IEEE Access
Multidisciplinary | Rapid Review | Open Access Journal

Date of publication xxxx 00, 0000, date of current version xxxx 00, 0000.

Digital Object Identifier 10.1109/ACCESS.2017.Doi Number

Image Recognition Technology Based on Machine Learning

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This work was supported by Key scientific research project of Neijiang Normal University (NO.18ZA06); Natural Science Foundation of Zhejiang Province.

ABSTRACT With the development of machine learning for decades, there are still many problems unsolved, such as image recognition and location detection, image classification, image generation, speech recognition, natural language processing and so on. In the field of deep learning research, the research on image classification has always been the most basic, traditional and urgent research direction. At the same time, computer intelligent image recognition technology is also conducive to gradually better respond to the development of international indicators, and promote the development and progress of various fields. Therefore, image processing technology based on machine learning has been widely used in feature image, classification, segmentation and recognition, and is a hot spot in various fields. However, due to the complexity of video images and the distribution of objects in different application backgrounds, the classification accuracy becomes important and difficult. In the paper transportation industry, image recognition technology is applied to license plate recognition to extract license plate from complex background, segment license plate characters and recognize characters, and construct a machine learning non license plate automatic generation algorithm, which may improve the efficiency of non license plate recognition. The diversity and high generation speed of license plate training sample set can achieve the purpose of effectively training strong classifier. By using genetic algorithm to optimize BP neural network to classify license plate information, the anti-interference ability and license plate recognition accuracy are improved to a certain extent.

INDEX TERMS Artificial Intelligence, Image Preprocessing, Image Recognition, Machine Learning

I. INTRODUCTION

Machine Learning (ML, Machine Learning) [1-5] is a fundamental and critical issue in the field of image processing [6, 7], especially in the field of massive image processing, machine learning methods can be from complex data [8]. The main features of the image are separated [9], so that image recognition can be reasonably applied in various industries and fields. Image processing technology based on machine learning has been widely used in image classification, segmentation, and recognition [10]. It is a hotspot of research and research in various fields. However, due to the complexity of image distribution and different application backgrounds, the improvement of image classification [11-12] has become the focus and difficulty. Therefore, how to improve the classification method to improve the classification accuracy and classification effect of the image of the ground object is a very meaningful and difficult research topic. With the development of machine learning and the introduction and improvement of various machine learning algorithms, machine learning is of great significance to various application fields in human life. Especially with the rapid development of modern technology and the application of video images in various fields of life, machine learning is particularly important for the processing of video images. At present, various machine learning algorithms have been maturely applied to signal processing in engineering, but in video image processing, there is still a broad application space. The application of

This article has been accepted for publication in a future issue of this journal, but has not been fully edited. Content may change prior to final publication. Citation information: DOI 10.1109/ACCESS.2020.3021590, IEEE Access

machine learning to target image classification technology is related to the development of various industries in China. Therefore, the application of machine learning in target image classification has become a very important research topic.

Computer image recognition technology [13-17] is actually the abbreviation of computer image processing and recognition technology, also known as infrared technology. The core of this technology is computers and information. These two technologies are the most developed in the world. The former is the real carrier of technology. It undertakes the analysis and processing of the image, and then carries on the different localization correctly. The object of the information. Infrared technology can be said to be the product of social development and the progress of the times [18]. The image is input into the neural network, and the loss function is minimized by using the forward propagation and back-propagation error algorithms of deep learning. After the weight is updated, a better recognition type is obtained. Then, the trained model is used to predict the new image. The flow chart is shown in Figure 1.2. General pattern recognition system includes three important parts: image preprocessing, feature extraction and classifier. In traditional image recognition algorithm, they are separated from each other. In the framework of convolutional neural network, convolution is used to extract features directly, and then the classification results are fed back to the classifier, and the model is jointly optimized by batch gradient descent. The process of computer preprocessing [19-21] is mainly to separate the image area and background area in the image to be recognized, refine the image, enhance the image binarization, and improve the speed and efficiency of computer intelligent image recognition post-processing. In order to restore the authenticity of the image and reduce the false features of the image as much as possible, the unique features of the image can be expressed in numerical form. With the development and progress of technology, digital image is gradually used in the field of image recognition. The advantages of digital processing technology provide the basis for the further development of image recognition. In these two development stages, infrared technology explored a series of successful methods through the research and application of artificial intelligence [22,23], and finally realized the effective identification of information. Since then, this technology has been widely used. Image recognition is widely used in traffic field. In traffic construction, image recognition technology is mainly used in intelligent transportation system [24]. Vehicle information detection [25-28] has greatly promoted the development of transportation modernization.

Vehicle detection is an important part of the effective operation of the traffic monitoring system, but if you want to better identify and track the vehicles in the traffic network, you need to correctly segment the vehicle and obtain the target area [29]. The same is true for license plate recognition. This method can be carried out well by image recognition technology. This paper identifies the license plate based on the machine learning method, and classifies the sample using BP neural network trained by genetic algorithm [30]. Compared with the genetic algorithm under different fitness, the solution with higher accuracy is obtained.

II. PROPOSED METHOD

A. MACHINE LEARNING

Machine Learning (ML) is a multidisciplinary subject involving many disciplines such as probability theory, statistics, approximation theory, convex analysis, and algorithm complexity theory. Specializing in how computers simulate or implement human learning behaviors to acquire new knowledge or skills and reorganize existing knowledge structures to continuously improve their performance. It is the core of artificial intelligence, and it is the fundamental way to make computers intelligent [31]. Its application spans all fields of artificial intelligence. It mainly uses induction, synthesis rather than deduction.

Simply put, machine learning is a process of extracting useful information from unordered data. It spans multiple disciplines such as computer science, engineering, and statistics and requires multidisciplinary knowledge. In the Internet age, people create and collect a large amount of data. How to extract valuable information from these data is a topic worth studying. Now is also the era of “data is king”, companies are crazy to collect user data, personal information, usage habits, search records, watch records and even email content... hope to find user preferences and tap users’ needs . Who has the data, who has the next opportunity. However, it is not enough to have such data. The massive data has exceeded the feasibility of direct calculation. To extract information efficiently from it, a special learning algorithm is needed. This is the role of machine learning. The “machine learning period” is also divided into three stages. In the 1980s, connectionism was more popular, representing work with Perceptron and Neural Network. In the 1990s, statistical learning methods began to occupy the mainstream stage. The representative methods were Support Vector Machine [32]. In the 21st century, deep neural networks were proposed. Connectionism has never been seen, with the increasing amount of data and computing power. Many AI applications based on Deep Learning have matured.

Machine learning is a general term for a class of algorithms that attempt to mine the implicit rules from a large amount of historical data and use them for prediction or classification. More specifically, machine learning can be seen as looking for a function, and input is sample data. The output is the desired result, but this function is too complicated to be formally expressed. It is important to note that the goal of machine learning is to make the learned functions work well for “new samples,” not just for training samples. The ability of the learned function to apply to a new sample is called generalization capability. In terms of scope,

machine learning is similar to pattern recognition, statistical learning, and data mining [33]. At the same time, the combination of machine learning and processing techniques in other fields forms an interdisciplinary subject such as computer vision, speech recognition, and natural language processing. Therefore, in general, data mining can be equivalent to machine learning. At the same time, what we usually call machine learning applications should be universal, not only limited to structured data, but also to applications such as images and audio.

Machine learning is widely used in many fields. For example, speech recognition is a combination of audio processing technology and machine learning. Speech recognition technology is generally not used alone, and generally incorporates related techniques of natural language processing. The current related applications are Apple's voice assistant siri and so on. In image processing techniques, images are processed into inputs suitable for entry into a machine learning model, and machine learning is responsible for identifying relevant patterns from the images. There are many applications related to computer vision, such as Baidu map, handwritten character recognition, license plate recognition and so on. This field is very promising and is also a hot research direction. With the development of deep learning in the new field of machine learning, the effect of computer image recognition has been greatly promoted, so the future development of computer vision industry is immeasurable [34].

B. ARTIFICIAL INTELLIGENCE

In the process of using computer vision algorithm to simulate human image recognition, researchers have proposed many different image recognition models. Among them, the image recognition algorithm based on template matching is the most widely used. Whether the target image features in the image database are consistent with the target features to be matched is determined by matching the target image with the predicted image. The principle of image recognition technology in artificial intelligence is combined with the algorithm principle of computer processing data, so the simple image data information extraction and analysis can be combined with the computer, but in the case of fuzzy image information or large amount of information in the image, the recognition efficiency is high, and the image recognition technology may be reduced. Therefore, when analyzing the principle of image recognition technology, we also need to find a better and more convenient image recognition technology. Its principle is to change the image recognition technology, make the principle of image recognition technology more simple, and achieve better in function and image processing.

The principle of image recognition technology in artificial intelligence is to use computer to process pictures, and then extract the information in pictures. Through the analysis and experiment of Chinese professionals, the technical principle of image processing technology is obtained. The whole principle is not complicated, that is, the view between people can be regarded as completing an image recognition technology, and then the acquired information is analyzed in the brain according to the impression. The principle of artificial intelligence image recognition technology is the same as that of computer processing data; therefore, simple image data information extraction can be performed by computer, but when the amount of information is large, the recognition rate of image recognition technology will decrease, and relevant personnel are analyzing The principle of image recognition technology should look for more optimized methods for innovation, so as to improve the quality and efficiency of image processing. The image recognition technology in artificial intelligence has the advantages of convenience and intelligence. The advantages of the technology directly determine the application quality and effect of image recognition technology in the development of science and technology. First of all, from the perspective of intelligence, the most obvious advantage of artificial intelligence image recognition technology is intelligence. Compared with traditional image processing technology, it shows a clear difference. This function can realize intelligent selection and recognition when processing pictures, such as the face unlocking function in the mobile phone, which is very similar to the intelligent recognition function in image processing, that is, the face unlocking can be permanently used as long as the face unlocking is completed. Intelligentization not only enables image recognition and other functions, but also enables self-analysis and preservation. Secondly, from the convenience of graphic recognition technology, with the application of image recognition technology, it has created a lot of excellent services for people's life and work. In this technology, people do not need to perform complex image processing to achieve the purpose, such as brushing face punching, brushing face unlocking, etc., which bring convenience to people's lives. With the development of society, image recognition technology has become more and more popular, and it is more convenient to use.

Because the image recognition technology is implemented based on artificial intelligence, the image recognition process of the computer is almost the same as the human brain image recognition process. The biggest difference is that the computer image recognition is displayed in the form of technology. The specific artificial intelligence image recognition process is as follows. First, information data is obtained. Information collection is a prerequisite for image recognition. It mainly converts various special signals into electrical signals through sensors, and then obtains the required information and data from them [35]. However, the information acquired in image recognition technology belongs to the special data of images. The data must be able to distinguish the gaps between the graphics. Second, information data is preprocessed. This stage is mainly to

smooth, transform and other images, in order to highlight the important information of the image itself. Third, feature extraction and selection. This is the key content of image recognition technology, especially in the recognition mode, the actual operation requirements are higher, which also directly determines whether the image can be successfully recognized and whether the extracted features can be stored. Fourth, classifier design and classification decisions. This is the last step of image recognition. This part mainly formulates the recognition rules according to the operation procedure, and recognizes the image according to the standard instead of the chaotic recognition. The purpose is to improve the recognition degree of the image processing, thereby improving the efficiency of image evaluation.

C. IMAGE PREPROCESSING

In the process of image acquisition, it is often subject to various external conditions and random interference. Such directly acquired images often contain complex useless backgrounds or redundant data, which interferes with the further application of images. Therefore, some necessary pre-processing techniques need to be performed on the original data image. Commonly used image processing operations include color image grayscale technology, image enhancement technology, image restoration technology, image segmentation technology, smoothing and sharpness, and the like [36]. In order to facilitate computer processing, reduce the resources occupied by the computer, and increase the speed of the operation, the color image is first grayscaled before digital image processing. Generally, the gray level of the grayscale image is a gray level, and the brightness can be divided into 0 to 255 levels, 0 is the darkest all black, and 255 is the all white. At present, the most mature technology application is the RGB color mode. The digital image represented by the RGB mode has three image components, and the RGB values of three pixels of each pixel respectively reflect the brightness values of the three colors at the pixel. The actual color represented by the pixel is the result of the color superposition of three different brightnesses. Since there are 256 kinds of values for each color, there are more than 16 million (256*256*256) color variations per pixel. However, after conversion to a grayscale image, there are only 256 variations of each pixel, so the amount of computation of the computer can be greatly reduced. The converted grayscale image, like the description of the original color image, still contains the correlation characteristics of the original image's chromaticity and brightness [37].

The purpose of the enhanced technique operation of the image is to enhance the perceived effect of the image, making it more suitable for a specific application [38]. Purposefully highlight certain features of the image, emphasizing the differences between different images to suit specific situations or special requirements. In a broad sense, as long as the structural relationship between the parts of the original image is changed, the purpose is to better the application effect and the judgment result to meet the specific application requirements. This processing technique can be called image enhancement processing. technology. The image enhancement technology can be roughly classified into two categories, a spatial domain method and a frequency domain method, according to different positions of objects processed by the enhancement technique. The spatial domain-based algorithm refers to the gray value of the original pixel directly processed when the image is based on the image's own plane. The frequency domain method is to enhance the image on another transform domain of the image. Histogram equalization is a processing method that enhances the operation of digital images based on probability theory. The histogram, also known as the mass distribution map and histogram, is a statistical graph based on the report. The histogram of a digital image is a distribution of the total number of pixels of different gray values in an image. Through the histogram of an image, we can see the brightness of the grayscale distribution of the pixel of this image. The grayscale value of the histogram of the over-dark image is concentrated at the lower part, the overall over-bright image, its histogram The body of the graph is distributed at a higher gray value. The method of histogram equalization is to transform the histogram of the original image by gradation transformation and to correct the stretching according to a certain rule, and obtain a new histogram image with stable gray value distribution. According to the theory of information theory, when the distribution of gray values of an image is relatively average, the amount of information contained in the image is also large, and the image has a clearer effect from the visual point of the human eye. Median filtering technology, median filtering can not only eliminate the pulse interference noise better, but also effectively reduce the image edge blur while suppressing the pulse interference. It is a nonlinear signal processing technique based on the theory of sorting statistics that can effectively suppress noise. It replaces the value of a point in a digital image or a digital sequence with the median value of each point in a neighborhood of the point, so that the surrounding pixels are gray. A pixel with a large difference in degree value is changed to a value close to the surrounding pixel value, so that an isolated noise point can be eliminated, which is effective for salt and pepper noise. The advantage of the median filter is that it has advantages when filtering out superimposed white noise and long tail superimposed noise, but it is not suitable when there are many details in the image such as points, lines and apex. The improved algorithm has the right to median filtering, the switching median filtering algorithm based on the sorting threshold, and the adaptive median filter.

D. IMAGE RECOGNITION

In a broad sense, image technology is a general term for various image-related technologies. According to the research method and the degree of abstraction, the image

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technology can be divided into three levels, which are divided into: image processing, image analysis and image understanding. The technology intersects with computer vision, pattern recognition and computer graphics, and biology. Mathematics, physics, electronics, computer science and other disciplines learn from each other. In addition, with the development of computer technology, further research on image technology is inseparable from theories of neural networks and artificial intelligence. Image processing includes image compression, image encoding, image segmentation, etc. The purpose of processing the image is to determine whether the image has the required information and filter out the noise, and to determine the information. Common methods include grayscale, binarization, sharpening, denoising, etc.; image recognition is to match the processed image, and the category name is determined. Image recognition can be extracted on the basis of segmentation. The features are filtered, and then these features are extracted and finally identified according to the measurement results. The so-called image understanding refers to the description and interpretation of the image based on the classification and structure analysis based on image processing and image recognition. Therefore, image understanding includes image processing, image recognition, and structural analysis. In the image understanding section, the input is an image and the output is a description of the image.

The development of image recognition has experienced three stages: text recognition, digital image processing and recognition, and target recognition. Usually, when a domain has a requirement that can't be solved by the inherent technology, the corresponding new technology will be produced. The same is true of image recognition technology. The invention of this technology is to let the computer instead of human processing a large number of physical information, and solve the problem of information that can not be recognized or the recognition rate is very low. Computer image recognition technology is the process of simulating human body image recognition. In the process of image recognition, pattern recognition is essential. Pattern recognition is a basic human intelligence. However, with the development of computer and the rise of artificial intelligence, human pattern recognition has been unable to meet the needs of life, so human beings hope to replace or expand part of human brain labor with computers. This way the pattern recognition of the computer is created. Simply put, pattern recognition is the classification of data. It is a science that is closely integrated with mathematics. Most of the ideas used are probability and statistics. Pattern recognition is mainly divided into three types: statistical pattern recognition, syntax pattern recognition, and fuzzy pattern recognition.

Since computer image recognition technology is the same as human image recognition, their processes are similar. Image recognition technology is also divided into the following steps: information acquisition, preprocessing, feature extraction and selection, classifier design and classification decision. The acquisition of information refers to the conversion of information such as light or sound into electrical information through sensors. That is to obtain the basic information of the research object and transform it into information that the machine can recognize by some means. Preprocessing mainly refers to operations such as de-drying, smoothing, and transforming in image processing, thereby enhancing important features of the image. Feature extraction and selection means that in pattern recognition, feature extraction and selection are required. The simple understanding is that the images we study are various. If we need to distinguish them by some method, we must identify them by the characteristics of these images. The process of acquiring these features is feature extraction. Features obtained in feature extraction may not be useful for this recognition. At this time, useful features are extracted, which is the choice of features. Feature extraction and selection is one of the most critical techniques in the image recognition process, so the understanding of this step is the focus of image recognition.

On the basis of in-depth learning, image recognition technology has been able to recognize moving objects. Its main principle is to process and make decisions on blurred image information through intelligent module, and then obtain results with high similarity, and then confirm image information through screening. Classical image recognition model: LeNet is an earlier CNN model (1994). It has three convolution layers (C1, C3, C5), two pooling layers (S2, S4) and one full connection layer (F6). The input image is 32 x 32, and the output image is the probability of 0 to 90 digits. At that time, the error rate of the network model was less than 1%. LeNet was arguably the first commercially valuable CNN model since it was successfully used to identify mail codes. AlexNet is a milestone in the history of CNN development. Compared with LeNet network, AlexNet network is not much improved in structure, but has great advantages in network depth and complexity. AlexNet has the following meanings. It reveals the powerful learning and expressive ability of CNN, which leads to the upsurge of CNN research. (2) GPU is used for calculation, which shortens the time and cost of training. (3) Training techniques such as ReLU activation function, data augmentation and random inactivation were introduced to provide samples for subsequent CNN.

III. EXPERIMENTS

The license plate detection was chosen as the target, the study of the target vehicle image recognition method based on machine learning, test software environment: windows XP, VC ++ 6.0, Matlab7. The test hardware environment is: CPUAMD4400 +, the memory is 2G . The object is to be sorted (3.2.2) H, U, V, W. The training sample comes from two aspects: (1) the set of license plate characters after the division; (2) the license plate characters obtained by the manual screenshot. Due to the particularity of the license

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plate characters, the amount of characters other than numbers is small, and it is unrealistic to find a large number of test samples that match the actual probability distribution. Therefore, some characters are added to the training sample set by manual means for training. 100 All test samples after dividing by the plate image, from the normalized characters. In the process of optimizing the weights and thresholds of neural networks, genetic algorithm firstly encodes all weights and thresholds and then synthesizes a long string in a certain order. In this way, when the network structure has been determined, each chromosome string describes all the parameters of the neural network, including threshold and weight. In order to calculate the fitness of each individual, we assign the individual string to the network parameters (decoding). The network calculates the training input samples, and then returns the sum of squares of errors (fitness) according to the output samples. In genetic algorithm, neural network plays the role of calculating function. Throughout the iteration process, the structure of the neural network, including the number of nodes in the hidden layer, the number of nodes and the connection mode between nodes are fixed and unchanged. This paper chooses: (1) neural network based on genetic algorithm selection, (2) BP neural network, (3) KNN algorithm for comparative experiments. Firstly, according to the formula:

$$h = r + \sqrt{i + o} \tag{1}$$

$$h = r + \sqrt{i \times (o + 1) + 1} \tag{2}$$

Equations 1 and 2 are used to calculate the number of hidden layers, where R is a random number between 1 and 10, I is the dimension of input layer and O is the dimension of output layer. Then, the chromosome generated by genetic algorithm is decoded, and the fitness of the sample in the test set is tested directly. The adaptive genetic algorithm can keep the population diversity and ensure the convergence of the genetic algorithm. However, the template based image matching algorithm requires that the image to be predicted and the template must be completely consistent before it can be recognized effectively. In practical applications, the same image corresponds to complex and changeable feature templates in different environments (illumination, deformation, selection, etc.), which requires that machine learning can not only recognize the image information characteristics completely consistent with the feature template, We also need to be able to effectively identify the images whose feature templates are not completely consistent in different environments. When the group fitness is large, we should choose a smaller cross probability. When the fitness is small, a large cross probability is used to speed up the search. For example, formula 3. Fitness function is an important function (i.e. hypothesis) to evaluate the advantages and disadvantages of chromosomes. The fitness function constructed in this paper is based on the minimum score. Class errors are standard. The algorithm flow is as follows: calculate the fitness of the given hypothesis, input: H chromosome. Output: fitness value D, fitness calculation as formula.

$$P_c = \begin{cases} p_{c1} - \dfrac{(p_{c1} - p_{c2})(f_b - \bar{f})}{(f_m - \bar{f})} & f_b \geq \bar{f} \\ p_{c1} & f_b < \bar{f} \end{cases} \tag{3}$$

$$f = \frac{1}{1 + \delta^2} \tag{4}$$

After initializing the network with chromosome h, the percentage of incorrect classification in the test set. According to this fitness function, each hypothesis can be evaluated and ranked according to its merits and demerits. In further evolution, we can select excellent individuals according to the fitness of each individual and eliminate inferior individuals.

IV. DISCUSSION

The experimental results show that the optimal individual has been optimized by the genetic algorithm of 5000 generations. When it evolved to the 3,000th generation, it basically converges. The fitness curve is shown in Figure1.

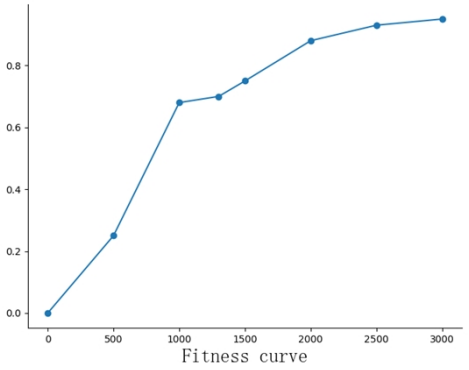

FIGURE 1. Fitness curve

The parameters of the BP neural network are: the learning rate is 0.08, and the impulse is 0.1, which is directly trained using the training sample set. The accuracy of the training set finally obtained after training is 0.9756. KNN does not require training and is an inert classification. Under the assumption that the fitness is Fitness(h1)=0.9543, Fitness(h2)=0.9456, and Fitness(h3)=0.9325, the classification results are shown in Table 1.

TABLE I
CLASSIFICATION RESULT

Classification	Noiseless test	Noisy test	Training time	Recognition time (ms)
h 1	93.41%	86.90%	12H23M	12
h 2	95.82%	85.45%	12H23M	11
h 3	94.01%	73.56%	12H23M	12
BP	92.23%	81.96%	12M	12
KNN	92.67%	88.54%	Null value	46

Among the three hypotheses selected, H1, which performs best in training set, does not perform best in test set. The results show that genetic algorithm can not

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completely solve the over fitting problem of neural network. In the classification experiment, the overall accuracy is high. Due to the problems of character offset, deformation, skew and blur in the acquired image, any text features have spatial distribution. In the case of noise interference, it is difficult to accurately classify with a few simple features. The license plate recognition results show some differences with different degrees of adaptation, 2,3,4.

FIGURE 2. H1 recognition results under fitness

FIGURE 3. H2 recognition results under fitness

FIGURE 4. H3 recognition results under fitness

It can be seen from the recognition result that the recognition accuracy of Fig. 2 is not high, and the target area cannot be accurately captured. The recognition result in Fig. 3 is good, and all the target areas in the image can be captured, and the target area in Fig. 4 identifies the defect. The overall correct rate in the comprehensive classification experiment, when the fitness in this experiment is Fitness(h2)=0.9456, the performance of the recognition image is better. From the observation of recognition rate, we can find that the recognition rate of neural network based on genetic algorithm training is better than that based on traditional method training. In addition, the traditional KNN classification method also shows good results. Although the recognition time increases with the increase of the number of training samples, it has good simplicity and anti-interference. In non-real-time analysis environment, the cross-use of multiple methods can be considered to further improve the recognition rate.

V. CONCLUSIONS

As an important method in the field of artificial intelligence, machine learning has been widely used in traffic identification research in recent years. Because of its intelligence, good generalization and high recognition efficiency, it has gradually become the mainstream of image recognition research. This paper studies the application of image recognition technology based on machine learning in license plate recognition. In order to complete the research of this paper, a lot of research on the current development of license plate recognition research is carried out, and the horizontal and vertical research and research are carried out in the field of recognition. Some basic technologies of license plate recognition are studied, such as image processing, pattern classification, machine learning, artificial intelligence and so on.

In order to complete this experiment, a large amount of target data was collected, but in the field of target recognition, it is very difficult to obtain large-scale effective data. This is also the primary problem that hinders the application of deep learning in the field of image recognition. To this end, it is necessary to find a more effective way to carry out manual data expansion based on the original database, so that deep learning can be effectively applied. Data in life is ubiquitous, but tagged data is not common. Similarly, it is easier to collect data in the field of image recognition, but manually collecting the collected data is a time-consuming and labor-intensive task. To this end, unsupervised learning algorithms are also the focus of research in deep learning, such as generating confrontational network models. In the correction process of the license plate, this paper mainly focuses on the linear information provided by the framed license plate. If the license plate location module provides a license plate without a frame, then a targeted algorithm should be developed. At the same time, in view of the control of the generalization accuracy of the classifier in the license plate character recognition, this paper combines the genetic algorithm with the optimal solution search tool which is better than the exhaustive method to solve the global space of the weight of the neural network. After experimental verification, the three solutions with the

highest fitness are obtained from the genetic algorithm. The generalization effect after decoding to the neural network is relatively good.

ACKNOWLEDGEMENTS

This work was supported by Key scientific research project of Neijiang Normal University (NO.18ZA06); Natural Science Foundation of Zhejiang Province.

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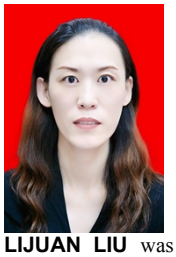

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