INNOVATION

CAMERA BASED SOLUTIONS FOR IMAGE PROCESSING – TO DETECT PARKING SPACE AVAILABILITY

ABSTRACT

As there are more cars on the road, parking is becoming a more challenging issue in urban areas.Many studies have been done over the past ten years in an effort to create the optimum autonomous.There is an automated system that can park a carfor you, but it needs to know which spots are available and which are taken.The approach for parking spot detection proposed in thispaper uses image recognition.This study offers suggestions for parking-space occupancy detection, open parking space visualisation, parking data, wireless networking, widely available components, and.The camera may broadcast a live feed of the parking lot to the system.Images are taken each time a car enters or leaves the parking lot.

INTRODUCTION

- In recent years, visual detection has been the research trend of artificial intelligence, especially in the direction of autonomous driving. When detecting distance with radar in traditional parking [1,2,3], there must be a reference vehicle on both sides of the parking space. Furthermore, the position and angle of parking are strictly required. To solve the above problems, visual parking systems [4,5] have been proposed. During these years, many scholars have completed extensive research in the field of vision detection parking systems.
- Target detection has been widely studied. It is mainly designed for specific targets, such as face recognition and pedestrian detection. However, it is not easy to detect other targets [6,7,8]. To address this issue, Suhr et al. [9] proposed an end-to-end single-stage parking space detection method, which used Convolutional Neural Network (CNN) to simultaneously obtain global information and local information, and combined them with the attributes of the parking space to detect the parking space. Dusan et al. [10] utilized active visual ID tags to simultaneously locate and identify vehicles. The tags with 2-D color can be captured by cameras above the parking lot, thus effectively protecting against changes in ambient lighting and helping to reduce costs.

IMAGE PROCESSING

An image is a matrix composed of a pixel. Image processing is to manipulate the pixel matrix. For color images, the color of a pixel can be represented by Formula (4), where (x, y) represents the coordinates of the pixel, and any color can be represented as the linear sum of three basis vectors. Therefore, the corresponding colors of the specific pixels can be changed by determining the specific coordinates of the pixels and changing the values of the three-color channel corresponding to the pixels. It can be seen from the formula that after the coordinates of the pixel point are determined, the color of the pixel point can be changed by changing the RGB channel value corresponding to the coordinates of the pixel point.

With the model trained by deep learning, some small areas can be detected and extracted from the panoramic aerial view. These areas contain images of only one parking space, which are raw RGB color images. To process color images, we need to adjust the RGB values separately, which greatly increases the computation. At the same time, RGB images cannot represent morphological features, but image colors.


Free
parking spot
Wrong parking
Only electric
car
Non-electric
car
Parking
time is out
R
Reserved
parking spot

IMAGE ENHANCEMENT

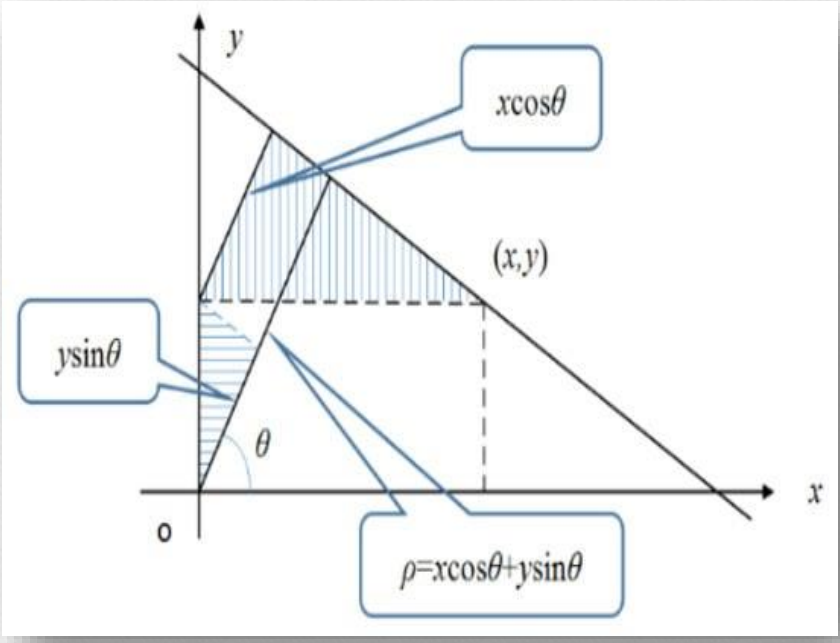
There will be a lot of noise in the image because the camera will be disturbed by many factors when taking photos. It will interfere with the identification of parking spaces. The region of interest in the image is enhanced to reduce noise interference and improve the accuracy of recognition. That is to preserve the details of the image and suppress the noise as much as possible, which is necessary to filter. The filtering effect will directly affect the subsequent processing and recognition. In this paper, spatial domain enhancement is selected because it is more suitable for parking detection. Median filtering [25] is better than Gaussian filtering in detail retention and image noise suppression. After a comprehensive comparison, median filtering is finally selected. The principle of median filtering is to use a filter template of a certain size to average the region of a certain size in the image. A 3 × 3 filter template is utilized as an example. The filter template is composed of the pixels to be processed and the 8 pixels around them. The concept of the fuzzy radius is utilized in median filtering. The fuzzy radius of the 3 × 3 template is 1.

BINARIZATION

Threshold segmentation should be carried out on the image before parking space recognition. The foreground and background should be separated, which is called binarization [26]. The most basic threshold segmentation method is global binarization. It obtains the global threshold through the gray level calculation of the whole image. The pixels higher than this threshold are set to 255. The pixels lower than thresh are set to 0. The formula is shown in (6), where x represents the gray value of the input pixel, $f(x)$ represents the gray value of the calculated output pixel, and T is the threshold value of binarization. The maximum inter-class variance method OSTU [27] is used to calculate the optimal threshold T.

HOUGH TRANSFORM

Four vertices need to be positioned after the pre-selected parking space is obtained. In this paper, an improved Hough transform method is adopted to make the decision. Hough transform [31] is a method to transform the straight-line detection problem into the point detection problem in the polar coordinate system. Cartesian and polar coordinates can be converted. Under the rectangular coordinate system of a straight line corresponds to the polar coordinates of and . In the figure, is the angle between the line perpendicular to the line and the *X*-axis. is the distance between the origin and the given line.



CONCLUSION

A fisheye camera was used to take real-time pictures of the surrounding environment of the vehicle. At the same time, a faster R-CNN parking detection model was established, which could detect and extract parking spaces from images as the image input of the parking positioning system. Additionally, we addressed the inability of global binarization to handle images with uneven lighting or complex backgrounds by removing background light from the original image. A parking space extraction method based on connected regions was proposed. This method simplified the extraction of parking spaces. It removed interference from irrelevant areas. Finally, the identification and positioning of parking spaces have been realized. The experimental results show that the proposed method can accurately complete the tasks of parking space detection and image processing in the case of uneven illumination or complex background.


THANK YOU