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Monocular Lane Detection By Inverse Perspective

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Abstract: *The lane line detection is through the on-board camera to deal with the captured image, to extract the lane line information from the image. The lane line detection is often applied to the advanced driving assistance systems, such as adaptive cruise lane, lane departure warning, maintain, secondly it is unmanned intelligent car vision navigation. Real-time performance, robustness and accuracy is the goal of the lane line detection research, including unmanned intelligent car visual navigation of the lane line detection real-time performance, robustness and accuracy requirements of the highest. The lane line detection method according to whether using inverse perspective image (have a bird's eye view of the image) detection is divided into the lane line detection method based on the perspective of image and image the lane line detection method based on inverse perspective.*

Keyword: *On-board camera; Lane line; Inverse perspective image*

I. INTRODUCTION

With the continuous development of information technology, the traditional basic driving system has been difficult to meet the needs of people for safe driving and intelligent driving. Therefore, in recent years, a variety of auxiliary driving system research and development has become a hot direction in the field of electronic information. This kind of auxiliary system referred to as intelligent driving system. Intelligent driving system incorporates all aspects of cutting-edge technology, including automatic control technology, artificial intelligence technology, measurement and control instruments, etc. In intelligent driving system, the lane line recognition is key and basis of the core technology, almost all of the intelligent driving system will involve the use of the lane line identification technique for precise positioning, correct and prevent the deviation of a function [1].

II. SOBER OPERATOR EDGE DETECTION

Sober operator is mainly used to get a ladder of digital image, the common application and the physical significance is edge detection. Technically, it is a discrete first-order difference operator, a ladder is used to calculate the image brightness function approximation [2]. In any of the image using this operator will produce a corresponding gradient vector or the point at which a method of vector.

Function f(x, y) is at (x, y) gradient is a vector, namely

$$\nabla f = \left[\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}\right]^T \quad (1)$$

Calculate the size of the vector is

$$|\nabla f| = \left[\left(\frac{\partial f}{\partial x}\right)^2, \left(\frac{\partial f}{\partial y}\right)^2\right]^{\frac{1}{2}} (2)$$

The direction of the gradient Angle is

$$a(x,y) = arctan(\frac{G_y}{G_x})(3)$$

Level detection edge template for

$$G_x = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \qquad (4)$$

Vertical edge detection of the lateral templates for

$$G_y = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} \qquad (5)$$

III. The plane distance measurement method based on inverse perspective transformation

We know that inverse perspective like the camera image, as of a certain plane in such as roads, theimage is a plane linear reflection in the real world. Inverse perspective images (aerial or vertical view) in theory and real plane has a strict linear relationship [3], which have a bird's eye view of each pixel in the image block (1 pix x 1 pix) corresponds to the actual area is equal to, or have a bird's eye view of the image of a certain distance between two points and the plane corresponding to the real world there are two points of distance, the DAB = k * dab.
The DAB said of which is the real world plane Euclidean distance between point A and point B, DAB represents the real world plane points A and B in the bird's eye view of the image corresponding to the Euclidean distance between points A and B, unit is the pixels, and k is A bird's eye view of the image and the real world the relationship coefficient of plane.

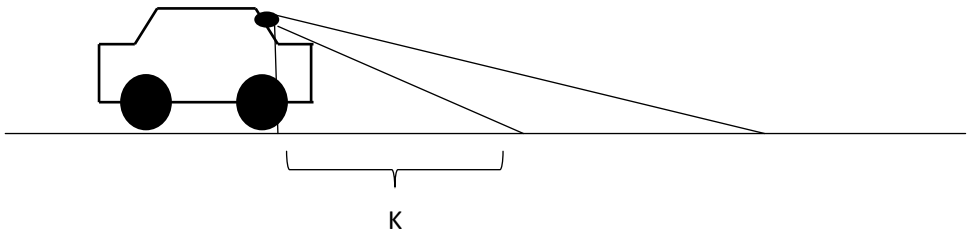

Figure 1. The car view inside schematic

In the practical application of smart car, as the camera installed in the car, the camera view generally have limited vision blind area, as shown in figure 1 sketch.

IV. MOVING TARGET TRACKING

After get the characteristics of the target, the process of target tracking is equivalent to the feature matching process between adjacent frames. Assume that shipment the rate of movement of the moving target for the same target area between two adjacent frames have sufficient overlap area as the prerequisite. Black rectangular piece of target location of the former a frame, after white rectangular block as a frame of the target position, grey as the goal in the former, After the two frame in the position of overlap[4]. Due to track moving targets in the process, can appear multiple targets in the scene, and will be sticky between the target even shade, crossover, and so on and so forth. To this end, according to the two frames in video images before and after different target formed between each other overlapping case, the target can be divided into single objective and multiple target adhesion, adhesion separation three kinds of circumstances are discussed, respectively focus on a targeted aim.

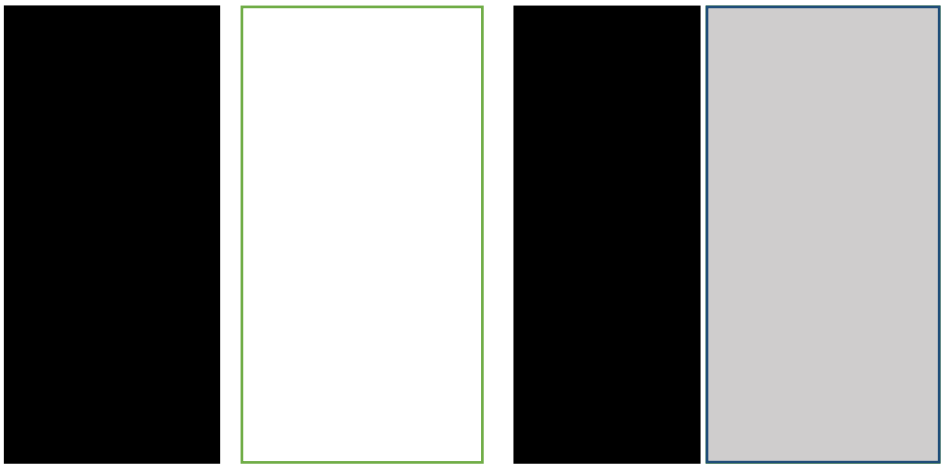

Figure 2.Moving target interface overlap area of schematic diagram

Define the target in the scene walking status as below.

(1) single target state

A single target state refers to the target with other unrelated or only one goal in the scene, is referred to as "single target state.

(2) adhesion target state

Adhesion target state refers to the target with other adhesion, made before the moment of two independent connected domain in the current frame for mutual adhesion and merged into a state of connected domain.

(3) adhesion separation target state

Adhesion separation of target state is to point to in the previous frame, because of mutual adhesion between target, merged into a state of connected domain, in the current frame, because have a goal to leave adhesion area to form a connected domain of the state of separation[5].

Color histogram is color distribution statistics, on the surface of a moving target from the target shape, posture, etc. So use histogram feature of target, and according to the matching of color distribution, has a good stability, resistance to hide partially, simple calculation method and the characteristics of small amount of calculation, is the ideal target color characteristics. In order to resist the effects of light to illuminate dark, general color histogram in HSV color is extracted.

V. VIDEO MOVING OBJECT DETECTION

Optical flow method can be roughly divided into the matching of optical flow method, frequency domain optical flow method and gradient method of optical flow 3 class. Movement of moving targets by Yu Gangliu not only carries the information also carried on the structure of a scene 3D information, so it can detect the independent movement object[6], scene any information do not need to know in advance, and to be able to use in the static background and exercise background two kinds of environment. But because of the noise, light, shadow, transparency, and keep out the reason, makes the light of the calculated flow field distribution is not very reliable and accurate. And most of the optical flow method to calculate complex and time-consuming, unless there is a special hardware support, otherwise it is difficult to realize real-time detection.

VI. THE LANE LINE DETECTION AND TRACKING

Although the lane line detection method based on the perspective of image has many shortcomings, but does not mean this kind of detection method isn't there a research value and use value. It is not the same as the lane line detection method based on the specific application requirements method is different also. Although the lane line detection method based on the perspective of image is not suitable for unmanned intelligent vehicles vision navigation, but it is often for lane departure warning system [7].. In addition, every coin has two sides, the same to do scientific research, we can give full play to the advantages of image detection method based on the perspective, first lane line for perspective image, and extract the lane virtual axis, finally converted to world coordinate planes to meet the requirements of unmanned intelligent vehicles vision navigation, as shown in figure 3.

Using the formula Gray = (R + B) / 2 Gray, R, and G, respectively is the value of red and green channel. Lane line is mainly white and yellow color, its value is white (255,255,255), yellow (255, 255, 0).

Here with the method of differential gradient edge detection, and not the classical edge detection methods, such as Canny, Sobe1, etc. Edge detection principle and the principle of attention are as follows [8]. The principle of edge extraction is according to lane line will produce larger extraction divide, big is also known as potential larger point is the point of the edge, as shown in figure 3.

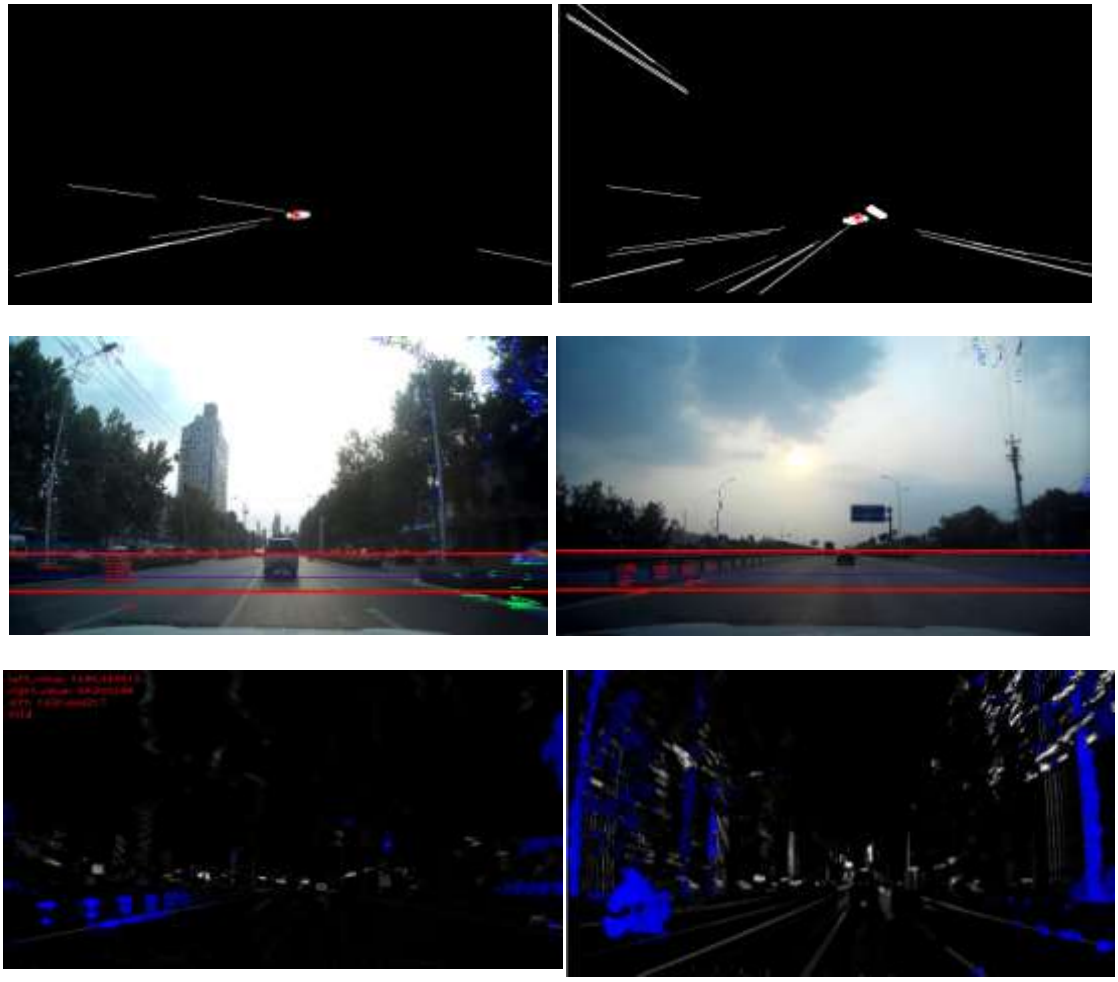

Figure 3.Lane Detection Result

VII. SUMMARY

Specifically for type curve observed the lane line, looking for high accuracy, fast and practical algorithm. In the existing detection system based on image, on the basis of trying for pavement video detection technology research. Looking forward to the future, intelligent transportation systems and intelligent vehicle research and

development, will get rapid development. More and more people into the auxiliary driving system technology research. The machine vision technology to the environment adaptability, still need to further improve the processing speed and algorithm. This topic put forward quickly, high recognition rate and high robustness lane line recognition algorithm, get some progress in the field of lane line intelligent identification.

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