ABSTRACT

Recent developments in the computerized analysis of medical images have enhanced various diagnostic tasks and provide valuable information for the healthcare experts. Earlier, the analysis of the medical images was performed by ophthalmologists and analysis was limited due to the non-systematic search pattern of humans, the presence of noise in the image and the complexity of the disease. This has motivated the integration of image data and clinical information to develop the computer-aided diagnosis (CAD) system. This approach is considered as a “second opinion” in detecting lesions, assessing extent of disease and supporting the diagnostic decisions for improving the healthcare systems.

In the recent years, mortality due to Diabetic Retinopathy has increased. The effective use of computer-aided decision support system is expected to help the ophthalmologists to detect the early stage of Diabetic Retinopathy to reduce blindness caused by it. The retinal image screening is an effective technique to classify the retinal image and its grading. Many techniques have been used to develop various decision support systems.

In the present work, SVM and Rule based classifier have been used to implement a Computer-aided Decision Support System to assist the ophthalmologists. The acquired retinal images have been pre-processed using
Gabor filter and Adaptive Histogram Equalization. Region of Interest (ROI) has been segmented using RGB segmentation technique. The features extracted are optic disc, blood vessel thickness and vein diameter. Some of Morphological operators used for the measurement of optic disc are Dilation and Area Opening. Then Skeletonization technique is applied to the RGB segmented image for the measurement of blood vessel thickness. Further Thinning was applied on the skeletonised image of the retina to measure the vein diameter. Finally for clinical decision making, the extracted features have been applied to the SVM classifier to classify the input image as Normal or Abnormal. The classification accuracy has been compared with various ANN techniques. It has been seen from the results that the use of SVM classifier with features extracted improves the accuracy. If the input image is classified as abnormal, Rule based classifier is used to grade it as Mild Non Proliferative Diabetic Retinopathy, Moderate Non Proliferative Diabetic Retinopathy, Severe Non Proliferative Diabetic Retinopathy, Very severe Non Proliferative Diabetic Retinopathy and Prolific Diabetic Retinopathy.

The performance of the developed clinical decision support system has been estimated and found that the grading sensitivity, specificity and accuracy are high which proves to be a reliable system for clinical pathology. In this research work, features of both bright lesions and dark lesions are considered for grading the retinal image. The mean sensitivity, specificity and
accuracy value for tested image for bright lesions are 96.61%, 98.31% and 98.18%. Similarly for dark lesions sensitivity, specificity and accuracy value for tested images of 88.54%, 98.22% and 97.51%. The proposed clinical decision support system can be used as secondary observer in clinical decision making.