Image Extraction Based on Machine Learning and Image Recognition and Analysis Technology

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Abstract. In recent years, with the rapid development of the Internet and mobile Internet, the image data on the Internet has shown explosive growth. Image data has simple and intuitive characteristics and contains a large amount of information, and is widely used as an information carrier. With the development of artificial intelligence in recent years, machine learning has also risen rapidly, and image recognition technology occupies a very important position in machine learning. This article first analyzes machine learning and image recognition through literature research methods and quantitative analysis methods, and then uses different image recognition and analysis technologies based on the big data platform gallery to test the accuracy of the technology, and provide research value for the application of image recognition and analysis technologies. The experimental results show that in the image recognition based on artificial neural network, in the case of the same number of levels and different node numbers, the recognition rate of the picture first increases, then reaches the peak, and then decreases. The overall rate of return is a trend that first rises and then declines. It can be seen that when the data is 450, that is, the number of nodes is set to half of the input data, and the artificial neural network has the highest recognition rate, the data has the best performance. In the image recognition based on convolutional neural network, the recognition rate of LeNet-5 in the CIFAR-10 image library was only 93 at the beginning, and the latter two models were 95 and 96 respectively at the beginning. CNN1 only achieves 30 times the stability, while the improved CNN2 and CNN3 models achieve a relatively stable recognition rate of nearly 20 times, thereby increasing the relative learning speed. In the end, the recognition rate of the CNN1 model reached 97.8, and the improved CNN1 model achieved a maximum recognition rate of 97.82. The model can reach 98.8 and 99.5, and the improved model algorithm significantly improves the image recognition rate

Keywords: Machine Learning, Image Recognition, Image Extraction, Analysis Technology

1. Introduction
With the development of Internet technology, access to not only computers but also mobile devices (for example, frequently used smartphones, tablet computers, etc.) has also caused a huge increase in...
network data [1-2]. Through these devices, you can share life through various online platforms, thereby opening up the connection between the individual and the whole world, so that talents will not come out and understand everything in the world [3-4]. Image data can display a variety of rich content, and images are intuitive and easy to understand. They are widely used by people to convey information and become an important method for people to obtain and share information [5-6]. However, the amount of image data on the Internet is very large, and it is very important to determine the importance of the required image from the measurable images. In the face of huge image data, through machine learning and image recognition technology, the network can accurately and quickly recognize images and obtain the required information [7-8].

In the research of image extraction based on machine learning and image recognition and analysis technology, many scholars have conducted research on it and achieved good results. For example, Chi Y put forward two key points and opened a new chapter in machine learning. The first point is that multiple hidden layers can learn more functions, are closer to human knowledge, and can have more substantial data knowledge, which is conducive to the detection of things. The second point is that neural network training is more difficult. Through layered training, you can simplify training and reduce the difficulty of training. Unsupervised machine learning performance is used at each level [9]. Rasel A increased the accuracy of image recognition by 10% and made a breakthrough in image recognition [10].

This article first analyzes machine learning and image recognition through literature research methods and quantitative analysis methods, and then uses different image recognition and analysis technologies based on the big data platform gallery to test the accuracy of the technology, and provide research value for the application of image recognition and analysis technologies.

2. Image Extraction Research of Machine Learning and Image Recognition Analysis Technology

2.1 Research Methods

(1) Literature research method

The literature research method mainly refers to the scholars obtaining research data through the books, newspapers, magazines, electronic reading materials, etc. that they consulted in a broad sense, so as to generate research inspiration. Its advantage is that we can understand the change and development history of the research object from our own origin, and understand the change status of the research object. Through the comparison with the data, we can make a more comprehensive understanding of the object we want to study.

(2) Qualitative analysis method

Qualitative analysis is related to quantitative analysis. Quantitative analysis refers to the determination of mathematical assumptions, data collection, analysis and testing. Qualitative analysis refers to the qualitative analysis of research objects, and refers to the classification of research based on subjective understanding and qualitative analysis, through research and bibliographic analysis.

2.2 Types of Machine Learning

(1) Classified by learning method

Machine learning is divided into shallow learning and deep learning. The essence of shallow learning and deep learning is artificial neural network. This statistical model is not based on manual rule settings, so it is more applicable.

(2) Classified by learning label

When dealing with the semantic problems of image content, machine learning is mainly divided into unsupervised learning and supervised learning according to the learning label. Unsupervised learning is not based on predefined labels, but learns by finding the correlation of the data itself. The algorithm is usually based on the calculation results of the two users before and after, by changing the training set or loss function, while maintaining the network parameters through transfer learning, to
judge the effect of learning and retraining, so as to achieve the target network parameters. Supervised learning uses predefined tags to guide functions to learn the correlation between images. Under the guidance of different tags, the same data set will have different learning results.

2.3 The Necessity of Image Content Recognition and Analysis

(1) The user returns the question to the mature big data analysis and chooses to associate the image with other text information to realize the description and search of the image. This operation will make the search of the question inaccurate. This is because the recognition of image content is not as clear as text at this stage.

(2) Most image researchers will break away from the background of big data and focus on information acquisition in small-scale images. This is because the demand for content analysis based on content semantics has existed for a long time, but images are different from text, and the digital composition of each image is not structured and large. Even analysis in a small data environment requires a lot of computing resources.

2.4 Image Extraction Algorithm of Image Recognition Analysis Technology

(1) Deep Hash algorithm

Auto encoder: Assuming the input is \( x = \{x_1, \ldots, x_m\} \). The encoding process and loss function are:

\[
h(x) = f(w^T x + b) \tag{1}
\]

\[
L(W, b) = \frac{1}{m} \sum_{i=1}^{m} (x' - x)^2 \tag{2}
\]

3. Image Extraction Experiment of Machine Learning and Image Recognition Analysis Technology

3.1 Research Purpose

This paper conducts experiments on the image extraction accuracy of different image recognition and analysis technologies, and analyzes the results of the experiments that the image recognition and analysis technology has a higher accuracy rate. Provide a basis for the application of image recognition technology.

3.2 Experimental Design

In order to verify the effectiveness of related experiments, the experiment used the classic CIFAR-10 image library. There are 9 different categories in the image library, namely cats, dogs, etc. There are a total of 50,000 different images, each type contains 5,000 images, the image format is 28x28 color images, of which 40,000 images are used as training data, and the remaining 5,000 Two images are used as test data, and then related experiments are carried out through MATLAB.

3.3 Data Enhancement

In machine learning and deep learning, in order to avoid excessive placement, a large amount of data is usually needed to train a data model. In fact, collecting large amounts of data is a bit difficult, so increasing the amount of data is a common method. Image data enhancement is the geometric transformation of the original data and the expansion of a person's data set to the assumption that the image attributes remain unchanged. Currently, commonly used data enhancement methods mainly include: image rotation transformation, inversion transformation, zoom transformation, translation transformation, noise interference, contrast transformation, color transformation, random image cropping, etc.
3.4 Data Normalization
In machine learning, data normalization is a necessary step in data processing. After the image attributes are extracted, due to the existence of multiple attribute vectors and the inconsistent size of the attribute values, there are often large differences in the price range, and the distribution is irregular. Inputting these data directly into the sorting algorithm will cause the model to converge slowly. And the accuracy is reduced. Therefore, in order to solve this problem, it is necessary to standardize the data, especially for data with different characteristics, and convert the data dimension to non-dimensional data.

4. Data Analysis of Experimental Results
(1) Image recognition based on artificial neural network
In order to verify the influence of the number of nodes and the number of levels on the network structure on the performance of the artificial neural network model, experiments are designed to verify. The ANN1 artificial neural network model uses a three-level network model, the input level is 780 dimensions, the number of hidden level nodes is designed to be 150, 250, 350, 450, 550, 650, 750, and the output level dimension is 10, in order to make the network converge faster. Set the learning rate to 0.2, set the mini-batch of the tilt algorithm to 40, and repeat the experiment 40 times. The ANN2 artificial neural network model uses a 3-level network model, the input level is 780 dimensions, the first hidden level is fixed, the number of nodes is 500, and then the number of nodes at the second hidden level is designed to be 150, 250, 350, 450, 550, 650, 750, and the dimension of the output level is 10. To speed up network convergence, set the learning rate to 0.2. The small batch size results of the tilted cathode algorithm are shown in Table 1.

|               | 150 | 250 | 350 | 450 | 550 | 650 | 750 |
|---------------|-----|-----|-----|-----|-----|-----|-----|
| ANN1          | 94.4%| 94.5%| 95.7%| 96.6%| 95.7%| 94.8%| 94.1%|
| ANN2          | 94.8%| 94.4%| 95.9%| 97.3%| 96.3%| 95.4%| 94.5%|

Figure 1. Accuracy of models with different numbers of nodes and layers (%)  
By comparing the experimental data, it can be seen that in the case of the same number of levels and different node numbers, the recognition rate of the picture increases first, then reaches the peak, and then decreases. The overall rate of return is a trend that first rises and then declines. It can be seen
that when the data is 450, that is, the number of nodes is set to half of the input data, and the artificial neural network has the highest recognition rate, the data has the best performance.

(2) Image recognition based on convolutional neural network

In order to verify the effectiveness of different improved methods of convolutional neural networks, a confirmatory experiment was carried out in the MNIST image library. For the convolutional neural network models CNN1, CNN2 and CNN3, in order to make the network converge faster, the learning rate is set to 0.1, the mini-batch size of the gradient descent algorithm is set to 50, and the experiment is iterated for 50 times. Statistics are 2 times and 7 times respectively, 12 times, 22 times, 32 times, 42 times, 52 iterations of image recognition accuracy, the results are shown in Table 2

| Number of experiment iterations | 2   | 7   | 12  | 22  | 32  | 42  | 52  |
|---------------------------------|-----|-----|-----|-----|-----|-----|-----|
| CNN1                            | 93% | 94% | 95% | 96% | 97% | 97.7%| 97.8%|
| CNN2                            | 95% | 96% | 97% | 98% | 98.6%| 98.7%| 98.8%|
| CNN3                            | 96% | 97% | 98% | 99% | 99.3%| 99.4%| 99.5%|

Figure 2. Accuracy rate of different models in MNIST (%)  

It can be seen from the statistical results that the recognition rate of LeNet-5 in the MNIST image library is only 93 at the beginning, while the latter two models are 95 and 96 respectively at the beginning. CNN1 only achieves 30 times the stability, while the improved CNN2 and CNN3 models achieve a relatively stable recognition rate of nearly 20 times, thereby increasing the relative learning speed. In the end, the recognition rate of the CNN1 model reached 97.8, and the improved CNN1 model achieved a maximum recognition rate of 97.82. The model can reach 98.8 and 99.5, and the improved model algorithm significantly improves the image recognition rate.

5. Conclusion

With the rapid development of machine learning and image recognition, machine vision is bound to achieve further brilliance in the future. The development of machine learning, especially the development of deep learning, deep learning can learn better characteristics from massive amounts of data. The amount of data in this article is relatively small. The larger the amount of data in the picture library, the more you can learn the essential characteristics of things. Later, I will study the application of larger-scale image recognition models. With the development of hardware, especially the development of parallel platforms and GPUs, the design of a deep learning network suitable for
distributed parallel learning platforms can increase the learning speed and improve the accuracy of image recognition. The explosive growth of massive image data, the rapidly developing distributed and parallel high-speed operating platform, and the design of image recognition models with fast learning speed and high accuracy with the help of machine learning theory will inevitably bring unprecedented new progress to machine vision.

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References
[1] Zhang Y, Li J, Wang Y. Research on Moving Target Recognition and Tracking Technology Based on Machine Learning[J]. Journal of Physics: Conference Series, 2021, 1738(1):012122 (6pp).
[2] Yanyan Z. Vibration separation of multiple mixed particle curves based on image recognition and machine learning[J]. Journal of Intelligent and Fuzzy Systems, 2021(7):1-13.
[3] Chen G, Wang L, Kamruzzaman M M. Spectral classification of ecological spatial polarization SAR image based on target decomposition algorithm and machine learning[J]. Neural Computing and Applications, 2020, 32(10):5449-5460.
[4] Lou G, H Shi. Face image recognition based on convolutional neural network[J]. China Communications, 2020, 17(2):117-124.
[5] Yan H, Lu J, Zhou X. Prototype-Based Discriminative Feature Learning for Kinship Verification[J]. IEEE Transactions on Cybernetics, 2017, 45(11):2535-2545.
[6] Zhou Y. Image modal analysis in art design and image recognition using AI techniques[J]. Journal of Intelligent and Fuzzy Systems, 2020(3):1-11.
[7] Zou W, Shen C, Yin G. Application of image recognition technology in agricultural production process[J]. International Agricultural Engineering Journal, 2018, 27(2):318-326.
[8] Chhikara R R, Sharma P, Singh L. A hybrid feature selection approach based on improved PSO and filter approaches for image steganalysis[J]. International Journal of Machine Learning and Cybernetics, 2016, 7(6):1195-1206.
[9] Chi Y, Wang D H, Sun H F, et al. Research on medical image segmentation based on machine learning[J]. International Journal of Simulation: Systems, 2016, 17(10):7.1-7.6.
[10] Rasel A, Yousuf M A. An Efficient Framework for Hand Gesture Recognition based on Histogram of Oriented Gradients and Support Vector Machine[J]. International Journal of Information Technology and Computer Science, 2019, 11(12):50-56.