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Product Shape Detection Method Based on Computer Image Recognition

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Abstract: Compared with image recognition technology, product modeling detection in computer vision image recognition is a more complex problem, because image classification only needs to determine the general types of images, but there may be multiple processing objects in product modeling, so all object objects must be classified and located. Therefore, product shape detection and classification is more complex than image recognition. In this paper, several modeling recognition methods based on depth learning are studied, and a target shape recognition method based on computer vision is proposed. This method uses chain code method to determine the product shape, distinguish the subtle differences of product shape, and determine the deformation detection of product shape.

1. Introduction

Since the 1990s, the image recognition technology based on computer vision has entered a period of rapid development. The related theories, methods and equipment have made great progress. Many technologies have been applied to software development and the modeling and testing of related products. This paper presents a measurement method based on computer vision to recognize the shape of objects. Based on the chain code method and target radius curve calculation, the power density spectrum is calculated through analysis and transformation to realize the recognition of product shape and shape. Compared with other methods, this method can quickly recognize the shape and shape of the body, even including some subtle differences that are not easy to detect.

2. Overview of the Development of Computer Image Recognition

Image recognition is the application of computer deep learning algorithm. The research of image recognition technology appeared in the 1950s. After more than 50 years of development, image recognition technology can be divided into three stages: 1. text image recognition. It started in 1950 and ended in 1965, mainly used to identify text type data; 2. Digital image processing and recognition. From 1965 to the beginning of the 20th century, the main features of digital images are recognition and processing. Compared with traditional analog images, digital images solve the problem of data loss during transmission and storage; 3. 3D object recognition. This is a challenge in the field of computer vision. It is also the latest technology emerging with the emergence of big data in the field of artificial intelligence in recent years. The research results have been widely used in industrial and robot fields[1].

2.1. Image Feature Extraction Technology

Image feature analysis is an interdisciplinary subject, which plays an important role in the field of computer vision in addition to image processing. This technology covers physics, mathematics, control theory, computer science and other fields of knowledge. Since its birth in the last century, after decades of development, it has been widely used in facial recognition, medical diagnosis, image analysis and other fields. Remote sensing data, behavior analysis, restoration and reconstruction of ancient buildings and other work are also common to the trace of image feature recognition technology. Capturing image features not only paves the way for the scientific and technological progress of image features, but also significantly improves the accuracy and accuracy of subsequent digital images. Its main idea is to calculate the singular values in the image to obtain the corners of the image used to create the image. The algorithm reads the attributes of the image by comparing the size of the center pixel and the local pixel. Over the years, many scientists have improved lbp algorithm to a certain extent, including the attributes of lbp unified model and mb lbp algorithm. In 1999, David Lowe proposed the scale change feature transformation algorithm (sift). The algorithm was expanded and improved in 2004. Its main idea is to select the most important features of an image on different spatial scales to generate an image. In 2001, Rainer Lienhart extended the algorithm. In addition, in object recognition technology, face recognition technology and hair features are combined with adaboost classification algorithm to obtain target images. In 2005, Dalal proposed the Hog algorithm, which can well describe the characteristics of local target regions. In 2008, Bay et al. improved the SIFT algorithm, shortening the running time of the algorithm and improving the performance of the algorithm[2-3].

2.2. Development History of Image Classification Technology

As deep learning technology was mentioned again in 2006, image classification algorithm based on deep learning emerged as the times require. This is a common image classification algorithm, which overcomes the difficulties of traditional machine algorithms in processing large amounts of image data. During the development of image classification methods, many scientists at home and abroad have proposed a series of famous algorithms, which are of great significance to the rapid development of image classification technology[4]. In 1997, OSUNAE introduced a face recognition algorithm based on SVM. The accuracy of the algorithm exceeds 97%. In 1998, Lecini proposed the LENET - 5 network structure, which allows the creation of a minimum data set. However, due to the technical limitations at that time, the process of processing large data samples on the computer was relatively slow, so the algorithm was not widely used.

With the development of technology, image classification technology has become more and more advanced, especially since 2006, and continues to develop rapidly and apply to all fields. In 2007, a group of well-known domestic scientists, including Dong Liyan, successfully applied image classification technology to the medical field[5-6]. Among them, Dong Liyan et al. used Bayesian classifier to classify urine images. According to the classification of 1500 samples of different categories, the accuracy is more than 94%. Use KNN model Kosikhon et al. In 2008, Yuan Shikai and other image classification technologies have been successfully applied to remote sensing cells, with a classification accuracy of 95%. Since 2010, there has been a trend of bubbles in image classification. During this period, more complex and in-depth network models were proposed, including the AlexNet 7-layer network model proposed by Alex Krichevsky and others in 2012, and the Google Network model developed by Szegdyc et al in 2014. The error rate of the Imagnet dataset further decreased to 3.6%, lower than the average level observed by humans.

2.3. Methods for Image Recognition

In image recognition, the essence of data is the space allocation from model to category. At present, there are mainly three detection methods: statistical model recognition, structural model recognition and fuzzy model recognition. Statistical model recognition is a Bayesian decision system, which uses statistical probability theory to identify models. First, according to the original data of the object to be detected, the relevant feature parameters are extracted to reflect some features of the object, and the combination of some parameters is selected as the feature vector according to the actual detection needs. According to the principle of statistical solution, they are divided into different rooms. Therefore, the purpose of this method is to recognize different object features[7-9].

The main classification methods include discriminant function method, nonlinear mapping method, K-nearest neighbor classification method (as shown in Figure 1), profile analysis method, etc. Structural objects recognize structural attributes based on objects. First, the complex structure of the model is decomposed into several relatively simple and easy to identify sub elements. If the sub topics are still difficult to identify, you can continue to decompose them until you get structures that are easy to express and identify, and then use these sub topics to recreate the complex structure of the model. It is mainly used to establish accurate communication between different parts of recognizable objects.

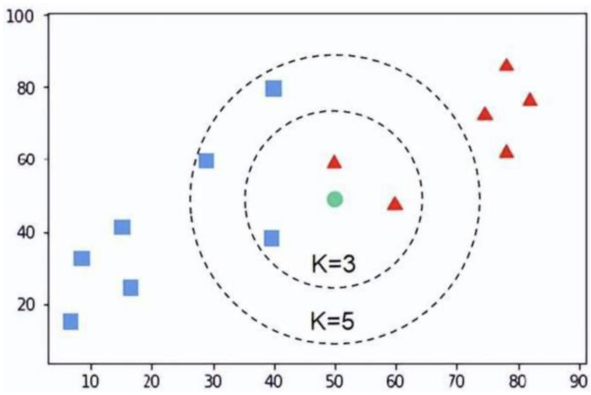

Figure 1: K Nearest Neighbor Classification

Uncertainty analysis is a useful supplement to statistical methods and structural methods. Fuzzy data is the theoretical basis of fuzzy recognition and evaluation. According to the characteristics of thinking logic and human brain, ordinary binary logic is converted into computer and then into continuous logic. The result of fuzzy identification is expressed by the degree to which the identifiable object belongs to a certain category, that is, if an object belongs to a certain category, the object belongs to a certain category. The recognition system can be simplified, and the thinking process of the human brain can be more extensive and in-depth, so as to better classify and identify the objective things. People can easily recognize images, but the machine has been running for a long time. In the field of computer vision, image recognition technology has developed rapidly in recent years. For example, when the pascal voc target is tested, the performance of the detector is improved from 30% of the average accuracy to more than 90% at present. In image classification, modern algorithms are more effective than human algorithms in complex image datasets. Video surveillance, autopilot, intelligent medical and other image recognition technologies have been widely used in our environment. The latest progress in image recognition is the power of deep learning. The success of deep learning largely depends on three aspects: creating large datasets, developing powerful models and various computing resources[10].

For various image recognition tasks, well-designed deep neural networks are far beyond the human based image design technology. Although great progress has been made in advanced image recognition training, there are still many challenges before such training is expanded. At the same time, we have seen many important research directions.[11-13]

3. Image Recognition under the Development of Computer Vision Technology

3.1. Practical Application

Human beings are entering the information age, and computers are increasingly used in almost all fields. On the one hand, more and more people without computer knowledge also need to be trained in computer technology. On the other hand, the functions of computers are becoming more and more powerful, and the application methods are becoming more and more complex. This has directly caused the contradiction between the flexibility of the dialogue and communication between human beings and computers and the rigour and rigidity required to deal with computers. People can exchange information through vision, hearing, speech and external communication to express the same feelings in different ways. Computers need to write programs in different programming languages to make computers work. In order to let more people use complex computers, it is necessary to change the past, so that people can adapt to computers and remember the rules of computer use. On the contrary, computers adapt to human habits and requirements, and usually exchange information with people, that is, they share information with people, not with people. At this point, the computer must have a logical basis and decision-making ability. The computer with the above functions is an intelligent computer.

Intelligent computers not only make computers more accessible, but also enable these automation systems and intelligent robots to adapt to the environment and make independent decisions in managing various automation devices, especially intelligent robots. In all dangerous and difficult situations, this can replace the high workload.

Computer vision and machine vision overlap. Computer vision technology is the most important technology for automatic image analysis in many fields. As shown in Table 1, image processing usually means combining automatic image analysis with other technologies and technologies that can automatically detect and control robots in industrial applications. Learning based methods are becoming more common.

Table 1: Shape Detection Relationship

shape	Index F	particle shape
circular	1	1:2.2
square	1.27	2.228
Regular hexagon	1.103	1.52

3.2. Visual Technical Requirements Related to Image Processing

Computer vision technology is almost applied to all levels of industrial production. The most important technology is image processing (as shown in Figure 2). These techniques include image acquisition, noise suppression, measurement and final graphic creation. According to the purpose of image processing, image processing is divided into three stages: gray image processing, two-dimensional image processing and depth image processing. The application of computer vision in industry also has many different aspects, which can improve the speed and efficiency of industrial production, achieve the speed and accuracy of industrial production, and improve the stability of image processing. Due to the non-contact nature of image processing, the expansion of the scope of computer vision processing provides more detailed image parameters that can be analyzed. These parameters can be grouped to facilitate 3D engineering processing. The application technologies related to computer vision perception include lighting equipment, detection equipment, information acquisition equipment, industrial CCD camera, image processing technology, etc. Industrial CCD camera is mainly used to measure device size and provide basic information of industrial parameters (including size) of the tested product. The application of 3D technology requires a large number of high resolution 3D depth images.

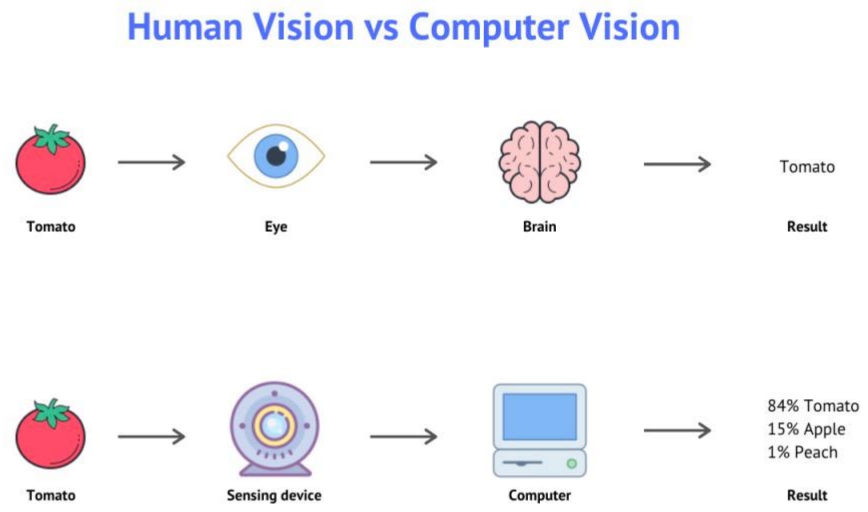

Figure 2: Computer Vision

3.3. Recognition mode of Computer Vision Pattern

The application of computer vision recognition system mainly includes analyzing the specific features of objects, recognizing the features and structural models of computer image recognition system, and distinguishing objects according to their types. Computer recognition models are usually identified by different detection methods based on different technologies. According to the different characteristics of the measured data, the computer identification method is introduced. After eliminating redundant information and noise, data analysis improves the accuracy of technical application.

The difficulty of model recognition is related to the key problems of feature measurement and search pattern analysis in image processing technology. According to different image processing modes, statistical data of structural characteristics can be used for technical applications. Model identification deals with and analyzes model changes based on differences between statistical methods and reporting methods. The whole pattern recognition process can be divided into two stages: pattern copy and pattern reset. Classifiers should be used instead of actual industrial product models. Classifiers are mainly selected by analyzing a large number of data files. When selecting a classifier, it is usually necessary to carefully analyze and verify the selected data samples to implement the model.

3.4. Computer Deconstruction of Visual Images

After image preprocessing, artificial intelligence technology is also required to decode the image and interpret the image according to human understanding. Computer data processing and decomposition is an image processing method different from computer vision. In addition to image description, computer vision image processing and decomposition technology, it can also understand the true content of the image and explain the true meaning of the image for decision-making. (as shown in Figure 3). Image processing system includes digital processing technology, image generation technology, image processing technology and artificial intelligence. The theoretical knowledge of biotechnology and vision systems also requires additional data processing techniques. Computer vision systems usually include image processing, analysis and output modules. The image analysis unit shall be decomposed and analyzed. These modules are interrelated, different, and interrelated to describe image attributes. Image interpretation system is based on image processing and acquisition technology. In image processing, the content of these systems actually exceeds the content of the subject. Computer vision system is a bionic system that simulates objects, usually biological objects. In order to apply computer simulation to vision, it is necessary to analyze the theory of biological vision system.

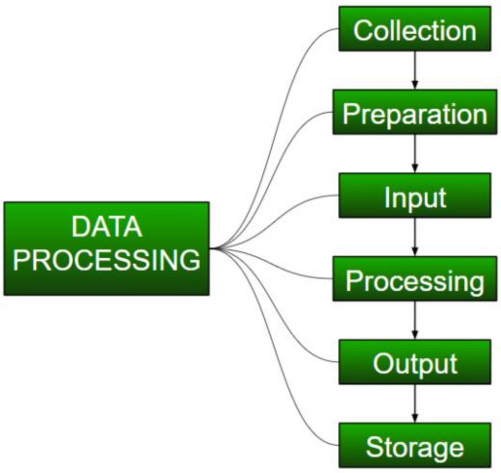

Figure 3: Understanding Data Processing

3.5. Object Modeling Detection of Computer Image Recognition

In target determination, the image is divided into subcategories/routes to determine the target, and then the sub elements are transmitted as the input of the target recognition model. The most direct way is through the sliding window. The method of dragging and dropping the window is to list all nested image fragments according to the size of the image. Unlike the sliding window method, there is another region method. One of them is selective research. The reason for choosing SS is that region selection algorithm allocates pixels to several parts of different positions and sizes, rather than sliding window algorithm. Therefore, the number of algorithms in the final candidate region is far less than the number of sliding windows, which significantly reduces the number of operations in the target selection algorithm. At the same time, the selection range of candidate region algorithm will certainly consider the size difference. The whole R-CNN process can be interpreted as selective search+CNN+SVM, namely:

Step 1: Obtain candidate areas

Preparatory stage: 2000 candidates were screened by SS method. According to the list size and unified image size required by CNN, the scaling ratio of 2000 lists is 22727dpi. Test stage: 2000 candidates were screened by SS method. According to the list size and unified image size required by CNN, the scaling ratio of 2000 lists is 22, 727dpi.

Step 2: Feature extraction

Preparation stage: prepare CNN model to extract features in advance. In the development process of cnn model, the calibration requirements for training data are relatively low, that is, the calibration requirements for training data are relatively low. Test phase: After receiving 22727 single resolution quotation, CNN model obtained through training will be introduced. The final output of the measurement vector of the all connected layer reaches 40961, which is the attribute of the final test.

Step 3: Generate Results

The results of the SVM assessment will be available for all proposals. After deleting some of the lowest ranked proposals, the list of candidates is the same as other proposals. The maximum braking technology is not used in two or more overlapping areas to find an alternative that best represents the final test results.

Let's briefly review the specific operations unrelated to the maximum deletion: based on the previous network, each unit can obtain a label. The higher the label, the closer the inserted value is to the expected value. As shown in the figure 4, both targets have multiple parameters. Now we need to remove the extra check boxes. Select maximum local field and delete the iou>0.7 field, as shown in figure.[14-15]

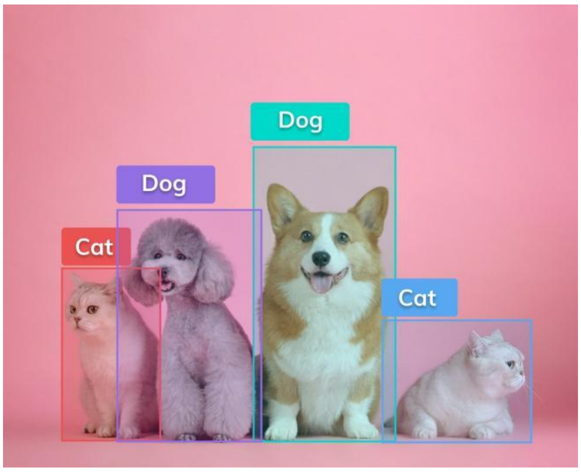

Figure 4: Candidate box of final detection results

4. Conclusion

With the continuous improvement of science and technology, the application scope of computer and network information technology is expanding. However, as computer science and neuroscience are currently linked, the "computer application" section should be opened into a new application chapter. Computer vision technology can be applied to the field of industrial manufacturing. With the wide application of computer recognition technology in the field of industrial manufacturing and artificial intelligence, it will provide a great space for the development of computer vision technology. It can significantly reduce the testing cost of the product model and reduce the cost.

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