

An Appearance based Parking Slot Detection and Tracking using Background Subtraction

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Abstract: Appearance-based approach is a method used to perform recognition of the images. Here Appearance-based approach is used to detect available car parking space with the help of Background Subtraction. The Background Subtraction with adaptive background model is used as the object (cars) detection module. It is an effective method for detecting moving objects in video. Since this method assumes that image variations are caused only by moving objects (i.e., the background scene is assumed to be stationary) however, it was applicability limited. We propose a background subtraction method that robustly handles various changes in the background and also it recognize the positions and occupancies of various types of parking slot markings, stably track them under practical situations in real-time manner. The tracking process carried through in Android application in mobile phones. The parking area can be viewed in smart phones. The proposed system consists of three stages: parking slot occupancy, parking slot occupancy classification and parking slot marking tracking. The proposed system is expected to help drivers conveniently select one of the available parking slots and support the parking control system by continuously updating the designated target positions.

Keywords: Appearance-based approach, Background subtraction, Adaptive background model, parking slot marking detection.

I. INTRODUCTION

Due to the rapidly growing interest in parking aid products, automatic parking systems have been extensively researched. Target position designation is one of the primary components of automatic parking system. This has been explored in a variety of ways that can be categorized into four types: user interface-based, free space-based, parking slot marking-based and at last the infrastructure-based approaches.

Most of the (semi-) automatic parking system products on the market designate target positions by the process utilizing a user interface-based approach via a touch screen or a free space-based approach via ultrasonic sensors (usually mounted on both sides of the front bumper). Once the target position is designated, the system generates a path from the initial position to the target position and autonomously controls the steering to follow the path. For this purpose, it continuously estimates the ego-vehicle position using in- vehicle motion sensor-based odometry.

The video surveillance system is an important system and can find in many areas both in parking lot or public areas. Most video surveillance systems are passive system. They always monitor events from recorded videos. With development of computer vision technology, the system can do some functions automatically. For example, we can detect abnormal events at a road or can detect available car space parking lot.

The proposed system consists of three stages: parking slot marking detection, parking slot occupancy classification, and parking slot marking tracking. First, the parking slot marking detection stage recognizes various types of parking slot markings in appearance-based approach using background subtraction. Second, the parking slot occupancy classification stage probabilistically identifies vacancies of the detected parking slots using video camera surveillance. Finally, the parking slot marking tracking stage continuously estimates the position of the selected parking slot while the ego-vehicle is moving into it. Server updates the positions that are available to park the car. Also it helps the user (driver) to view occupied and booked slots using the background subtraction with android application.

The proposed parking slot marking detection method is based on the appearance-based approaches. Background subtraction helps to detect the available vacant slot. The background subtraction runs with the help of foreground method. Foreground detection is one of the major tasks in the field of Computer Vision whose aim is to detect changes in image sequences.

II. PARKING CLASSIFICATION

A. Parking slot marking detection

The proposed parking slot marking detection method is based on the appearance-based approaches. Background subtraction helps to detect the available vacant slot. The background subtraction runs with the help of foreground method. Foreground detection is one of the major tasks in the field of Computer Vision whose aim is to detect changes in image sequences.

B. Parking slot occupancy Classification

The proposed system classifies occupancies of the detected parking slots by utilizing the surveillance camera. This is ingrained as android application with the help of back ground subtraction and the user can find the occupied slots in their android mobiles.

C. Parking slot marking and tracking

In this proposed system the marking tracking process is to find the vacant and occupancy slot and that can be viewed by the android application users in android mobile. With this application the user can track the available vacant slot and select the desired vacant slot to park the car.

III. METHODOLOGY

A. Histogram analysis

A histogram is a graphical representation of the distribution of data. For the construction of histogram, the first step is to “bin” the range of values divide the entire range of values into a series of small intervals of values, and then count how many pixel values fall into each interval. Histograms are used to graph the density of data of an image, and also for density estimation.

This method compares the pixels of parking spots with those of an empty parking pavement with road. If there is a large degree value of similarity in both then it means that the parking spot is probably empty whereas if there is a low degree of similarity then it means that there is a car parked in the spot.

The histogram analysis is a main key tool in image processing. It is one of the most useful techniques in gathering information about an image. It is especially useful in viewing the contrast of an image. The background image of the car and parking area were splitted using the value of pixels. Further if they are well spread out, it splits the a high contrast image.

This method compares the pixels of parking spots with those of an empty parking pavement and for a road texture. If there is a high degree of similarity in both then it means that the parking spot is probably empty whereas if there is a low degree of similarity then it means that there is a car parked in the spot.

In this figure the overall pixel was calculated and then it was equalized, the image it was change the contrast and where it changes low to high value. After that it was move to next step for Background subtraction.

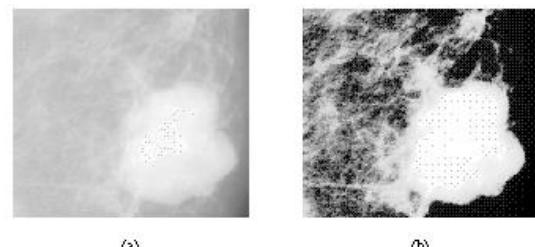


Fig.1: Image before and after equalization

Histogram-Equalization

After an image has been equalized the features become much more defined and easier to identify for the viewer.

B. Background subtraction

Background subtraction is a computational vision process of extracting foreground objects in a particular scene. A foreground object can be described as an object of attention which helps in reducing the amount of data to be processed as well as provide important information to the task under consideration. Often, the foreground object can be thought of as a coherently moving object in a scene.

Background subtraction is a widely used approach for detecting moving objects in videos from non-movable cameras. In this were the car is moving (dynamic) from that we were extracting the foreground object (i.e., car) and in which it was separated from the background image.

There are many challenges in developing a good background subtraction algorithm. First, it must be robust against changes in illumination. Second, it should avoid detecting movable background objects such as moving leaves, rain, snow, and shadows cast by moving objects. Finally, its internal background model should react quickly to changes in background such as starting and stopping of vehicles.

Background subtraction, also known as Foreground Detection, is a technique in the fields of image processing and computer vision wherein an image's foreground is extracted for further processing (object recognition etc.). Generally an image's regions of interest are objects (humans, cars, text etc.) in its foreground.

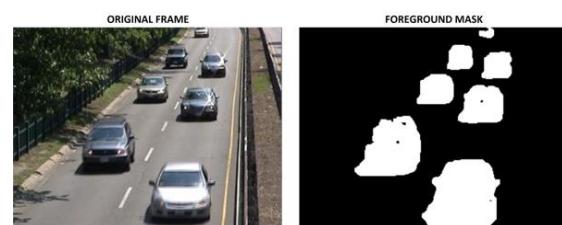


Fig.2: Background subtracted image

After the stage of image preprocessing (which may include image de-noising, post processing like morphology etc.) object localization is required which may make use of this technique. Background subtraction is a widely used approach for detecting moving objects in videos from static cameras. The rationale in the approach is that of detecting the moving objects from the difference between the current frame and a reference frame, often called “background image”, or “background model”. Background subtraction is mostly done if the image in question is a part of a video stream. From this process after it was updated to the web server. This is one part and another part will carry over to Android server. From that it was updated to smart phones, it was connected through Internet.

C. Web server process

A web server is a computer system that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer either to the entire system, or specifically to the software that accepts and supervises the HTTP requests. Decisions are update to web server receives the value from the DB via MATLAB. we send SMS and MAIL (per day 1) to administration for delayed car duration (12 hours above) based on Validate the information's. A web server is a computer system that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer either to the entire system, or specifically to the software that accepts and supervises the HTTP requests.

The most common use of web servers is to host websites, but there are other uses such as gaming, data storage, running enterprise applications, handling email, FTP, or other web uses.

The primary function of a web server is to store, process and deliver web pages to clients. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). Pages delivered are most frequently HTML documents, which may include images, style sheets and scripts in addition to text content.

A user agent, commonly a web browser or web crawler, initiates communication by making a request for a specific resource using HTTP and the server responds with the content of that resource or an error message if unable to do so. The resource is typically a real file on the server's secondary storage, but this is not necessarily the case and depends on how the web server is implemented.

D. Android application service

Android application collects all information from server through web server, and it calculates total no of slots, engaged and free slots. It shows graphical view for engaged and free slots via apps. It validating information's continuously to the web server. Android software development is the process by which new applications are

created for the Android operating system. Applications are usually developed in the Java programming language using the Android Software Development Kit, but other development tools are available.

Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touch screen mobile devices such as smart phones and tablet computers, with specialized user interfaces for televisions (Android TV), cars (Android Auto), and wrist watches (Android Wear). The OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Many smart phones are developed with different OS for the customer convenient and it was useful for playing games and for application design etc.

In the Android part we can view from our smart phone and were from any distance. The web server will update the status of the car parking whether the slot is free or not. From the mobile we can view and also we book the relevant parking slot as the need of customer.

Android is popular with technology companies which require a ready-made, low-cost and customizable operating system for high-tech devices. Android's open nature has encouraged a large community of developers and enthusiasts to use the open-source code as a foundation.

E. Decision process

The car parking area was filled by car means it defined as “Occupancy”. The car parking area has a free space means it defined as “Vacancy”. This decision updated to server part.

IV. SYSTEM DESIGN

This System mechanism explains that all MAT lab process and ANDROID part. Where server to server communication process will take place. The calling process will be done by the URL method.

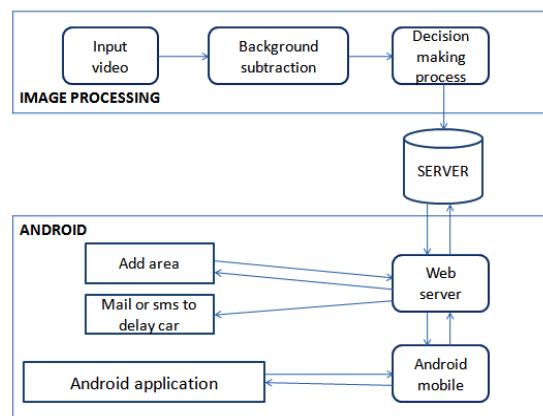


Fig.3: System architecture

From the image processing where background subtraction is done, where the car was detected from the slots. Next process will carry over to Android, the smart phone will be used to view the car parking area. It is a server to server communication in which the second part will have features like Add area, Mail or sms to delay car.

V.CONCLUSION

The vacant parking slot detection can be tracked accurately and occupied easily with the help of background subtraction using android application. In the existing system they used hardware components which is costly but in this proposed system an android application is used which is cost effective and easy to handle. Moreover the day-night issue in the existing system was overcome by this appearance-based approach.

Where many car parking android application were developed for games only. This project was developing for the real time application, from this we can spot the parking area and select the slot. This will reduce the driver tension and also saves the fuel.

Through this method we can able to view the parking area and also select the particular parking slot and it will wait for a while. For the future development it was developed under the Night mode vision, Outdoor parking and etc.

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