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Prabhakar Telagarapu

Dept.of.ECE,GMR Institute of Technology, Rajam, Srikakulam District, Andhra Pradesh- 532127, India,
Prabhakar.t@gmrit.org

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A Novel Traffic Tracking System Based on division of Video into Frames and Processing

Prabhakar Telagarapu, B. Jagdishwar Rao, J. Venkata Suman & K. Chiranjeevi

Dept.of.ECE,GMR Institute of Technology, Rajam, Srikakulam District, Andhra Pradesh- 532127, India
E-mail : Prabhakar.t@gmrit.org

Abstract - The objective of this paper is to visualize and analyze video. Videos are sequence of image frames. In this work, algorithm will be developed to analyze a frame and the same will be applied to all frames in a video. It is expected see unwanted objects in video frame, which can be removed by converting colour frames into a gray scale and implement thresh holding algorithm on an image. Threshold can be set depending on the object to be detected. Gray scale image will be converted to binary during thresh holding process. To reduce noise, to improve the robustness of the system, and to reduce the error rate in detection and tracking process, morphological image processing method for binary images is used. Morphological processing will be applied on binary image to remove small unwanted objects that are presented in a frame. A developed blob analysis technique for extracted binary image facilitates pedestrian and car detection. Processing blob's information of relative size and location leads to distinguishing between pedestrian and car. The threshold, morphological and blobs process is applied to all frames in a video and finally original video with tagged cars will be displayed.

Keywords - Image, video, threshold, morphological operations, Blob analysis, visual tracking.

I. INTRODUCTION

Road transportation systems have been subject to constant increase in traffic congestion and accidents during the last years. With increased number of vehicles on the road, and elevated degree-of-the complexity of the traffic problems, employment of advanced traffic monitoring technologies using artificial intelligence and automation becomes necessary. Of particular interest, is traffic control in randomly populated intersections that do not have a fixed pattern for predetermined traffic signal adjustments. Commonly used loop detectors only detect vehicles crossing the intersections and cannot be used for tracking and model the flow of pedestrians. A vision-based pedestrian and car tracking system which is able to distinguish between car and pedestrian as well as being able to report if pedestrian is waiting or crossing the street, can be a solution to this problem. This system can provide the traffic controllers with better input data statistics to control the traffic signals. Many researches and works have been done on image processing as well as tracking, surveillance and monitoring. Digital image processing and visual tracking have been extended to traffic monitoring applications, human and pedestrian detection and tracking as well as vehicle tracking. Some models have been used to distinguish between people and other subjects. But since the system is designed for indoor scene, for outdoor applications of this system, the outdoor noise may cause some error. To remove the

outdoor noise a denoising method employing Bayes Shrinking is used. This forms the pre-processing stage. Work is done describing a pedestrian detection system that integrates image intensity information with motion information. The algorithm scans a detector over two consecutive frames of a video sequence. Motion extraction is done by subtracting the information of two separate regions in rectangle filters. Some systems deployed are able to detect waiting pedestrian based on background subtraction method, and the background detection and background update is done when there is no pedestrian waiting. However, in busy intersections it is hard to find such a gap. Work reported in some papers extends a system based on background subtraction and analysis of moving areas in video sequence. A mask is applied to ignore the undesired regions. Optical flow method is combined with background removal to increase the robustness. The work presented in this project conveys the development and testing of vision based tracking system for pedestrian and vehicles in intersection. Objects of interest are tagged using the proposed algorithm. This system is designed to handle outdoor noise in the pre-processing stage. Algorithm also involves proposed work to distinguish between pedestrian and cars. Moreover, the unique feature of this system is that it is able to tag interested pedestrians or cars waiting for traffic light or they are crossing the street. A package has been developed in MATLAB®. btained.

1.1 Tracking Algorithm

Strategies

Step 1: Access the Video and explore it.

Step 2: Develop the Algorithm

Step 3: Apply the Algorithm to the Video

Step 4: Visualize Results

1.2 Video-Preprocessing

Fig1.1 : Flowchart for Video-preprocess

1.3 Tracking Pre-Process

Fig1.2 : Flowchart illustrating tracking process

1.4 Exploring the Video

Step 1 : Access Video with MMREADER

Use mmreader to access the video and get basic information about it.

Video Parameters: 15.00 frames per second, RGB24 160x120. 120 total video frames available. The get method provides more information on the video such as its duration in seconds.

Step2 : Explore Video with IMPLAY

Step 3: Development of Algorithm

II. EXPERIMENTAL RESULTS

2.1 Sample Frame to apply the algorithm

Fig 2.1: A Sample frame taken to apply the algorithm

A frame that has both light coloured and dark coloured cars is taken in order to apply our algorithm and realize the goal of tagging the light coloured cars

Fig. 2.2 : A RGB to gray converted image affected by Gaussian noise

2.2 Case 1: Pre-processing stage

To eliminate external noise in the frame by de-noising technique

Fig 2.3: De-noised image after pre-processing stage

Conclusions from our first experiment:

- In the processed image, the external noise induced due to weather conditions and other external sources has been removed.

2.3 Case-2

To eliminate dark coloured cars in the image frame
Determining threshold to tag desired cars

- To eliminate the dark-coloured cars, determine the average pixel value for these objects in the image
- Specify the average pixel value (or a value slightly higher) as the threshold

Algorithm :

Fig. 2.4 : flowchart demonstrating classification of objects in the frame

Fig. 2.5: Result of applying threshold to eliminate dark coloured cars

In the processed image, note how most of the dark-coloured car objects are removed but many other extraneous objects remain, particularly the lane-markings. The regional maxima processing will not remove the lane markings because their pixel values are above the threshold. To overcome this morphological processing is used to remove small objects from a binary image while preserving large objects

2.4 Case 3

Applying Morphological processing to the frames

To perform morphological processing proper size and shape of the structuring element should be used in the operation. Because the lane-markings are long and thin objects, we use a disk-shaped structuring element with radius corresponding to the width of the lane markings.

Fig. 2.6 : Result of applying morphological processing to eliminate Small sized objects (lane markings)

Small and other extraneous objects are removed after this experiment. Now we need to tag the desired object in each frame. To achieve this Blob analysis is performed in the next experiment

2.5 Case-4

Performing Blob analysis to each frame. To complete the algorithm we must go for blob analysis (regionprops) to find the centroid and other statistical data of each frame. Use this information (statistical data) to tag the light coloured cars in the frame

Fig. 2.7: Result of applying Blob analysis (Light coloured cars are tagged)

This step we tagged the desired light or dark coloured cars in each frame. Now the algorithm should be applied to all frames. Now play the video, with the algorithm applied to all frames, to tag cars in the entire video. This completes our aim of tagging desired cars in a video of traffic

III. CONCLUSION

In this paper, we presented a framework for detecting and tracking required vehicle in traffic intersection. Pedestrians can be differentiated using the blob analysis concepts. A method for tagging a required car was proposed and applied. The tracking and distinguishing method was robust under many difficult conditions. As the experimental results proved, almost all pedestrian and vehicles were successfully identified and tracked. The key advantage of this system is that it is able to report events (i.e., waiting or crossing pedestrians), and this can be extended to control the traffic signals in intersection as a replacement for existing loop detectors and push buttons.

IV. SCOPE FOR FUTURE WORK

An adaptive background update method can be employed to analyse real-time video. Improve the system noise reduction stage to obtain better results in critical weather conditions such as heavy wind and rain. Enhance the system robustness to shadows and water surface reflection. Develop an algorithm to detect and identify overlapping objects.

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