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Research on Real-time Tracking Algorithm of Moving Objects Based on Machine Vision

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Abstract: *With the rapid development of -IT and digital image processing technology, moving target tracking based on machine vision has always been a very active research topic in the fields of computer vision, robot and artificial intelligence, image processing and pattern recognition. As a research field with a wide application background, moving target tracking based on machine vision has attracted a large number of researchers. Many foreign research institutions also list it as an important research direction, and have achieved a lot of results. Artificial intelligence and other technologies have been widely used in various fields. At present, the moving target tracking algorithm based on filtering theory has attracted much attention. In this paper, a template matching method based on multi association is proposed for tracking. Experiments show that the separation accuracy of the algorithm is enhanced, the tracking effect is good, and can meet the real-time performance.*

Keywords: *Machine vision; Real-time tracking; Image preprocessing*

1. Introduction

Machine vision, also known as computer vision. Mobile robot is an important branch of robotics. It is a comprehensive system integrating multiple functions. It integrates the research results of sensor technology, mechanical engineering, computer vision technology, artificial intelligence, automatic control engineering and other disciplines [1]. Now all places are experiencing traffic congestion problems. Due to the increasing number of vehicles and relatively insufficient road capacity, my country's road traffic accidents are increasing and traffic congestion is getting worse [2]. Therefore, intelligent transportation systems have attracted more and more attention [3]. Moving target tracking based on video sequences is an emerging research field at present, which includes pattern recognition, computer vision, artificial intelligence and other technologies, and it is a technology with very broad application prospects. The purpose of machine vision is to use computers instead of human eyes and brains to perceive, interpret and understand the environment of the scene. Therefore, the vision system must be able to extract useful information from the scene image to complete these tasks [4]. This paper takes road traffic video image sequences as the research object, and conducts in-depth research on the key technologies in the video tracking method, which is conducive to better development of intelligent transportation systems.

The goal of computer vision is to make computers replace human eyes and brain to perceive, interpret and understand environmental information. With the rapid development of science and technology and vision technology, the impact of computer vision technology on human production and life is gradually increasing. The main idea of machine vision is to let computers replace human eyes and brain, capture visual information in real life like eyes, and intelligently analyze and understand the captured information and make corresponding operations like human brain [5]. Stereo vision can be divided into monocular vision and multi camera stereo vision equipped with multiple cameras to obtain stereo information. Stereo vision is to extract feature points from the visual images of the same scene obtained by different cameras and obtain the parallax information of the feature points to obtain the three-dimensional information of the target or scene [6]. Dynamic real-time tracking and positioning of targets have been used in many fields, ranging from daily life, such as intelligent transportation, intelligent monitoring, medical navigation surgery, to industrial production, such as industrial defect detection, to national defense security, such as military target detection [7].

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2. Machine vision processing related technology

2.1. Image preprocessing

In practical application, because the image collected by the robot vision sensor is limited by noise, illumination and other conditions and random interference, the quality of the output image will decline and can not be used directly in the vision system. Therefore, the original image must be preprocessed before image recognition, such as gray correction and noise filtering, in order to highlight useful information and suppress useless information. For machine vision systems, the image preprocessing method used does not consider the reasons for image degradation, and only conditionally highlights the features of interest in the image, and attenuates the unwanted features [8]. In a relatively complex background, the template matching method is used to track the vehicle, which is conducive to better extraction of traffic parameters.

2.2. Overview of pretreatment methods

The image preprocessing stage is mainly to process at the pixel level, taking a set of pixel sequences as input, and generating another set of pixels to improve certain characteristics of the pixel sequence. It mainly has the following functions: correcting the geometric distortion of the image, removing the The blur caused by camera movement, the smoothing of image noise filtering, the sharpening of the boundary of the target object, etc., these tasks are particularly important [9]. Template matching can be divided into two types: target based and target region based. In the target tracking problem, the target tracking information is determined by the matching of the image relative to the original image. In fact, there is a certain degree of difference between the template participating in the image matching and the potential matching factor [10]. Frequency domain based preprocessing is an indirect processing method. In order to meet the requirements of real-time, spatial technology is generally used in machine vision system.

3. Feature extraction of moving target

3.1. Fast color image segmentation based on YUV space

According to the color characteristics of the target, the corresponding region is determined in the RGB color space. The points in the color space of the same region belong to the same kind of color, that is, different colors are defined through the partition of the color space, that is, the so-called "color segmentation". The process of finding the difference between the target and the non-target is called feature extraction. In order to extract the target from the image background, the image must be divided according to some feature differences between the extracted different targets, that is, the image Split. Before the machine realizes target tracking, it can extract the color features of different targets and distinguish the target and non target according to the color. This process mainly includes: target sampling, color analysis, color segmentation and so on.

Moving target tracking in video sequence refers to marking the moving target detection results on the original image in a specific scene. There is a specific tracking algorithm to track the target, and a series of morphological characteristics of the moving target are obtained in the tracking process, such as the position, shape information and motion of the target. The principle of moving target tracking based on machine vision is shown in Figure 1.

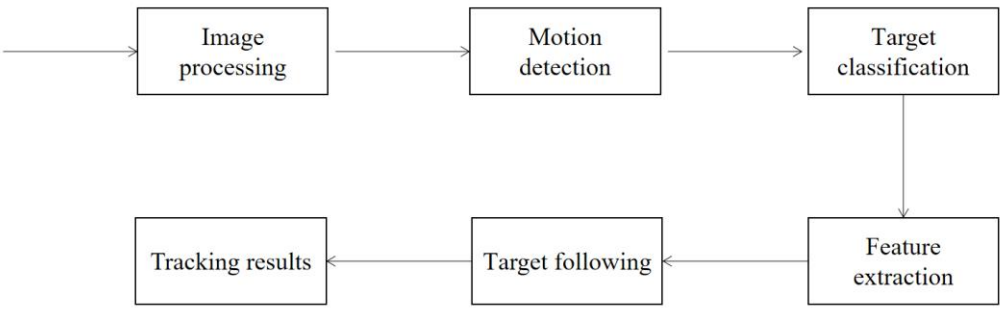

Figure 1 Moving target tracking block diagram

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For fixed target models that cannot be stable for a long time, the target features need to be updated in real time to adapt to changes in the target. If the target model of the current frame cannot accurately describe the current target, this will lead to incorrect model updates.The simplest result of image segmentation is a binary image, that is, all pixels in the image are divided into target and non-target. The point corresponding to the target pixel is set to 1, and the other pixels are set to 0. For multi-target image processing, multiple binarized image results need to be obtained, and these binarized images are actually obtained from the same image. The trajectory tracking technology of moving targets is an important research direction in the field of machine vision, and it has great practical value in real life. Moving target trajectory tracking technology is mainly to process the continuous images in the video, and the continuous images contain more information about the moving target.

3.2. Threshold determination and fast color category judgment method

The threshold and color acquisition of target color can be divided into manual mode and automatic mode, because the automatic mode involves various complex algorithms such as clustering. In the moving target trajectory tracking technology, it is an important performance requirement of the algorithm to reduce the amount of computation and improve the real-time performance. At present, the images obtained by camera equipment are generally color images, also known as three channel images. It is composed of three different components: R (red), G (green) and B (blue). The mean filter is simple to calculate and can well filter out granular noise, because the mean filter obtains the mean of the adjacent region of the pixel. Based on the three stimulus theory, human eyes sense color through the stimulation of three kinds of visible light on the cone cells of the retina. The stimulation of these lights peaked at 630 nm (GE), 500 nm (green) and 450 nm (blue). The human eye feels the color of light through the intensity comparison in the light source. The improved judgment of color category is realized by bit operation. And it can quickly judge and extract all the target colors as long as it loops once.

When the robot is tracking a moving target, there may be collisions or other factors that cause the camera to shake and cause some noise interference that is difficult to remove in the detection. Therefore, after detection and segmentation, the authenticity of the target needs to be judged to remove false Target interference. The steps of target extraction are shown in Figure 2.

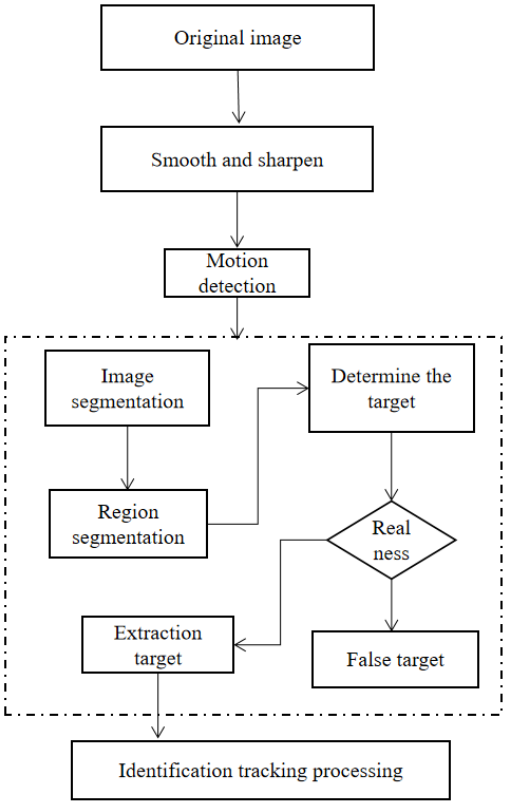

Figure 2 Target extraction framework

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When judging the color of pixels, in order to minimize the impact of light, the colors to be recognized can be placed in the brightest and darkest parts of the field for sampling. The robot realizes the tracking of the moving target, and the real-time requirement of the system is quite high. Obviously, the calculation amount of the above method is relatively large, and the processing efficiency is relatively low. In order to shorten the execution time of the program, it is necessary to select an algorithm that has the smallest amount of calculation and can quickly identify the moving target at the same time. Several typical noises such as salt and pepper noise, additive noise and Gaussian noise in digital images. Salt and pepper noise refers to salt noise and pepper noise. Because two kinds of noise generally appear at the same time, they are often combined together and called salt and pepper noise. Additive noise generally refers to the thermal noise generated by the channel and has nothing to do with the processed signal. Gaussian noise changes the pixel value and is an irrelevant noise caused by the high temperature of the electronic device itself. Remove the noise in the image, enhance the pixel contrast of the image, improve the clarity of the image, and enhance the visual effect of the image.It is a pity that the algorithm fails or the effect is very poor due to noise. Image denoising methods are mainly divided into frequency domain filtering and spatial domain filtering.

4. Conclusion

A greedy prediction algorithm based on the idea of greedy algorithm is designed to make up for the defect that cam shift algorithm has high requirements for the initial prediction position, so as to greatly improve the real-time and robustness of tracking. The achievements of machine vision have spread all over industry, agriculture, military, production, entertainment and other fields. Moving target trajectory tracking is a hot research field of machine vision, which is applied in traffic monitoring, motion analysis, safety prevention and so on. It has great economic and practical value.

It is very meaningful to continue the research in this field. Based on the analysis of the existing target tracking algorithms, this paper focuses on the moving target tracking algorithm based on filter theory. The quality of moving target tracking algorithm will directly lead to the success and failure of tracking. Real-time, accuracy, and real life sometimes need to track multiple targets, the multi-target tracking algorithm is very complicated and faces more difficulties. The complexity of the real environment, the complexity of the occlusion of the target and the change of the environment, and the contradiction and reconciliation of real-time and accuracy are all issues we have to consider. Accuracy is an important performance for studying target tracking. The research on moving target tracking will be more mature, get more results, and be more widely used in all aspects of society.

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