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Vehicle detection using MATLAB

Roshni M.
roshnimandrwad27@gmail.com
PDA College of Engineering, Kalaburagi, Karnataka

Maleka Anjum
malekaanjum786@gmail.com
PDA College of Engineering, Kalaburagi, Karnataka

Noorain Fatima
noorainfatima77@gmail.com
PDA College of Engineering, Kalaburagi, Karnataka

ABSTRACT

Automatic detection and counting of vehicles in unsupervised videos on highways are very challenging in computer vision with important practical applications like monitoring traffic activities. Counting the number of objects is an integral part of image processing. Knowing the number of objects present in the image is very useful in wide range of applications. The main objective of our study is to develop the methodology for automatic vehicle detection and its counting on highways. A system has been developed to detect and count objects efficiently. We present a system for detecting and tracking vehicles in surveillance video which uses segmentation with initial background subtraction using the morphological operator to determine salient regions in the sequence of video frames. Determine salient regions in the sequence of video frames.

Keywords: *Foreground detection, Vehicle detection, Background subtraction, Image segmentation, Morphological operation*

1. INTRODUCTION

To control traffic management image processing has been introduced. It is Easy to calculate traffic density which is cost-effective. Image processing can detect vehicles in any climatic conditions. Using the information given by image processing technique, the user will get traffic density at the location of his choice. Works with latest technologies like digital image processing. The system consists of cameras that monitor traffic by capturing videos. Extracts video frames at regular intervals and frames are compared to determine whether there is traffic or not.

Image Processing is a technique to enhance raw images received from cameras/sensors placed on space probes, aircraft and satellites or pictures taken in normal day-to-day life for various applications. An Image is a rectangular graphical object. Image processing involves issues related to image representation, compression techniques and various complex operations, which can be carried out on the image data.

The operations that come under image processing are image enhancement operations such as sharpening, blurring, brightening, edge enhancement etc. Image processing is any form of signal processing for which the input is an image, such as photographs or frames of video; the output of image processing can be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.

2. RELATED WORK

A brief survey of the related work in the area of video segmentation and traffic surveillance is presented in this section. Chen et al., [1], [2] have addressed the issues regarding unsupervised image segmentation and object modelling with multimedia inputs to capture the spatial and temporal behaviour of the object for traffic monitoring. In [3] algorithms for vision-based detection and classification of vehicles in monocular image sequences of traffic scenes are recorded by a stationary camera. Processing is done at three levels: raw images, region level, and vehicle level. Vehicles are modelled as rectangular patterns with certain dynamic behaviour. Daniel et al., [4] presents the background subtraction and modelling technique that estimates the traffic speed using a sequence of images from an uncalibrated camera. The combination of moving cameras and lack of calibration makes the concept of speed estimation a challenging job. Cheng and Kamath [5] compare the performance of a large set of different background models on urban traffic video. They experimented with sequences filmed in weather conditions such as snow and fog, for which a robust background model is required. Kanhere et al., [6] applies a feature tracking approach to traffic viewed from a low-angle off-axis camera. Vehicle occlusions and perspective effects pose a more significant challenge for a camera placed low to the ground. Deva et al., [7] proposes a concept to automatically track the articulations of people from video sequences. This is a challenging task but contains a rich body of relevant literature. It can identify and track individuals and count distinct people. Toufiq P. et al., in [8] describes background subtraction as the widely used paradigm for detection of moving objects in videos taken

from static camera which has a very wide range of applications. The main idea behind this concept is to automatically generate and maintain a representation of the background, which can be later used to classify any new observation as background or foreground. In [9] background subtraction also involves computing a reference image and subtracting each new frame from this image and thresholding the result. This method is an improved version of adaptive background mixture model, it is faster and adapts effectively to changing environments.

3. SYSTEM DESIGN AND IMPLEMENTATION

This is the block diagram showing different stages of the system

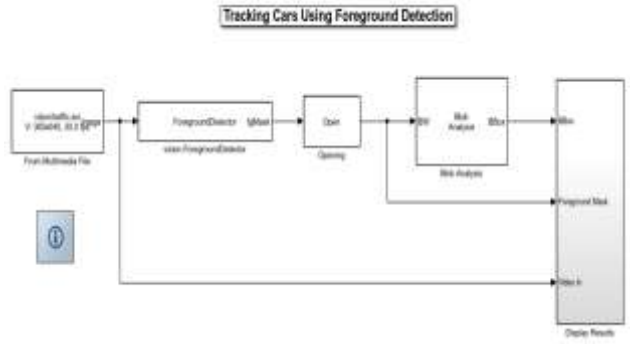

Figure 1: Vehicle Detection

The figure above shows the block diagram (flow chart) for the proposed system which is divided into different modules.

First the video input is given to the system which is from a CCTV camera in the case of real time. But here the test is done using videos of real-time situation. The videos given as input are of the same resolution as the video from a CCTV camera. In the second stage the video is extracted to frames for analyzing the video frame by frame.at a time single frames are analyzed. In the third stage we check for any cars in the incoming frames and if any save that frame to a memory location and keeps the coordinates of the cars in an array. The next stage checks whether the frame is first frame or not. If it is first frame store it as background image after a conversion from R GB to gray. And the next coming frames are also converted to grayscale and compared with the stored background image. If there is any change is detected. That is any new object is come in next frames (moving or stationary), that will save as the foreground image. If there is no change the result of background subtraction will be zero i.e., we will get a black image. So now after change detection we have to ignore the moving objects and concentrate on stationary objects which are not in the scene before.so we avoid the motion changes using some thresholding method. And find the stationary objects. We avoid stationary objects of small area. Because of chance of presence of noise. And find the objects of some range of area. After this operation the resulting image will be a binary image showing objects detected as white and all other as black.

Now we calculate the centroids of objects including the cars which are saved earlier to a particular location. Then we have to track the stationary objects in order to detect when it is abandoned. So we keep an eye on each object is alone without the presence of its owner for a particular time delay, the object is termed as abandoned, and when the object is detected as abandoned we find the minimum distance car centroid from the object centroid in order to find the car of the owner. And finally, we make an alarm or pass a message to the authority subject to the detection of the abandoned object and displays the frame from the video in which the car of the owner is marked inside a box. And if there is no object is detected as abandoned the process is repeated looking for any change in the incoming frames. i.e. Looking for foreground image. This process repeats.

3.1 Video acquisition

This processing unit is the process of importing the video from a video stream and capture into sequence frames.

Video Stream – This method receives a streaming video from a file or a CCTV camera. Currently, the following video file formats are supported, mp4, avi, bmp, and others. By far, this paper works with only one video from one camera or one video file at a time.

Sequence Frame – After the program reads the video file, it takes and processes each image by querying frames from the video file.

Capture Image Displaying – Creating a window in which the captured images from the camera will be shown on that window.

4. RESULTS

Detecting and counting cars can be used to analyze traffic patterns. Detection is also a first step prior to performing more sophisticated tasks such as tracking or categorization of vehicles by their type.

This example uses the vision. Foreground Detector to estimate the foreground pixels of the video sequence captured from a stationary camera. The vision. Foreground Detector estimates the background using Gaussian Mixture Models and produces a foreground mask highlighting foreground objects; in this case, moving cars. The foreground mask is then analyzed using the Blob Analysis block, which produces bounding boxes around the cars. Finally, the number of cars and the bounding boxes are drawn into the original video to display the final results.

Figure 2: Video Frame

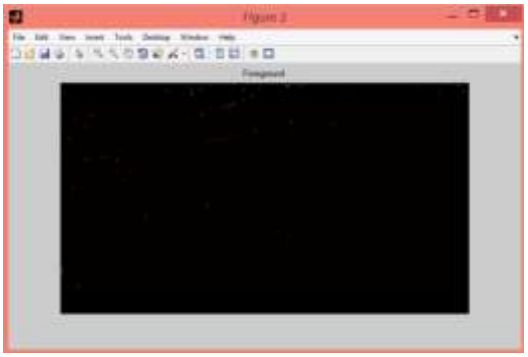

Figure 3: Foreground

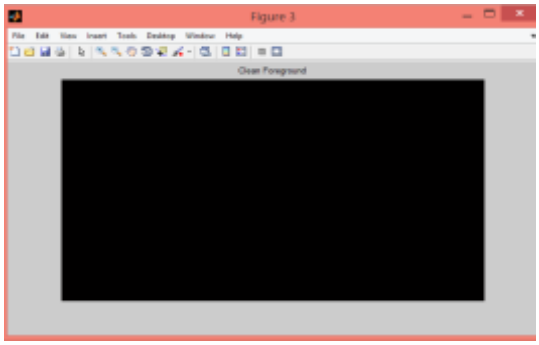

Figure 4: Clean Foreground

Figure 5: Counting of cars

Figure 6: Counting Of Cars

5. CONCLUSION

"Vehicle Detection using image processing" technique that we propose overcomes all the limitations of the earlier (in use) techniques used for controlling the traffic. Earlier in automatic traffic control use of timer had a drawback that the time is being wasted by a green light on the empty. This technique avoids this problem. Upon comparison of various edge detection algorithms, it was inferred that Canny Edge Detector technique is the most efficient one. The project demonstrates that image processing is a far more efficient method of traffic control as compared to traditional techniques. The use of our technique removes the need for extra hardware such as sound sensors. The increased response time for these vehicles is crucial for the prevention of loss of life. The major advantage is the variation in signal time which control appropriate traffic density using Image matching. The accuracy in calculation of time due to single moving camera depends on the registration position while facing road every time. The output of GUI clearly indicated some expected results.

6. FUTURE WORKS

- **Processing time.** Full search in the frame takes a large amount of time. We reduce searching time by searching only in some parts of the image. We use motion to trigger the search and search only in the moving region. However, this is still too slow for real-time applications. A searching algorithm such as hierarchical search or block matching algorithm might be able to make this program faster because it reduces the number of pixels to be searched.
- **Occlusion.** We do not include occlusion in the program. If an occlusion occurs, tracking accuracy will be severely degraded. One way to fix it is to use the database keeping the template of a couple of last frames and keep track of the mean absolute difference or correlation in template matching. If the difference increases (or the correlation decreases) dramatically and abruptly, it suggests that occlusion already occurs. Then, the program could wait until the occlusion passes, or use an old template in a database instead of a template of an occluded object.
- **Motion Analysis.** Another area that is very challenging. The segmented moving object from tracking can be further analyzed with the statistics of each motion to verify whether a car is speeding or not, or whether a person is running, walking, or jumping.

7. REFERENCES

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