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AUTOMATIC LOCAL SEGMENTATION TECHNIQUE FOR DETECTION OF ROAD SURFACE CRACK

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Abstract- Image processing technique has been implemeted to detect the crack on road surface. However, the accuracy of the detection is still low due to the difficulties in segmentation between crack and non-crack area. This research proposes the implementation of Sauvola technique to perform automatic local segmentation of crack. The methodology involves pre-processing, image segmentation, feature extraction and classification step. In segmentation step, in addition to Sauvola, other techniques, i.e. manual thresholding, Otsu and Bernsen, are also implemented for comparison purpose. The result shows that Sauvola technique produces consistent segmentation results on high, medium and low quality images. Sauvola method also perform the best accuracy detection of 96% among them.

Keyword- Image Processing, Road Surface Crack, Segmentation, Sauvola Technique, Thresholding

I. INTRODUCTION

Periodic evaluation of road is important to maintain the condition of a road surface. The evaluation is performed by observing the presence of surface cracks. Currently, the observation is done manually where the officers observe the surface crack visually along the road and then they make marks on the road when the crack was founded. This conventional method is not effective since it requires long inspection time, labor intensive and not accurate. It is also dangerous when the inspection is performed in the high traffic way.

To overcome the above problem, researchers offer methods to detect the presence of cracks by utilizing camera and image processing techniques. As summarized by Chambon and Moliard[1], various techniquesbased on image processing for detection of crack are categorized into five approaches, i.e. histogram, morphology, training-testing, filtering, and modeling.Histogram approach is implemented based on an assumption that the intensity of crack region and background is separated. This approach is usually continued by applying thresholding technique to segment between the crack region and background[2-3,4]. Histogram and thresholding technique are selected mostly because of their simplicity and efficient computation process. The other approach is morphology that modifies intensity pixel of an image to significantly improve the segmentation process[5,6,7]. This approach produces better results than histogram technique.

The steps of image processing methods for crack detection are pre-processing, image segmentation, features extraction and classification step. In this paper, we focus only on the image segmentation, which is a step to differentiate between the crack and background image.The conventional method for image segmentation is thresholding technique. This technique selects a threshold value to differentiate between crack object that usually has lower pixel intensity compared to the surface pixel intensity. The selection of the threshold value might be manual or automatic whereas the value might be constant or dynamic value.

Riyadi et al.[4] apply a constant global threshold value to convert images from grayscale to binary number. Several valueswere previously selected by observing histogram of overall images data and then implemented to obtain the optimal one. The pixels with gray level below than the threshold value are segmented as crack and pixels value higher than the threshold value are considered as background. The result showed that the segmented images still contain noise or background part that is considered as crack whereas the other result, a part of crack is detected as background.

Instead of the manual global threshold value, an automatic global threshold value is also popular that firstly introduced by Otsu[8]. Otsu method assumed that the image intensity is a bi-modal histogram, i.e. object, and background. Then, the method calculates the threshold value so that the intra-class variance is minimal and the inter-class variance is maximal. The main drawback of global thresholding technique, either manual or automatic, is the fact that the real images are not bi-modal then the threshold value could not be precisely implemented on overall images data.

To overcome the global threshold problem, researchersproposed automatic local thresholding techniques, such as Bernsen technique. This technique is popular as fairly fast since it has a mechanism to reduce complex computation and does not need to compute images histogram. Other popular