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Title: Automatic Detection Of Diabetic Retinopathy Including Neovascularization Based On Morphological Operations

Diabetic retinopathy is a widely spread eye disease caused by diabetes complication. Screening to detect retinopathy disease can lead to successful treatments in preventing blindness especially at early stages. Dark lesions, bright lesions and neovascularization lesions are visible signs of diabetic retinopathy and markers for different stages in retinal disease. Detecting such retinal abnormalities in a large number of images generated by screening programmes, is very expensive in professional time and opens to human error. An automated decision support system for the purpose of detecting and classifying retinal abnormalities is carried out mainly using an image processing methods. The retinal images are automatically analysed in term of pixel-based diagnostics accuracies after comparing with ophthalmologist's hand-truth. An adjusted morphology-based, thresholding and mathematical-based pixel segmentation methods are developed to segment the bright lesions from background and distinguished from other retinal pathologies. Gradient classifier has been used to distinguish hard exudates and cotton wool spot from the bright lesion segmentation result. The preliminary pixel-based hard exudates and pixel-based cotton wool spot analyses are used to support the fact that development of a reliable retinal abnormalities identification system is feasible.

Detecting dark lesions is more complicated than bright lesions due to the size and uneven illumination of the images. There are small and large dark lesions detection methods. Image enhancement, image restoration, morphological operator, thresholding and compactness properties techniques have been used in the development of automatic dark lesions detection system. Blood vessel and fovea extraction are also included in the process of dark lesion detection to improve the pixel-based diagnostic accuracy. Detection of neovascularization is important since it signifies the disease has reaches a vision-threatening phase. The major challenge in this neovascularization detection system is that the size of neovascularization is smaller than natural blood vessel in the retina, and also a factor of uneven illuminated images. Therefore, image normalization, morphology-based operator, Gaussian filtering and thresholding techniques are used in developing the neovascularization detection. Moreover, a function matrix box based on predefined criteria of neovascularization have been used in order to classify the neovascularization from natural blood vessel. A region based neovascularization classification was attempt as a diagnostic accuracy since the characteristics of neovascularization are more complicated than other pathologies.