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The Comparison Of Vehicle Speed Accuracy Using Video Based Mixture Of Gaussian 2 Method and K-Nearest Neighbor Method

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Abstract

Background subtraction has various of methods including mixture of gaussian 2 and k-nearest neighbor. Some vehicle speed detection system in previous research have different accuracy in detecting speed of vehicle. The different of accuracy arose the idea to compare the accuracy in detecting the speed of vehicles using the mixture of gaussian 2 with k-nearest neighbor supplied by OpenCV 3.0 library. During this research, four video has been recorded with scenario ofvehicle speed 20 km/h, 40 km h, 50 km/h and 60 km/h. Each video has different vehicle's speed. The program was designed and built using mixture of 2 gaussian and k-nearest neighbor. Vehicle speed parameter retrieval conducted by 10 tests of four videos,which are 20km.avi, 40km.avi, 50km.avi and 60km.avi.The speed detected at each videois compared with the actual speed to obtain such further information as percentage of error accuracy of the two methods. From the test results, it is obtained that percentage error of mixture of gaussian 2 method is 0,36%-23,73%of the actual speed. The percentage error of k-nearest neighbor method is 64.2%-58,85% of the actual speed.

Key Word: *Background subtraction, comparison of accuracy, error percentage, Mixture of Gaussian 2, K-Nearest Neighbor*

1. Introduction

Now a days, digital image processing is used in various fields which one of them is in the field of traffic. An application of image processing in the field of traffic is applied to the vehicle speed detection system. The speed detection system uses background subtraction to separate the background and the foreground image.

Background subtraction has various of methods including Mixture of Gaussian 2 and KNearest Neighbor. From various background subtraction methods, it has not been discovered a research that comparing method accuracy in detecting vehicle speed. Some of the previous studies that the vehicle speed detection system has different accuracy. Thereforea research is conducted to compare the accuracy of mixture of Gaussian 2 method with K-Nearest Neighbor predefined library OpenCV 3.0.

2. Research Method

The research method is described in the form of a block diagram. Block diagram of the research can be seen in figure Figure 1.

Tables and Figures are presented center, as shown below and cited in the manuscript.

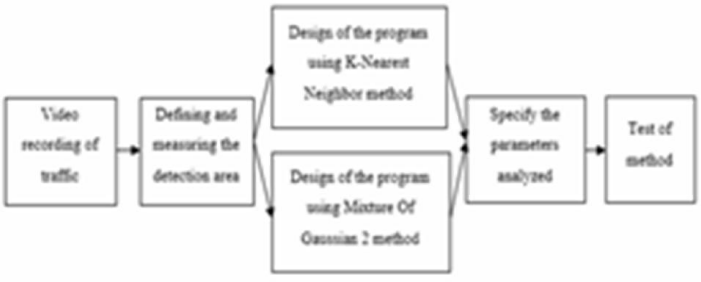

Figure 1. Block diagram of research

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Video Recording of Traffic

Video recording of traffic carried using a camera with a resolution of 13 MP.Video recording is done at 10:54 am under sunny weather conditions. The position of the camera facing downwards diagonally. In recording video, a scenario is made to get the actual speed parameter. Scenario speed recorded was 20 km/h, 40 km/h, 50 km/h and 60 km/h on a motorcycle.

Defining and Measuring the Detection Area

Area limits of detection used in this study is the motorline mark. Widthbetween motor way is 2.98 metre. Limits of detection area can be seen in Figure 2.

Figure 2.Limit of detection area.

Design of the Program using the MOG2 and KNN Method

The program design step of vehicle speed detection method and KNN MOG2 done by calling the functions that have been provided by OpenCV. Workflow speed detection program in this study can be seen in Figure 3.

Firstly, the program read the video input from the user, then the program will run frame by frame to frame in a video input discharged. While each frame is processed, the first frame will blur to eliminate noise before the input frame in the background subtraction. The process is done by calling the function blur(). Then the frames that have been in the blur will be in the background subtraction to get a moving object in the form of a binary image.

The process of background subtraction method MOG2 done by calling the function Create Background SubtractorMOG2, while the process of background subtraction method KNN calling the function Create Background Subtractor- KNN. After the binary frame has been obtained, subsequently reducing the noise in the binary frame using the morphology filter. The filter used the filter opening and closing. Opening the filter used for noise around the object in the filter using a filter while the noise inside the opening morphology object on reduction using the morphology filter closing. Filter morphology done by calling the function morphologyEx with the parameter input function for morphology closing CV_MOP_CLOSE and input parameter for the morphology opening function CV_MOP_OPEN.

The next step is finding contour of the frame that has been input in the filter. Contour search is done by calling the function findContours. Finding contour useful in detecting the speed of the vehicle. Contours which have been found on every frame will be selected in accordance with a limit of detection area. Then each contour will be sought its midpoint. After the midpoint of each contour is found, the next step calculates the speed of the contour. The parameters used in obtaining the contour velocity is displacement distance midpoint, the switching time frame. Equation is used in a previous research [12]. The equation is as follows.

$$actual\ speed = \frac{contour\ displacement distance x theorigi}{time\ x\ pathlengthof\ image}$$

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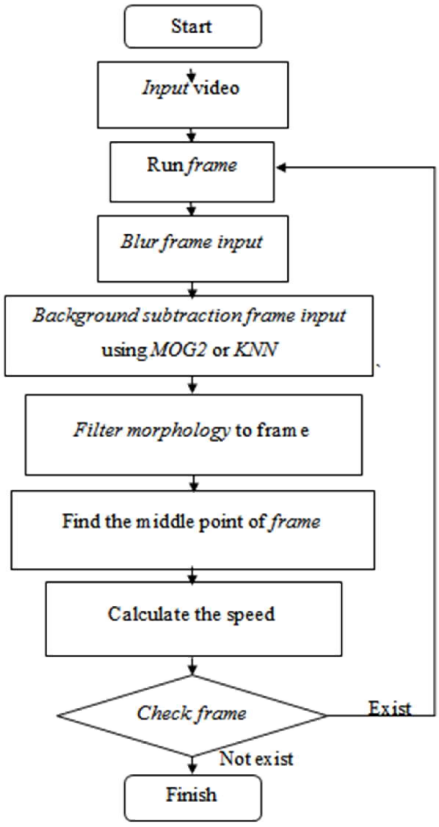

Figure 3. Flowchart Program

After the velocity contours is obtained, the next step is giving a bounding box on vehicles passing through the detection area and put speed above the contour of the object detected. The process gives a bounding box in the shape of a rectangle is done by calling the function rectangle ().while the process of putting the vehicle speed at the top of the object is done by calling the function putText ().The input frame is processed until the frame displayed on the video input depleted.Specify the parameters analyzed
Parameters taken to obtain accurate comparison MOG2 with KNN method is displacement distance midpoint, the switching time frame, the speed and the actual speed is detected. Then the speed is detected at any of the methods compared with the actual speed to get accuracy in terms of percentage error.

Testing Method

Testing method of mixture of gaussian 2 with k-nearest neighbor in every video program performed 10 -12 times by using a computer with specs Intel Core 2 Duo CPU, Windows 7 ultimate 32 bit, 2GB RAM and compiler Visual Studio 2012 . The same dominant Data from 10-12 times the test to be used as the data to be analyzed. Video examined, 20km.avi the actual speed of 20 km/h, 40km.avi with the actual speed of 40 km/h, 50km.avi with the actual speed of 50 km/h and 60km.avi with the actual speed of 60 km/h.

3. Results and Analysis

Sample results of testing program using mixture of gaussian 2 method can be seen in Figure 4.

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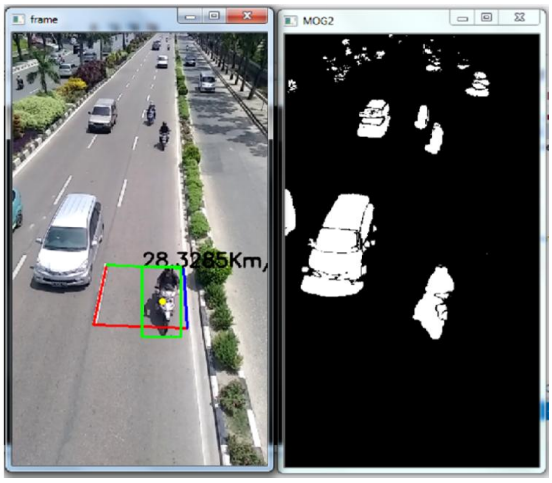

Figure 4. Sample results of testing program using mixture of gaussian 2 method.

Sample results of testing programs using k-nearest neighbor method can be seen in Figure 5.

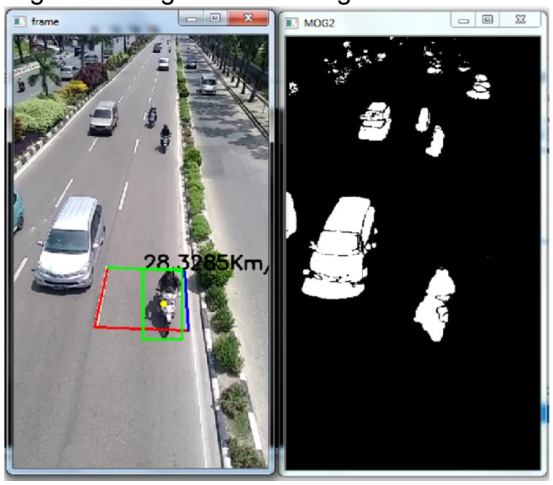

Figure 5. Sample results of testing program using k-nearest neighbor method.

Figure 6 shows the comparison of the error percentage to actual when using MOG and KNN. The graph shows that MOG has a minimum error than KNN

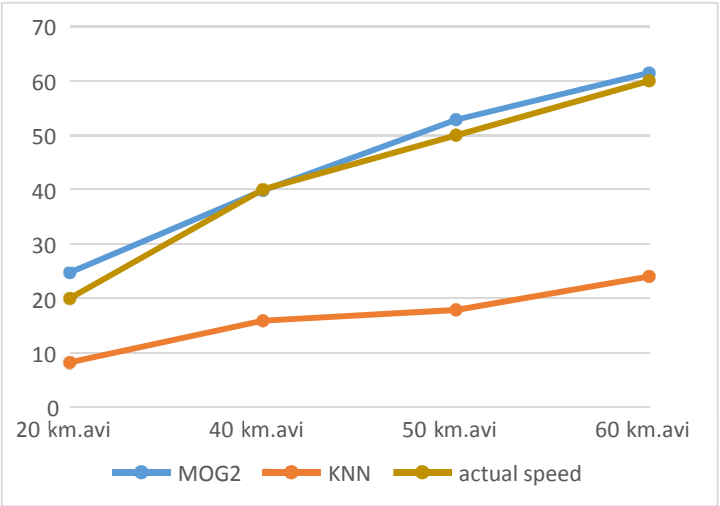

Figure 6. Comparison of the speed detected with the actual speed

4. Conclusion

Based on test results, that the method is more accurate than the MOG2 KNN method in detecting vehicle speed. The percentage of error of four videos that were tested using the method MOG2 0.36% -23.73 % of actual speed. While the percentage of error of four videos that were tested using the method KNN amounted to 64.2% -58.85%. This is caused by the switching time frame using methods MOG2 2.76 times faster than the method KNN because in KNN method, calculated distance of K value each pixel in frame should be done.

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