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Title : AUTOMATED LANE DETECTION OF GEL ELECTROPHORESIS IMAGE USING FALSE PEAK ELIMINATION

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Large numbers of previous work regarding the study of lane detection in DNA gel image have been proposed and performed on good quality images. Current lane detection methods that are available do not accommodate techniques that can be performed automatically on poor DNA gel image. Lane detection is the first step in any gel image analysis techniques which involved tedious and time-consuming tasks. The accuracy of this step is often compromised by technical variation inherent to DNA gel image. For that reason, the aim of this thesis is to identify and propose a method that is effective in detecting the lane in poor DNA gel image of plants. The imperfection of DNA gel image caused by the electrophoresis or during the acquisition of the gel image causes many types of noises, which contaminate the resulting image. These errors and noises significantly affect the processing and analysis of the DNA gel image. The conducted experiment examines 184 poor DNA gel images collected from Agrobiodiversity and Environment Research Centre, Institut Penyelidikan dan Kemajuan Pertanian Malaysia (MARDI), Malaysia. The DNA gel images were produced by electrophoresis-based method using polymerase chain reaction (PCR)-based marker system. There are two highlighted aspects performed to achieve the objective of this thesis that are image enhancement and lane detection. The image enhancement of the poor DNA gel image is performed using two different approaches that are spatial and frequency filtering. The two approaches are compared and the quality of the enhanced images was accessed and evaluated using objective image quality metric that is peak signal-to-noise ratio (PSNR). For lane detection, we describe the convention of threshold value in the analysis of poor DNA gel image to eliminate false peak contained in the intensity profile obtained from the enhanced image data projection. A false peak elimination method was proposed in which a set of threshold interval was applied in the peak detection process to eliminate the false peak and retain the true peaks representing the lane's border. The output of this method is used to track the lane's border, further the individual lane is identified. Evaluation of the results from the proposed method in detecting the correct lanes was done by carrying out the analysis based on visual observation. Later, the performance of the method was evaluated empirically where the performance being assessed according to the discrepancy measures on the outcome of the lane detection process using confusion matrix. Based on the two approaches of image enhancement process, the average PSNR for the spatial domain filtering is 42.4727 dB whereas frequency domain filtering is 39.1417 dB. Therefore, spatial domain filtering become an exceptional approach for the enhancement of the poor DNA gel images. Further, the performance of the false peak elimination method proposed in lane detection and tracking process results with recall rate and accuracy of detecting the true peaks are 97.63% and 87.88% on poor DNA gel images while 99.57% and 95.96% on good DNA gel images. This finding shows that the proposed false peak elimination method, utilizing a set of optimal threshold interval, proves to be a promising lane detection method for both poor and good quality DNA gel images. Additionally, when the tasks of lane detection and tracking are implement automatically, the false peaks can be adequately eliminated and significantly ease the subsequent process of DNA gel image analysis.