

**UNIVERSITI TEKNOLOGI MARA**

**VISUALIZATION OF EXUDATES  
FUNDUS IMAGES USING RADAR  
CHART AND COLOUR AUTO  
CORRELOGRAM TECHNIQUE FOR  
EARLY DETECTION OF DIABETIC  
RETINOPATHY**

**HASLIZA BINTI ABU HASSAN**

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## ABSTRACT

According to World Health Organisation (WHO) statistics in 2011, about 175 million people at present are with diabetes mellitus and it will increase to 366 million by 2030. Currently, there are several tests that have been used to early detect diabetes disease and these tests are difficult and hard on patients and can result in nausea. The alternative way to make it easy on patients is by analyzing the fundus image of retina to early detect or controlling the diabetes disease. Hence in this research, visualization of exudates in fundus images using Color Auto Correlogram (CAC) technique and radar chart for early detection of Diabetic Retinopathy (DR) is proposed. The method consists of capturing several key features of the CAC extracted from fundus images and plotting these features in the form of radar chart. The method is centred on the detection and removal of exudates from the original fundus image, then comparing the CAC features of the original image with the exudate removed from the image. If exudates are present, the CAC exhibits significantly different features which can be easily distinguished using the radar chart. A total of 149 fundus images from the publicly available MESSIDOR databases were used as database in this study. The image normalization was performed to standardize the colors in the fundus images. Then, the optic disc (OD) from the fundus image was removed. Here, the RGB pixels of exudates, non exudates and background pixels were extracted as features and the intensity colours of each pixel are further classified. All 149 fundus images were fed as inputs to the Multilayer Perceptron (MLP) and Support Vector Machine (SVM) for detection if exudates were present in them. Then, each of these images was visualized using CAC technique and radar chart. From exudates fundus images, the percentage results of non-overlapping CAC features of radar charts for MLP and SVM were 88.24% and 85.29% respectively. As for normal fundus image, the percentage results of overlapped CAC features of radar charts were 81.5% for MLP and 82.7% for SVM. Furthermore, to evaluate the effectiveness of the proposed method, the experimental results have been verified by ophthalmologist too. The ophthalmologist verification showed that the percentage results of non-overlapping and overlapping CAC features of radar charts were 88.24% and 81.5%. It is followed with the validation of visualization outcomes using Artificial Intelligent (AI) techniques. Results attained showed that the accuracy of MLP classifier was 86.36%. As for SVM classifier, the accuracy obtained was 83.8%. The visualization technique proposed is indeed suitable to be used as an initial stage in early screening of this disease.

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