picture scales lead to excessive differences in the postures of targets in many pictures. The actual driving process of the motion system is obtained through visual behavior analysis, and a unified visual and behavioral model is formed, as shown in Figure 1.
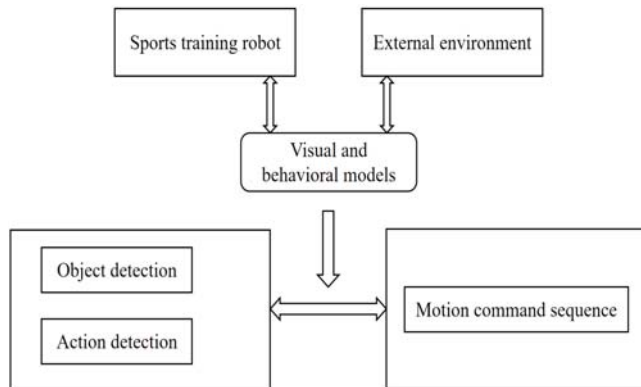

Figure 1 Vision and behavior model

If we want to improve the performance of deep convolutional neural networks, the most intuitive method is to increase the depth and width of deep convolutional neural networks, where depth is the number of layers and width is the number of nodes in each layer. Deep learning emphasizes the depth of network, aims at learning features at different levels, and then highlights the importance of learning, that is, learning high-level features from low-level features. In order to solve complex function problems by solving relatively few parameters, a multi-layer network is constructed, so that the input data takes the sequential action of multiple hidden layers, that is, the output of the previous hidden layer as the input of the next hidden layer, and the feature maps of different levels are obtained [12]. The cooperative training algorithm itself is designed for multi-view data, but later some improved algorithms appeared when dealing with single-view data, some of which use different classification learning algorithms, some use different data sampling methods, and even use different parameter settings to produce significant differences.

The images in the database obtained translation invariance and rotation invariance through the above positioning and rotation operations. According to the traditional image processing theory, these images still lack scale invariance. Each node in the hidden layer is related to a certain extent, and the input in the hidden layer involves the output of the previous period on the hidden layer and the output of the input layer. The generation countermeasure network in the form of deep convolution and the generation countermeasure network in the form of Laplace pyramid realize the combination of unsupervised countermeasure network and supervised learning convolution neural network, thus determining a set of structures that can realize stable training [13]. Bifurcation-based collaborative training method is a commonly used semi-supervised learning method, which can prove that if the view has sufficient conditional independence, the original weak classifier can be upgraded to a strong classifier with higher generalization performance by adding a large number of unlabeled samples

for collaborative training. The image classification method based on convolution neural network simulates the human brain vision system to classify the images through the model structure with convolution layer and downsampling layer alternating in turn. Convolution layer enhances the original signal and improves the signal-to-noise ratio to some extent. At the same time, according to the principle of local correlation of images, the downsampling layer samples images from different fields, extracts useful information and reduces the amount of data.

III. APPLICATION OF DEEP LEARNING IN IMAGE CLASSIFICATION AND RECOGNITION

A. Image Recognition

Image classification involves many technologies, such as image preprocessing, image feature extraction, image category labeling, and image classifier construction, all of which will have a certain impact on the image classification effect. In the process of RBM training, with the increase of training times, the network model gradually converges. When the error increment is getting smaller, it shows that the current learning rate is more appropriate. If the learning rate is blindly increased, the error may increase again, thus causing the network to oscillate. If the deep learning technology can be applied in remote sensing image classification, the classification effect can be effectively improved by constructing the deep learning model reasonably and applying the corresponding optimization algorithm. In the working process of image classification method based on deep learning algorithm, there are many key technologies, among which features and classifiers are the most critical [14]. For large-scale images, the classification effect of support vector machine is low, and it seems a little powerless to classify images accurately. Deep learning algorithm is a new type of machine learning algorithm developed on the basis of traditional neural network, which can learn large-scale data through multi-level network, accelerate the modeling speed, and be widely used in speech recognition, biological information and other fields. In the process of weight updating, inertia factor is introduced, which makes RBM model have strong global search ability with larger inertia weight in the early stage and good local mining ability with smaller weight in the later stage. Figure 2 shows the structure of digital image analysis system.

The attenuation rate of learning rate is adaptively adjusted by the error increment in each iteration, and the error control factor is introduced to control the influence of error increment on learning rate. At the same time, inertia factor is set. In the early stage of the algorithm, large inertia weight is used to have strong global search ability, and in the later stage, small weight is used to have good local mining ability, thus improving the convergence speed and stability of RBM training. In the practical application process, the stacked automatic encoder also operates layer by layer, and each layer has different data processing and expression methods, and the data characteristics caused by these differences will be summarized and analyzed, thus realizing data preprocessing. At the present stage, the importance of ImageNet classification for deep learning is also increasing, and at the same time, a network structure in the form of AlexNet has been formed. Compared with the traditional convolution network, this network structure has many advantages. AlexNet can effectively reduce the

computational complexity, and can effectively obtain the sparse neuron output.
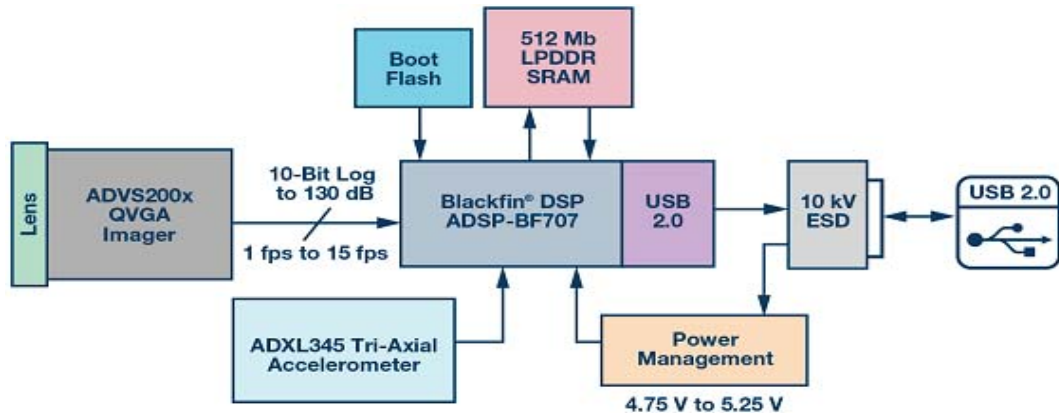

Figure 2 Digital image processing and analysis system structure

B. Image Classification

Global features and local features are the main forms of features in image classification. The global features of an image are structural features, color features and texture features. With the rapid development of modern society, the application scope of image recognition technology has been further expanded, and it has been widely used in the field of transportation. This kind of traffic image recognition technology is used in traffic sign recognition, lane departure warning and license plate recognition, and it also brings a lot of convenience for people's transportation. Color feature is characterized by the color of the image surface. It is a global feature to provide the basis for image classification by histogram method, but it is difficult for image feature to obtain satisfactory local information, so it needs to be combined with other features. Deep learning has also been applied properly in video image analysis, but it is still in its infancy, so it is easy to describe video static images by deep learning, and the related deep learning model can be obtained from ImageNet [15].

The study of extreme speed learning machine with class constraints is a study of distributed expression features. In this case, the data can be mapped to different spaces, and then through feature combination, a feature expression with discriminatory information is formed, that is, a distributed expression. Figure 3 shows the frame of sports detection and tracking system using image error technology.
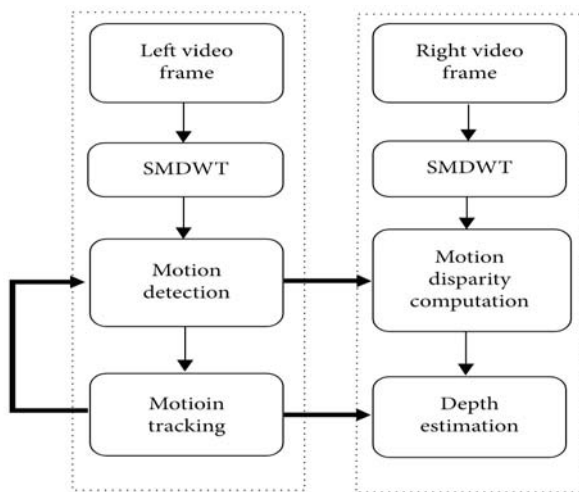

Figure 3 The framework of sports detection and tracking system using image error technology

The accuracy of image classification depends on feature extraction, but the ability of the underlying features to describe images is weak and the classification effect is poor. Therefore, the image is described by multi-feature fusion, and the complementary information and redundant information are eliminated, thus improving the image classification effect. As shown in Figure 4, the image path is determined by motion detection.
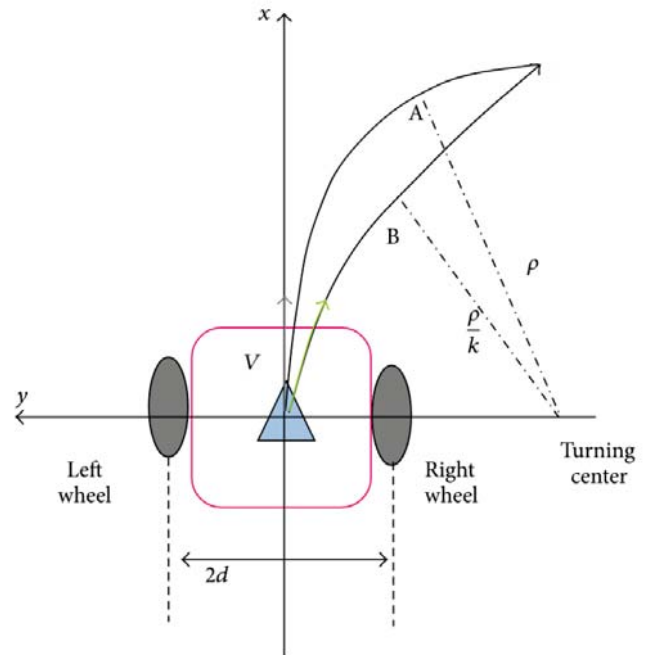

Figure 4 Motion detection to determine the image path

The deep learning algorithm has the highest accuracy in image classification, and the image classification results are very stable, mainly because the generalized regression neural network algorithm can accurately describe the mapping relationship between image classification input feature vectors and image categories, and can distinguish various categories of image classification, thus obtaining the optimal image classification results. In the process of moving image recognition, using deep learning to build a model of moving image recognition can not only improve the efficiency of moving image recognition, but also improve the technical level of sports training. At present, the application of deep learning in the field of image classification and recognition is relatively mature. Therefore,

rock features can be extracted by building a model, and then intelligent classification can be realized, so that the image results are more accurate. Studying the application of deep learning in image recognition can further enhance the research depth of related fields, which has a very positive effect on the effective application of various technologies and the development of related fields.

IV. Conclusions

Studying the application of deep learning in image recognition can further enhance the research depth of related fields, and has a very positive effect on the effective application of various technologies and the development of related fields. This paper mainly summarizes deep learning, analyzes the challenges faced by this technology in the application of image classification, and puts forward some practical application directions. The images in the database obtained translation invariance and rotation invariance through the above positioning and rotation operations. According to the traditional image processing theory, these images still lack scale invariance. In order to solve some problems existing in the current image classification process, such as high misclassification probability, an image classification method based on deep learning algorithm is proposed, and an image classifier is established by introducing generalized regression neural network of deep learning algorithm. The accuracy of image classification depends on feature extraction, but the ability of the underlying features to describe images is weak and the classification effect is poor. Therefore, the image is described by multi-feature fusion, and the complementary information and redundant information are eliminated, thus improving the image classification effect. Studying the application of deep learning in image recognition can further enhance the research depth of related fields, which has a very positive effect on the effective application of various technologies and the development of related fields.

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