Trademark search engine based on Python

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Abstract

This paper proposes a trademark search scheme based on Python, which can identify trademarks contained in imported pictures or a frame of pictures in video stream through machine learning and SIFT feature matching algorithm, and return the relevant enterprise information of the searched trademarks. Users can also search keywords to find related trademarks and their corresponding trademark information.

Keywords

Trademark recognition; Python; SIFT.

1. Introduction

With the advent of the information age and the rapid popularization and application of the Internet, the information on the Internet has also increased exponentially. At the same time, search engines have become an indispensable part of our normal life, and at the same time, search engines are developing rapidly. The existing search engines can meet the needs of our daily life. With the development of Python and machine learning,Computer image recognition and processing has a broader prospect, and people have more demands for the application of image processing. However, when we want to search for pictures, the existing search engines will be a little weak, while the search engines for trademarks are few and far between. The article is also focusing on trademark recognition.In this project, the trademark is pre-screened by convolution neural network, and then the neural network recognition results are further matched by SIFT algorithm, so that its accuracy is higher than that of single algorithm. At present, the project has been established as a provincial project and received financial support from the school. Item number: S202110146033.

2. Related Technologies.

2.1 Python And Its Advantages.

In this project, the third-party libraries Numpy, TensorFlow and OpenCV of Python are used. The use of these libraries greatly facilitates the development process. Nowadays, most search engines are written in C++. Compared with C++, Python has unique advantages in this respect, especially in memory processing and string processing. At the same time, Python has many powerful third-party libraries,In the development process, the development cycle can be greatly reduced. Python has Google's open source machine learning framework-—TensorFlow, Baidu's open source deep learning framework-—Paddle, etc.

2.2 OpenCV

OpenCV is a cross-platform computer vision and machine learning software library based on BSD license. it is lightweight and efficient, and provides interfaces of Python, Ruby, MATLAB and other languages, and realizes many common algorithms in image processing and computer vision. In the system, the preprocessing of input images is realized by means of operations such as morphology in OpenCV.With the introduction of OpenCV, the basic operation code for graphics processing is greatly reduced, and the image processing becomes more convenient.

2.3 TensorFlow

TensorFlow is an end-to-end open source machine learning platform. It has a comprehensive and flexible ecosystem, which can help researchers promote the development of advanced machine

learning technology and enable developers to easily build and deploy applications supported by machine learning.

TensorFlow, as the back end, is very beneficial to quickly build and train a new network model[1]according to requirements. In this project, TensorFlow is mainly used to construct convolutional neural network to realize the preliminary recognition of trademarks in pictures, and TensorFlow and CUDA are used to accelerate GPU to improve the training speed of the model.

3. Overall Design.

The design aims to improve the accuracy and efficiency of trademark search. The search engine relies on many technologies, such as web crawler, ranking retrieval technology, big data processing technology and so on. When entering the trademark information for the first time, it is necessary to enter the feature information of the pre-trained model and trademark template (obtained by SIFT feature detection) in addition to the trademark template.After that, the corresponding relationship between related words and trademark information articles will be constructed, and an index will be established and stored in the database. When using, the pictures will be read in through a camera or dragged from a folder, and the area near the trademark will be clicked on the picture. The color information of the trademark will be obtained by counting the pixel values in this area, and the high and low thresholds will be set by using the obtained color information.A binary image mainly containing trademark information is obtained through binarization processing (noise can be eliminated through morphological operation), and finally a picture containing only trademarks can be obtained based on the original image through convex hull detection, and then trademarks in the picture are identified and their corresponding information and keywords are returned, or related trademarks and information corresponding to trademarks can be searched through keywords.When searching for a specific keyword, it will return the list of webpages corresponding to the keyword and its corresponding URL. Then, TF-IDF (Term Frequency–Inverse Document Frequency) algorithm will be used to count the word frequency in the article, and then some common words will be removed so as to make a similarity ranking for the content. Finally, the final result will be returned in the form of a list to return the content most needed by users.Improve user experience.

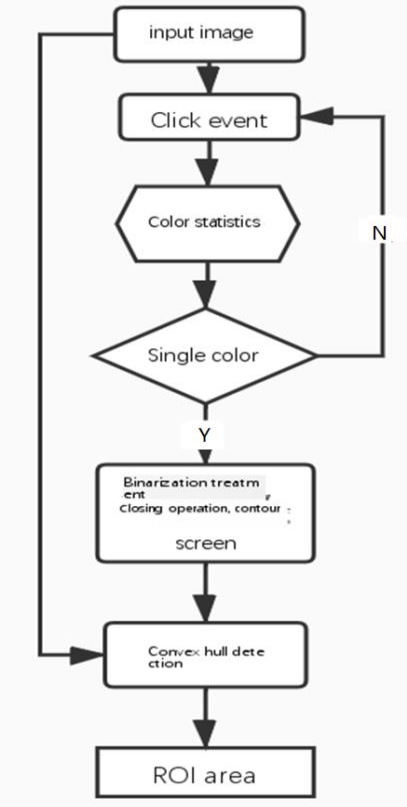

Figure 1 Pretreatment Process

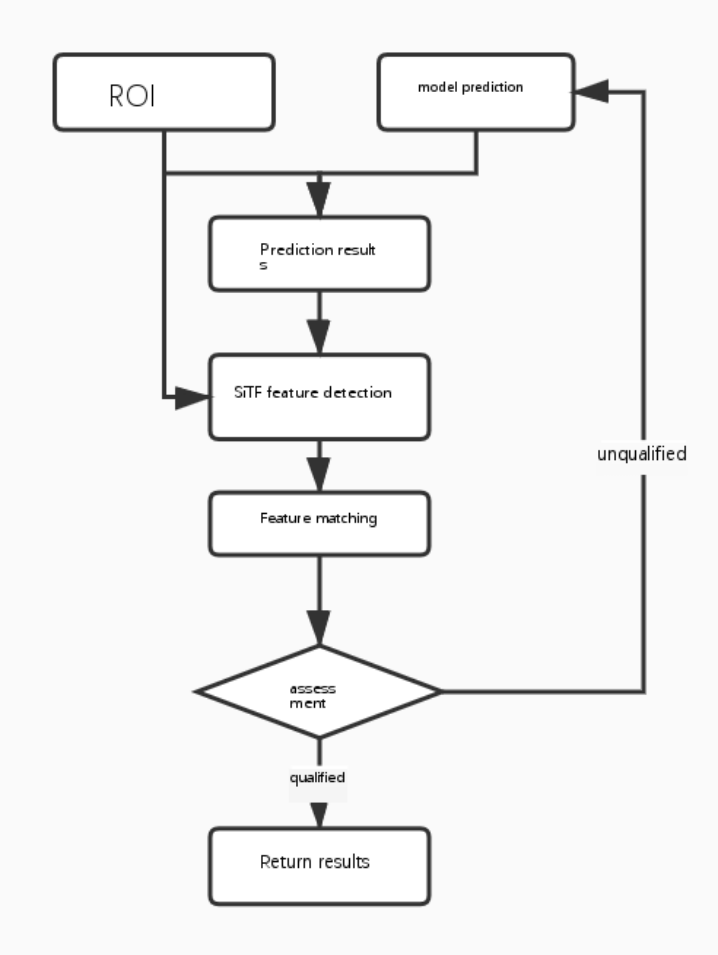

Figure 2 Trademark Matching Process

4. Implementation Of Main Functions.

4.1 Pretreatment and ROI.

First of all, we should make clear our goal. Our goal is to identify the trademark, not the whole picture. Because only the part containing the trademark has the characteristic information we need, we only need to deal with the area of interest. However, we need to preprocess the image to obtain the region of interest, that is, to obtain the local image of the trademark.The approximate range of ROI can be determined by sliding the mouse or clicking the finger near the trademark. There have been a large number of commercial applications of single color in China's market, and it is foreseeable that more and more commercial applications of single color will appear[2]. Therefore, local color statistics can be adopted to obtain the color of trademarks.Compared with RGB color space, HSV color space can express the lightness, darkness, hue and vividness of color more intuitively. It has unique advantages for RGB color model in the fields of computer vision and remote sensing image processing, and is more suitable for image analysis than RGB color image[3]. After determining the range of ROI area, we can transform the color space of this area,The color of the trademark can be obtained by converting the image into HSV color space, counting the H values of pixels and finally taking the maximum value. As shown in Figure 4, the sampling area is the trademark center, and the upper left corner of the picture is the color statistical result. After the statistical result is obtained, the RGB value is appropriately enlarged and reduced to obtain the high and low thresholds of binarization processing.After obtaining the binary image, align and close the operation, so that the isolated parts in the trademark are connected with each other as shown in the left side of Figure 5. Figure 6 is the region of interest selected according to Figure 5. The main operation is to find the outline of the binary image based on Figure 2 through OpenCV's own API, and use the outline information and

cv2.ConvexHull () gets the convex hull of the trademark, or directly selects the target trademark by using the rectangular frame containing all points in the outline (Figure 6).

Figure 4 Schematic diagram of color extraction

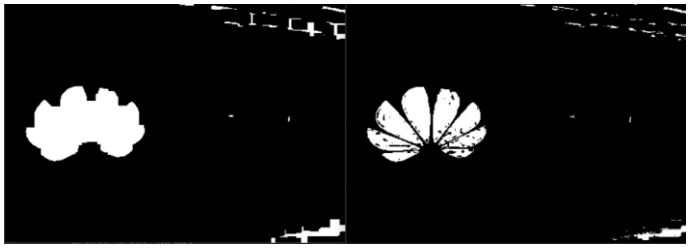

Figure 5 Schematic diagram of binarization processing

Figure 6 Get the target area

4.2 Identification of trademarks.

At the end of preprocessing, the trademark has been extracted from the original image (as shown in the upper left corner of Figure 6). firstly, the extracted image is identified by the pre-trained model, and the first three results with higher confidence are obtained. then, the SITF feature detection is performed on the model identification results and the input graphics in turn.

SITF matching algorithm was proposed by Lowe in 1999 and improved in 2004. SITF extracts local features, and the features extracted by SITF are insensitive to image rotation and scale changes, and have good robustness to illumination and noise, which makes SITF often used in image mosaic and video tracking [4].The first stage of SIFT feature matching is to extract feature vectors irrelevant to scale scaling, rotation and brightness changes from the processed images. The second stage mainly includes detecting extreme points, obtaining scale invariance, filtering feature points, assigning direction values to feature points, and generating feature descriptors.After the feature vectors of the preprocessed image and the trademark template image are generated, the similarity of feature points

in the two images can be judged by calculating whether the Euclidean distance between two points is greater than a certain threshold.

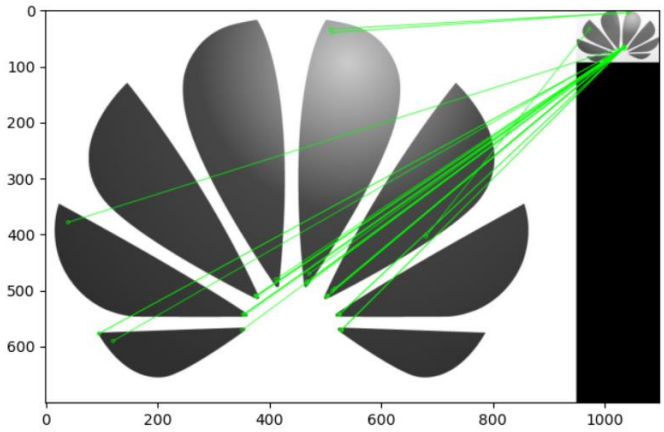

Figure 7 SITF feature matching results

4.3 Model training

The advantages of deep learning technology, especially convolutional neural network, are that it can automatically extract the specific features of learning, and it has strong self-adaptive ability to the changes of some features. Compared with the traditional methods of extracting features manually, it has more outstanding flexibility and accuracy[5]. TensorFlow is used to construct convolutional neural network,Through a series of operations such as convolution and pooling, the category information is obtained, the error between the predicted result and the real result is calculated by the loss function, and the parameters are updated by the gradient descent algorithm in the process of back propagation, thus achieving the effect of convergence of the model.

5. Conclusion

This paper introduces a trademark search engine based on Python, in which trademark recognition is carried out by a model trained by machine learning, and the recognition results of the model are compared and confirmed again by SIFT algorithm, thus alleviating the problem of low recognition rate of single method to a certain extent. There are also some problems at present,In the process of downsampling the preprocessed image, some unimportant features will be lost. When the trademark is too small, it will affect the result of feature matching and then the result of recognition, but the trademark of normal size will not be affected.

Acknowledgements

Liaoning University of Science and Technology Provincial College Students Innovation Training Project in 2021 ProjectNo.: S202110146033.

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