# ABSTRACT

For any living thing, the eye is a crucial sensory organ. Loss of livelihood and confidence result from vision impairment in human beings. Uncorrected refractive error, cataract, glaucoma, Diabetic Retinopathy (DR), corneal opacity, trachoma, and other conditions can all impair vision. The main causes of blindness among these disabilities are glaucoma and diabetic retinopathy. Diagnosis of glaucoma and diabetic retinopathy is a challenging task. The motivation for this research is that there is currently no national strategy or standardized approach to diabetic retinopathy screening in the Indian public health system, and multiple socioeconomic barriers prevent access to eye examination all over India. A thorough examination of an eye is necessary for the clinical diagnosis for eye diseases. This examination includes tonometry, which measures internal pressure, ophthalmoscopy, which examines the optic nerve, perimetry, which maps the entire field of vision, gonioscopy, which measures the angle where the iris meets the cornea, and pachymetry which measures the thickness of the cornea. Patients with diabetes are typically at risk for developing diabetic retinopathy. Symptomless DR is typical in the early stages. A visual acuity test, tonometry, pupil dilation, and optical coherence tomography can be used to assess the current condition of an eye. A thorough examination enables the ophthalmologist to look for alterations and leakages in blood vessels, macula swelling, lens changes, and damages to nerve tissue in the retina.

The aim of this research to enable ophthalmologist identify the patients with Diabetic Retinopathy at earlier stages to prevent loss of vision among the patients with eye diseases. The methodology of the present research work is in three sections. The first section deals with the detection of Optic Disc segmentation in order to locate the Optic Disc clearly. This helps to diagnose eye diseases like diabetic retinopathy, using automated segmentaion and classification

of the fundus images of Optic Disc. There are several methods for identifying “OD in low-resolution retinal images”. In this work, a digital fundus image is captured and image processing is used to automatically detect OD. The categorization of Optic Disc is accomplished using a unique Particle Swarm Optimization (PSO) optimized K-Nearest Neighbours (KNN). PSO, an optimization technique with natural inspiration, is used to identify KNN optimization parameters to get the accurate classification.

There are two steps in preprocessing of the images. The first one is to obtain the Green Channel from the fundus images. The second one is to get the high contrast in the images using histogram equalization. In the next stage, Fuzzy C-Means (FCM) has been utilized for OD detection. The PSO-KNN classifier is then employed to identify the healthy and unhealthy images in OD. The proposed method is evaluated using the common database of DIARETDB1 fundus images after being developed in MATLAB. According to the results, the proposed technique significantly improves accuracy when compared to other algorithms.

The second part of the research uses retinal fundus images for detecting the exudates in macula edema. A completely automated system is proposed in this part for the early diagnosis of macular edema. Anatomical elements of a retinal image, such as the vasculature, the fovea, and the Optic Disc are initially recognized. The Contrast Limited Adaptive Histogram Equalization (CLAHE) technique is utilized on the green channel picture to upgrade the differentiation of the anatomical structure of the retinal images. The 2 Dimensional Gabor matched filtering is applied on the CLAHE’s output for enhancing the blood vessel and then thresholding strategy is used to obtain the final vessel output. The exudates in the fovea area are observed to assess macular edema. The freely accessible DRIVE datasets are used to test the proposed method.

The third section of the study discusses an effective method for preprocessing, feature selection and classifying diabetic retinopathy into various categories of severity. The input images of the human retinal fundus are first

preprocessed with histogram equalization and then Gabor filtering is used to remove noise in preparation for enhancement and segmentation of blood vessels and optic nerve. Using the Watershed approach, feature extraction is used to recover the features. With the use of the PCA (Principal Component Analysis) technique, the best features are chosen. The post-processing method is used to further improve the quality of a few chosen features. To predict the retinal image as normal, abnormal, or severe, the classification strategy is finally carried out using a Google NET CNN classifier. Google NET CNN has been created to differentiate visual features directly from picture pixels with a minimal amount of preprocessing. The effectiveness of the new approach is then compared to other existing methods, and the results are assessed. The quantitative data are shown to produce superior outcomes to existing methods when accuracy, precision, dependability, positive predictive levels, and false predictive levels in parameters were analysed. The proposed method showed better results for predicting and detecting the DR than the earlier methods observed. PSO-KNN classification achieved the accuracy of 98.3 % and the Google NET CNN has returned the specificity of 98.46 %.