

# **SEGMENTATION OF OPTIC DISC, EXUDATES AND MACULA IN RETINAL FUNDUS IMAGES**

*Thesis submitted by*

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## ABSTRACT

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Diabetic retinopathy, a microvascular complexity prevalent in long-term diabetic patients, is a serious vision menacing condition that leads to blindness in working citizens worldwide. Prolonged high sugar level in the blood weakens and damages the vessels in the eye, blurring the vision. Moreover, diabetic retinopathy is painless and individuals do not experience any symptoms unless sight loss prevails, hence the fundus must be checked regularly to assure timely treatment. It is time-consuming and tedious to manually examine the retinal pictures. An automated screening method can become a popular tool for detecting the pathologies of diabetic retinopathy. The advancement in research works has developed several strategies to automatically identify the retinopathy lesions.

Numerous retinal anomalies manifest in the optic nerve head in the beginning of diabetic retinopathy, which, if identified in the initial phase, will aid ophthalmologists to treat patients effectively. Glaucoma monitoring approach considers the optic cup to optic disc ratio which necessitates the identification of optic disc. It is also vital to recognize the macula for assessing the seriousness of diabetic retinopathy. The consequences of the degeneration of macula perform a crucial role in the evolvement of visual deterioration. The development of microaneurysms, exudates and haemorrhages are the key symptoms of diabetic retinopathy. Therefore, exudate segmentation is considered to be an important task for early diagnosis and treatment. Since the pathologies of diabetic retinopathy are typically difficult to discern, finding the appropriate characteristics to automatically recognize the exudate in retinal pictures are critical. This study presents a computerized technique to aid experts in retinopathy screening services by indicating the lesions of diabetic retinopathy in fundus photograph.

The high efficacy of deep neural networks makes them a popular choice for evaluating medical images. This work presents encoder-decoder architectures which employ convolutional network to detect the exudate, optic disc and macula region automatically in fundus pictures. The convolutional neural networks are designed to learn distinctive features

and patterns associated with the various retinopathy pathologies, enabling precise segmentation. To overcome the limitations of the unavailability of significant amount of labelled training data, data augmentation techniques such as rotation, scaling, and flipping are applied during the training phase.

Extensive experiments are conducted on publicly available datasets to evaluate the performance of the proposed system. The results demonstrate its effectiveness in accurately detecting and segmenting the exudates in retinal fundus images. Furthermore, the robustness of the designed algorithms are confirmed by implementing them on a broad range of fundus images with varying image qualities acquired from several datasets like DRIVE, IDRiD, MESSIDOR, STARE, CHASE-DB1, DIARETDB0 and DIARETDB1. Performance indicators namely F1-score, sensitivity, accuracy and specificity are computed and compared to those of the existing techniques. This work outperforms the existing methods, showcasing its potential as a reliable tool for computer-aided diagnosis of diabetic retinopathy.

The proposed models provide promising approach for efficient and accurate segmentation of exudates in fundus photographs. The performance of the models surpasses the existing methods making them a valuable tool to assist an ophthalmologist in making decisions quickly. The experimental results provide insights into the system's ability to generalize well across different imaging conditions, enhancing its applicability in real-world clinical settings.