

# Research on Target Detection Algorithm and Tracking Algorithm based on Artificial Intelligence Technology and Machine Vision Recognition

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**Keywords:** Artificial intelligence; Visual recognition; Tracking technology; Object detection

**Abstract:** With the support of computer technology, modern science and technology can liberate labor force, promote production efficiency and improve production quality. Artificial intelligence technology has developed rapidly and has been applied in many fields. The development of emerging technologies promotes the continuous innovation of artificial intelligence technology, and artificial intelligence identification technology is a branch of artificial intelligence technology. It can solve the problem conveniently. existing in traditional intelligent technology in financial payment, code scanning and other fields, and facilitate people's work and life. Intelligent transportation system, automatic aiming and precise guidance in military affairs, etc. have begun to be applied, and they also show broad application prospects in agriculture and industry. The main purpose of visual tracking is to predict the position, scale, motion state and other information of the target in the subsequent video sequence according to the given initial target information. Combined with artificial intelligence technology, visual tracking algorithm has made a series of progress. The proposed algorithm has high success rate and accuracy, and has good tracking performance in complex scenes such as target rotation, deformation and background interference.

## 1. Introduction

In recent years, with the rapid development of computer hardware devices such as image processors and high-performance chips, and relying on artificial intelligence technologies such as machine learning and deep learning, computer vision has been favored by many researchers, and has developed many branches such as target detection, image segmentation and vision tracking. Computer artificial intelligence recognition technology has been widely used in many social fields, such as language translation, two-dimensional code recognition, facial recognition and other social activities. The so-called visual tracking refers to the detection, extraction, recognition and tracking of moving targets in image sequences, so as to obtain the moving parameters of moving targets, such as target, robot position, speed, centroid, etc., as well as the moving trajectory, so as to carry out further processing and analysis, and realize the behavioral understanding of moving targets, so as to accomplish higher-level tasks. Visual target tracking is in automatic driving, video surveillance, human-computer interaction and intelligence.

As described above, visual tracking technology has a very broad prospect. With the development of Internet of Things, artificial intelligence and other technologies, it can greatly change people's way of life and work. Artificial intelligence technology has gradually evolved from a concept prototype into a main type of technology that permeates all aspects of life. From a certain point of view, the rapid popularization of artificial intelligence technology depends on the rapid development of computer technology and the wide application of micro-processing technology. In the era of intelligence, people's requirements for artificial intelligence technology are constantly increasing, not only hoping that it can exert its strength in the field of industrial production, but also hoping that it can change human daily life. In intelligent transportation system, visual tracking is mainly used in many aspects, including traffic flow control, vehicle abnormal behavior detection, pedestrian behavior judgment, intelligent vehicles and so on. In augmented reality, virtual objects are generated by real-time visual tracking technology and visualization technology, and the virtual objects are fused with the real environment with the help of display devices, which enriches users' perception of the real world and human-computer interaction, and presents people with a new

environment with real sensory effects.

## 2. Methods

### 2.1. Development status of artificial intelligence technology

From an objective point of view, the global research on artificial intelligence technology is still immature, and its practical application needs to be based on the assumption of a specific physical symbol system, otherwise it will not be able to play its role. From the application field of artificial intelligence, artificial intelligence technology can be seen in many fields, such as medical diagnosis, trade, finance, internet and so on, except in daily life. Artificial recognition technology is an extension of speech recognition technology, which is mainly used in mobile phone control to provide high-quality services for people's lives. However, it is undeniable that the current artificial intelligence technology relies too much on computer technology and automation technology, and has not realized artificial intelligence in the true sense. From the long-term practice and research, it can be found that artificial intelligence technology is more suitable for the development in the field of software engineering, and its application in software engineering can promote the change of management mode and development method, thus extending brand-new products, fundamentally changing the status quo of traditional software development, and promoting its efficiency and quality. The recognition of specific scenes plays a very important role in public security, fire control, monitoring and other fields. The overall structure diagram of the designed specific scene recognition system based on artificial intelligence vision is shown in Figure 1.

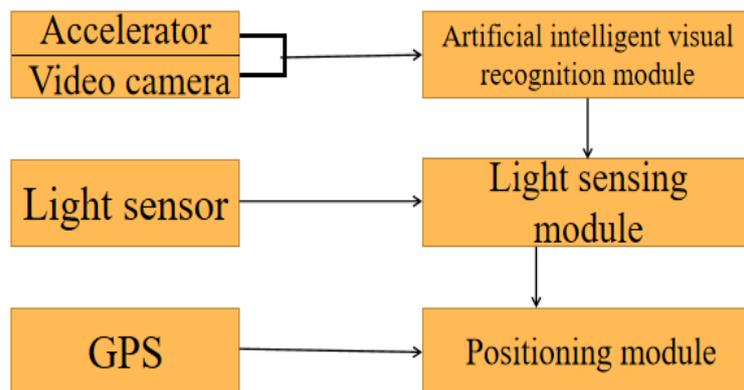


Figure 1 Overall structure diagram of the system

At present, artificial intelligence identification technology can be divided into two types: animate identification and inanimate identification in the process of identifying objects. First, there are three kinds of living recognition technologies: voice recognition; Fingerprint identification; Face recognition technology. Secondly, the inanimate identification technology is mainly divided into the following three types: smart card technology; Bar code identification technology; Radio frequency identification technology. Therefore, it is necessary to give full play to the role of artificial intelligence technology, add your perfect management mechanism, further realize intelligence, and at the same time do a good job in data information collection and fault detection, and analyze performance linearity and trend. In addition, by using the computer artificial intelligence identification technology, the staff can also know the running status of the equipment, make clear the internal problems of the program, adjust them, and analyze the detection target, diagnosis target and recovery index of the equipment to realize the normal operation of the equipment. The extensive application of artificial identification technology is helpful to improve the identification efficiency and accuracy, and to reduce the investment of human resources. In addition, artificial intelligence identification technology has been fully applied in the construction of intelligent experimental space and research platform, which mainly includes five parts: (1) the construction of artificial intelligence experimental platform; (2) Building an artificial intelligence capability

platform; (3) the construction of artificial intelligence experimental resources; (4) the establishment of intelligent hardware support resources: the creation of intelligent accessories is to ensure the normal work of artificial intelligence experiments; (5) Creation of artificial intelligence laboratory environment: In order to form a high-quality experimental space, the laboratory is divided into three parts, namely, the intelligent enjoyment area, the practical teaching area and the experimental space publicity and experience area. Through these products, everyone can experience the concrete application of the current intelligent artificial technology, which helps to apply it to all aspects of people's lives and brings various conveniences to people's lives.

At present, artificial intelligence technology is in a critical period of research and development. Relevant research institutions and researchers need to correctly understand the development principle and application scope of artificial intelligence technology, attach importance to technological innovation, practically improve the intelligence degree of artificial intelligence products, and speed up the penetration of artificial intelligence in life and production. The artificial intelligence identification technology of computer also plays an obvious role in remote planning and control. For example, in the aerospace field, the distance between the earth is managed and controlled by this technology, so as to achieve the purpose of controlling the outer space spacecraft. At the same time, it can strengthen the staff's ability to grasp the actual operation of the spacecraft more accurately, find out the problems existing in the program, make timely and effective adjustments, and make clear the detection and diagnosis targets and recovery indicators of various problems, which can provide efficient guarantee for the safe operation of the spacecraft in space. If you want to effectively realize the operation, you need to take subjective judgment consciousness as the basis, and then realize deeper analysis and research. This technical way can make some abstract activities simple and concrete.

## **2.2. Visual tracking technology architecture**

The main technical problems involved in vision recognition and tracking include target detection, target recognition and target tracking. Moving target recognition and tracking is to divide the image sequence into several moving objects in the space domain, and then model, recognize and track these objects in the time domain. Visual tracking of target is a new technology, which takes image processing technology as the core, organically integrates many theories and technologies such as computer technology, sensor technology, pattern recognition and artificial intelligence, etc. It relies on imaging technology to obtain richer target information, and through the relationship between the target and real space information, it can effectively reduce the delay of maneuvering estimation and improve tracking performance. However, the stable tracking in some complex scenes has not been effectively solved, and with the expansion of the application field of visual tracking technology, the challenges in actual scenes are becoming more and more severe. Excellent tracking algorithms should not only ensure the stable and accurate tracking of targets, but also meet the real-time requirements. At present, the difficult problems in the field of visual target tracking mainly include the following aspects: target occlusion; Target deformation; Fast movement; Scale change; Similar target interference; Illumination changes.

Based on the twin network framework and DSiam, the dynamic template and color histogram features are introduced, and the apparent changes of the target are learned and the background is suppressed by quickly transforming the model, which effectively improves the robustness of the visual tracking algorithm. When tracking a moving target, the adjusted shooting angle is controlled by the rotation of the pan/tilt and the robot. The captured image is converted by the image acquisition box and then transmitted to the camera. After a series of target recognition and tracking and control software, the pan/tilt and the robot are controlled to rotate to track the moving target, thus forming a closed-loop control system, as shown in Figure 2.

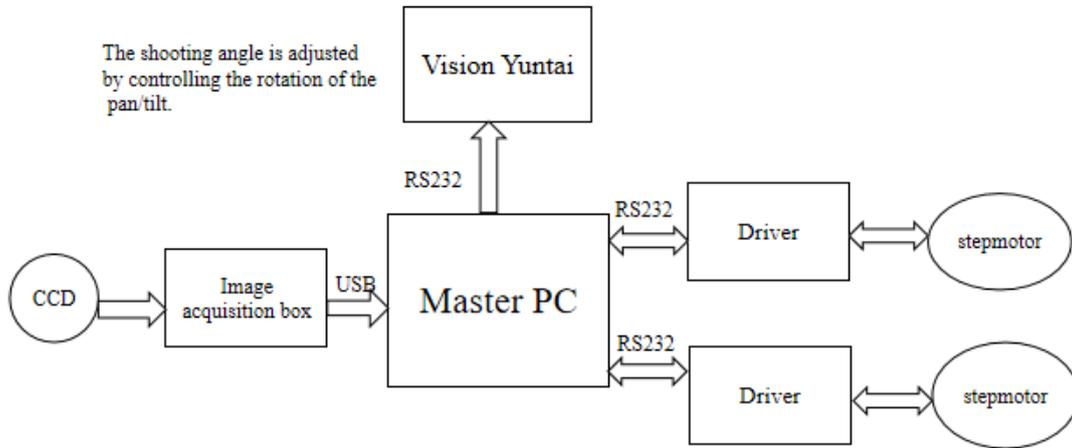


Figure 2 Overall framework

The hardware of the system mainly includes the following aspects: the hardware of the robot's vision system consists of a color camera on the robot, an image acquisition card or interface-based image acquisition box, a dual-core central computer with a main frequency, a tripod head which can rotate vertically, and the design of a small wheeled mobile robot. The process of target tracking can be roughly divided into six modules: input image, search strategy, feature extraction, observation model, model update and integrated processing. Besides the above six main target detection methods, a target detection algorithm based on motion energy is also proposed. ; Target detection algorithm based on information fusion of multiple color space components: Saliency detection algorithm based on selective attention mechanism: Combined with the mutual information value between successive images, the target is detected. Moving target detection based on autoregressive moving average model.

### 3. Result analysis

Use the formula "recognition efficiency = image relative data amount/recognition time" to summarize the data into a recognition efficiency curve, as shown in Figure 3.

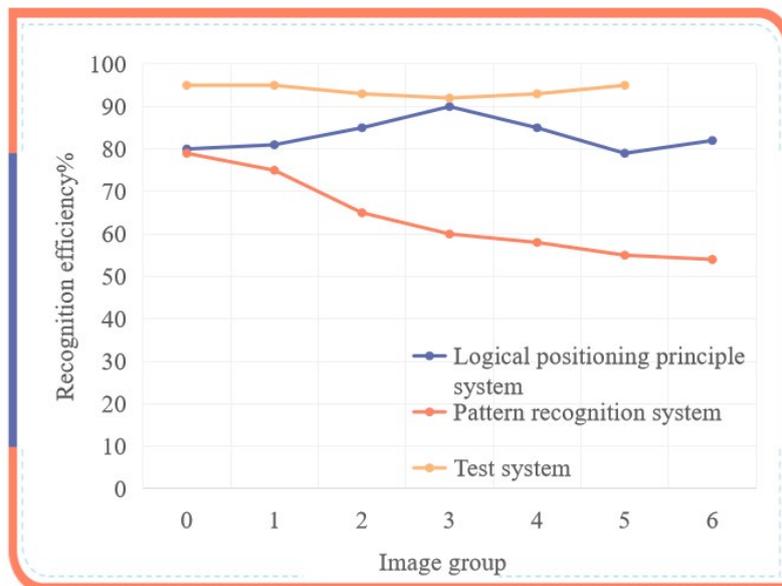


Figure 3 Identification efficiency curve

As can be seen from Figure 3, the order of the recognition efficiency of the three systems from high to low is: this system, the specific scene recognition system based on logic positioning

principle, and the specific scene recognition system based on pattern recognition. This result can prove that this system has high recognition efficiency. The experimental accuracy is shown in Table 1.

Table 1 Statistical table of average identification accuracy of system

Image group	This paper system	Based on the principle of logical positioning Specific scene recognition system	Pattern recognition based Specific scene recognition system
1	98.56	95.26	96.68
2	97.36	93.68	95.38
3	97.02	91.18	95.63
4	98.61	92.35	96.08
5	98.33	93.22	96.13

In order to improve the recognition efficiency and accuracy of the recognition system in a specific scene. Experimental results show that the system has high recognition efficiency and accuracy. The software design of target recognition and tracking system is completed in VC++ environment. And realized the human interaction interface. The man-machine interface can be used to start or stop the tracking motion control of the target and the shooting of sequence images, etc., and the feasibility of the target recognition and tracking system is verified.

#### 4. Summary

Vision-based target recognition and tracking technology is a research field with a wide application background. However, it has a strong dependence on specific objectives and environment. Starting with the research and discussion of image segmentation, target recognition, target tracking and other technologies, the visual target recognition and tracking system based on small wheeled mobile robot platform is completed. On the one hand, due to the inherent defects of computer technology, there may be security risks such as information leakage in the process of use; on the other hand, due to the interference of environmental factors such as noise, the results of speech and facial recognition may be wrong, which will affect the application accuracy of artificial intelligence recognition technology. With the rapid development of artificial intelligence, it has attracted the attention of a large number of researchers in the field of visual tracking. The end-to-end design is realized based on the twin network method, and this kind of algorithm has good tracking performance through offline training of a large number of data sets. The proposed algorithm has been tested on several data sets, and the experimental results show that this method can effectively improve the performance of the algorithm, and improve the tracking accuracy and success rate. In order to expand the application scope, it is necessary to sum up experience in the future practice and application process, do a good job in technology research and development, and have a far-reaching impact on the production and life of human society.

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