

Three Level Automatic Segmentation of Optic Disc using LAB color space Contours and Morphological Operation

Abstract: The optic disc, also known as the optic nerve head, is a critical structure in the eye that plays a vital role in vision. It is the point in the retina where the optic nerve exits the eye and carries visual information from the eye to the brain. The optic disc serves as a vital location for diagnosing and tracking various eye conditions. Fundus disorders like Glaucoma are a serious health risk that affects people all over the world, lowering their quality of life. The optic disc assists in both identifying exudates and determining the position of the macula in the eye. Optic disc segmentation is a crucial step for automatic detection of fundus disorders such as Diabetic Macular Edema and Glaucoma. This work presents an efficient and accurate optic disc segmentation methodology from eye fundus images. In the proposed methodology, fundus images are transformed from RGB (Red, Green, and Blue) color space to LAB (Luminance, A-axis, B-axis) color space. A new image is generated using the luminance, A-axis component, and image information content. As a pre-segmentation stage, the unsupervised approach extracts the region of interest containing optic disc. The adaptive threshold method, followed by morphological operations, extracts the contours of the optic disc region and removes the spur. Segmentation of optic disc is a challenging task due to similar intensity levels with neighborhood, vascular occlusion, and retinal atrophy. The proposed work overcomes the challenges by segmentation of the optic disc at three levels, which enhances the functionality at different illumination conditions. The features are extracted at various levels to determine whether the segmented image contains the optic disc or not. The efficiency of the proposed methodology demonstrates by applying it to a variety of fundus images from datasets, namely ISBI IDRiD, DRISHTI-GS, and SYSU. Key performance metrics like Intersection over Union and Dice Coefficient are used to evaluate the performance of the proposed methodology. The proposed methodology achieves Intersection over Union of 0.996, 0.997, and 0.994 on ISBI IDRiD, DRISHTI-GS, and SYSU datasets, respectively. Similarly, the proposed methodology obtains 0.96, 0.97, and 0.98 Dice Coefficient on the three datasets.