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Research Article

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Object Tracking Scheme based on Color Recognition

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Abstract With the advancement of the times, today's social science and technology has been rapidly developed. The accuracy of target tracking and target recognition in the field of robot vision is not high, and the tracking speed is not fast enough. The opencv library based on python is used in color recognition and tracking technology to conduct a study on the flexibility and practical significance of opencv in this regard. The reason of tracking failure, color recognition error are discussed. By improving the accuracy of the mean shift method algorithm and Kalman filter tracking method, the results show that this method greatly shortens the tracking time.

Keywords pattern recognition; intelligent system; tracking

1. Introduction

The human eye is an important tool for receiving information. According to research studies, 80% of the information received by humans comes from the eye. Similarly, the camera as the eye of the robot is also an important tool for receiving information. There is a name for "the eye of the robot" in the computer field-computer vision. Computer vision integrates knowledge in the fields of image processing, computer graphics, artificial intelligence, neural networks, physics, and mathematics. The fusion of multiple knowledge highlights the variability of computer vision itself. At present, we mainly study the target tracking and target detection in computer vision. These two items have always been the most important part in the field of computer vision. Target detection is the analysis and recognition of moving objects, which belongs to video analysis. Video analysis integrates higher-level links in the field of computer vision, specifically, it can process image sequences. The movement of the target object can be anatomically analyzed to achieve the predicted "action" of the target in the future. Target tracking and identification are now widely used in military defense, aerospace and other major fields, so it can reflect its research value.

2. Related Work

2.1. Color recognition

The color recognition is a small block of computer vision [1], which mainly contains two contents: one is computer self-learning to understand color recognition in human cognition, and the other is the approximate color of the target identified in the entity The framework finally gives feedback to the terminal. The earliest development of this block was to learn by the machine itself (camera) while discriminating the colors independently. Today, we are more optimizing and improving its performance, such as neural network [2] associated with it, let it learn efficiently and quickly [3], the color channel segmentation makes it more accurate. Since then, color segmentation has gradually evolved toward color image segmentation [4] has deepened the research level of robot vision at home and abroad, and now, color space has become a hot spot in the field [5], and academic workers have begun to further Research. Color recognition technology is now widely used in military, medical, transportation [6], life [7]. For example, the automatic recognition of traffic lights that can be seen, the color recognition of vehicles, etc. are all manifestations of its functions. We will conduct an in-depth

study of opencv [8]'s robot vision to create a variety of color recognition methods, which also highlights the diversity of color recognition and improves robustness.

2.2. Target tracking

The field of robot vision is mainly composed of target detection, recognition and tracking [9]. Target tracking technology has been a hot research topic in the field of robot vision for nearly 30 years, and it is widely used in military and civilian fields. Target tracking can only be divided into two categories, namely, under the camera, the target and the camera are relatively stationary and relatively moving. The former is simpler than the latter, and it can be continuously tracked only by maintaining the same speed (excluding other external interference factors). The latter needs to take a series of measures to track, for example, calculate the speed of the object, the distance away Wait. Thus approaching or becoming the former state. In recent years, with the deep learning of the target tracking algorithm convolutional network [10], the performance of external parts is stable, big data, cloud computing, and blockchain are developing rapidly. Target tracking (MS [11], Kalman [12]) also ushered in new challenges. Scientists' repeated experiments have found that if the tracking is to be carried out in full, then we must solve the interference of factors such as the weather of the car while driving, and the shaking of the camera [13]. This is also a problem of current target tracking, so we carried out research on this subject.

3. Our Scheme

3.1. The structure of the car

Our research works are divided into four modules: main control module, drive module, motor module, and external frame module. The main control module is composed of a Raspberry PI 3B +. It adopts the Linux system and can adapt to multiple programming languages. The whole body of the car is connected with screws by polymer plastic. There are four rubber unidirectional wheels and four DC motors. L298N dual H-bridge DC motor driver chip is the core driver board to drive. (As shown in Figure 1, Figure 2 is a physical picture of our car)

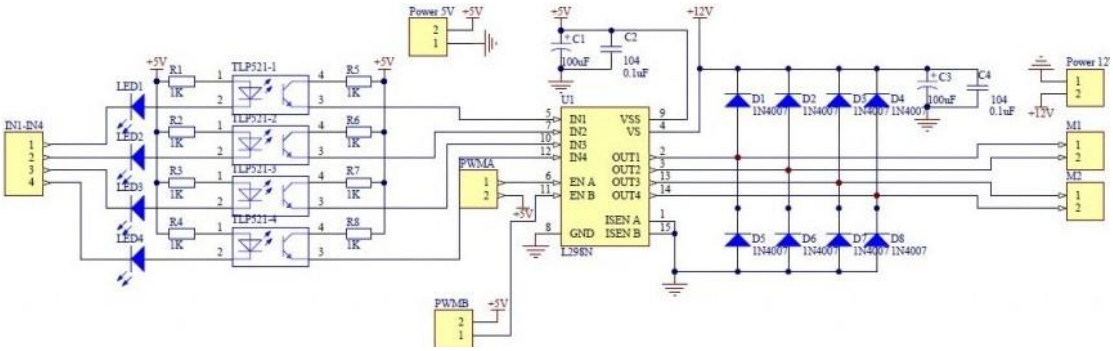

Figure 1: Internal wiring diagram and working principle of H-bridge

Figure 2: Car physical map

Software module In this study, we used some python-based algorithms and library functions to achieve the goal of tracking and recognition. The recognition technology uses opencv based on Python programming and its expansion function. The recognition technology uses the mean drift method to calculate the distance of the target to the car to control the rotation of the motor to maintain the distance. Figure 3 is my detailed analysis and introduction of this process.

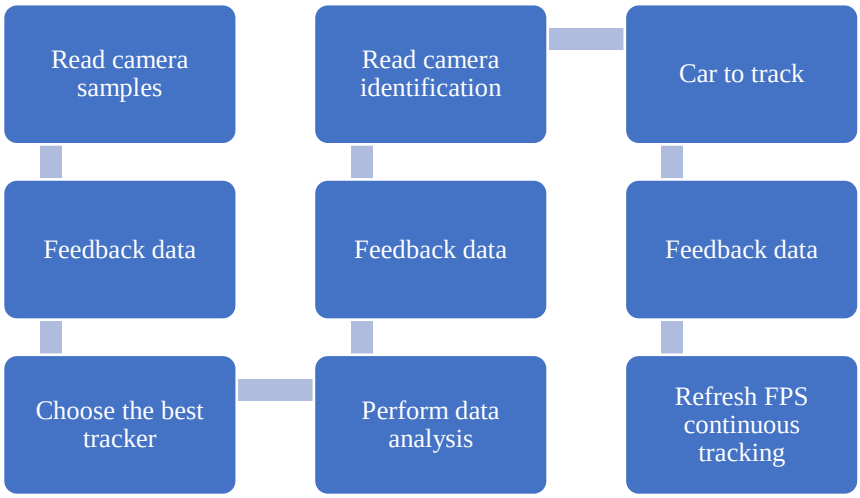

Figure 3: Operation schematic diagram

3.2. Perception and recognition

In environmental information perception, visual information accounts for a very large proportion. First of all, python's status in the current programming language is one of the best, so we adopted python as the programming language we studied this time. The first step in identification is to use the python call function inside the Raspberry PI 3B + to enable the camera and read the data, and then feed the read data back to the chip for data processing. The call of the python internal function determines whether it is trackedtThe goal, so as to enter the next stage of tracking. During this period, the Raspberry PI 3B + camera version uses the Raspberry PI 3B + Camera Rev 1.3 5 megapixels for data reading. The diagonal viewing angle is 69.1 °, the viewing area is wider, and more information is read. In Python, we use the opencv function library to read the camera, and use the data of various trackers to compare with each other to find the most suitable tracker (KCF) for our research. It can be known from Table 1 that this tracker is more suitable for this study than other trackers. After that, we call a webcam to collect and analyze the surrounding environment. As the incoming data is sent to Raspberry PI, it will feed back the received data to the operation terminal in the form of video. The operation terminal performs frame number processing and reads the frame rate cyclically. Here we have considered the frame break. If the last frame is not received, the program will stop running, which realizes the closed-loop operation of the system. If it runs normally, then start to adjust the size of the frame and get the size of the frame to facilitate better processing. At this point, we have completed the processing of the frame. The following is the identification and tracking stage. First, we detect whether we are tracking an object, virtual a coordinate system in each frame, and then obtain the new frame coordinates of the object, where we can check whether the object is tracked successfully, that is, to achieve a closed-loop operation. In this way, we cyclically update the FPS counter to achieve the tracking effect. We use a variety of algorithms to study this color recognition block. Below we explain the lbp algorithm.

$$f(x)\begin{cases}1, x > 0\\ 0, x \le 0\end{cases}$$

The lbp algorithm is a feature extraction algorithm. We first convert rgb to grayscale in a 3 * 3 nine square corresponding to the grayscale value of the area we extracted and compare it with the pixel value of the center point, and convert it into a corresponding binary value (more than the center area is 1 is less than and 0).

$$lbp(x_p, y_m)\sum_{p=0}^{p-1} 2^p f(i_p - i_m)$$

Then the final eight-bit binary number is converted into decimal. The final number is 256. All the central values (called the lbp value of the pixel) can reflect the texture information around the pixel.

Table 1: Analysis of tracker

Tracker	Advantage	Disadvantages
BOOSTING	Long history and slight drift	Tracking performance is mediocre
MIL	Good performance, the other is not much different from BOOSTING	Applicable to low version of opencv, unreliable tracking failure report
KCF	The accuracy and speed are better than the above two, and the tracking failure report is better than MIL	As with MIL, complete occlusion recovery is not possible, but there is still a bug that cannot return to the bounding box correctly (python)
TLD	Works best under the occlusion of multiple frames. In addition, track the best scale changes	There are so many false positives that he is almost unusable
MEDIANFLOW	Particularly perfect tracking failure report, the movement is predictable and works well when there is no occlusion	Not suitable for large-scale sports
GOTURN	Offline model training, faster	Can't handle occlusion well

3.3. Object tracking

On the basis of the basic research overview of moving target tracking technology, the mean drift target tracking algorithm is improved, and the tracking method of the mean drift of the color interval centroid to the mean drift is introduced. Tracking based on color, the design mainly includes the bottom layer driver program to realize the function of each module and the top layer tracking algorithm program to realize the system function. The bottom layer driver program realizes the stable work of each module of the intelligent car. On this basis, through the top layer algorithm program Control to realize the functions of intelligent car's autonomous navigation, direction determination, target tracking and so on. The robot uses the clever cooperation of the sensor and the motor to complete the predetermined action. The sensor of the robot is a Raspberry PI 3B + camera, which can collect images of surrounding objects and then feed them back to the Raspberry PI 3B +. After receiving the image signal, it analyzes and processes, Find the target object set by the pre-program, convert it into electric signal, and transmit it to the motor. The motor controls the wheel to coordinate and rotate accurately, find and track the target. Once the robot finds and reaches the target, the chip conversion program controls the wheel to rotate the robot and the target object always maintains a certain distance, the target object moves forward and the robot moves forward, and the target object moves backward and the robot moves backward.

The mean shift algorithm (ms) has been receiving much attention in this field. The principle of this algorithm is to collect *i* sample points in a given n-dimensional space Rn, and select a point x in the space to determine the basic form of the *ms* vector:

$$M = \frac{1}{K}\sum_{x_i \in S_P}(x_i - x)$$

(S_p here is a given high-dimensional sphere area of radius R, and also meets the set of y points of the following formula

$S_p(x) = \{y : (y - x_i)_T(y - x_i < R^2)$k means that there are k points in the i sample xi that fall in the Sp area)

4. Conclusion

The main concern here is the problem of robot perception. With the continuous update and development of intelligent technology, the use of intelligent robots is becoming more and more extensive. It has become an inevitable trend for social development that large-scale intelligent robots replace human labor. However, today's most intelligent robots also have many deficiencies in perception and recognition, so adaptation to the external environment has become a bottleneck in the current robot vision field, as the name suggests, perception and recognition. We can't directly imagine the robot's perception, so we map it to humans for analysis. Our human perception is determined by our own genes, which are like the internal programs of robots. By installing various sensors, the robot increases its perception of the external environment, processes and analyzes it, and finally transmits it to the terminal to achieve intelligence. Now people should upgrade and improve these sensors, so as

to achieve the robot's external perception. Using visual sensors to simulate human vision, you can perceive rich information from the outside world like humans, including geometric information of objects in the environment, specifically shapes, positions, postures, movements, etc., so that intelligent robots can make decisions based on the acquired information. Therefore, the tracking technology based on visual robots has become one of the main hotspots in robot research. Recognition and tracking are both popular research directions for the current two types of robots, but since the research is based on visual recognition tracking robots, the two are inseparable here, which also highlights the great research value of this direction. At present, the robot technology based on visual recognition tracking is not mature enough. It is quite difficult for robots to perceive and accurately understand the surrounding environment through cameras. Visual perception means that the human eye can accurately recognize and perceive the surrounding things through body organs. It is necessary for the robot to simulate human perception, so that the robot can also perceive external environmental information and make judgments based on vision. This is also what humans have wanted for many years. Realize the dream. Therefore, it is of great practical significance to study the robot's perception of the external environment and things. Figure 4 is the effect diagram of tracking through programming.

Figure 4: Tracking renderings

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