Abstract
Diabetic retinopathy is a severe and widespread eye disease that affects many diabetic patients and it remains one of the leading causes of blindness. Usually, diabetic retinopathy is
asymptomatic in the premature phase and intensifies as it grows. Hence, routine screening is essential to reduce the further complication to a significant level. In this paper, a state-of-art image processing techniques to automatically detect the occurrence of hard exudates in the fundus images are discussed. After the adaptive contrast enhancement as preprocessing stage, fuzzy C-means algorithm has been applied to extort the same. The standard deviation, intensity, edge strength and compactness of the extracted features of the fundus images have been fed as an inputs into a recurrent Echo state neural network to classify the extracted features as true candidate or not. A total of 50 images have been used to find the exudates and out of which 35 images consisting of both normal and abnormal are utilized to train the neural network and obtain 93% sensitivity and 100 % specificity.

Reference

- Michael Goldbaum, Saied Moezzi, AdamsTaylor, Shankar Chatterjee, Jeff Boyd, Edward Hunter, and Ramesh Jain, “Automated diagnosis and image understanding with object extraction, object classification, and inference in retinal images”, Department of Ophthalmology and Department of Engineering and Computer Science University of California La Jolla, California USA.
- Lena Kallin Westin "Receiver operating characteristic (ROC) analysis, Evaluating discrimination effects among decision support systems", UMINF 01.18, ISSN-0348-0542.
Conference of the IEEE, 22(26), 2007, 4969-4972.

**Index Terms**

Computer Science  
Biomedical

**Key words**

Diabetic Retinopathy  
Hard exudates  
Fuzzy

C-Means  
ESNN