Diabetic related eye diseases are the most common cause of blindness in the world. This thesis suggests methods for the early detection of Diabetic Retinopathy during mass screening in rural areas. Current methods used by the ophthalmologists are manual examination of the eye and it has lesser accuracy. Dilating the pupil of the patients by applying drops, the retina is seen through fundus camera. Fundus camera is a high resolution camera which is used specifically for the analysis of retinal images. Density analysis is less efficient which leads to think of the automated analysis. The current methods were studied in consultation with the ophthalmologists. The image processing techniques applied to the retinal images automatically detect the presence of any abnormalities during screening. These methods are easy to use and helpful for the Physicians in the screening of Diabetic retinopathy. The first part of the thesis, implemented different methods for the optic disk detection. The optic disk is the point in the eye where the optic nerves enter the retina. Precise localization of optic disk boundary is an important sub problem, which needs attention in ophthalmic image processing. Once the optic disk is identified, the position of fovea and anatomical features can be determined. Optic disk detection is fundamental for establishing a frame of reference for image analysis. The optic disk was detected using different methods and compared. The performance of the methods were compared using peak signal to noise ratio. The Principal Component analysis (PCA) was applied only to the clusters and the output of the PCA was given as input for the propagation through radii method. This saves time and gives good results with higher PSNR value.

Exudates are the primary signs of diabetic retinopathy which are the cause for blindness. Exudates can be identified as areas with hard white or yellowish color with varying sizes, shapes and locations. Once the optic disk
is detected, it can be segmented or removed so that the image is left with exudates. Different methods were used for exudates detection and all the methods were compared. Higher PSNR was obtained for exudates detection after extraction of optic disk using propagation through radii method.

Optic disk and exudates can also be detected by finding the blood vessels at first. This process includes local contrast enhancement and green band channel extraction from the digital fundus images. The blood vessel appearance can provide information on pathological changes caused by diabetes. The image of the blood vessel was segmented using wiener filter and also by morphological operations. Blood vessels are also used as a landmark in registration methods. After the vessel extraction, the boundary of exudates was detected using Laplacian and Gaussian operator. Smoothing operation was performed for thinning of blood vessels. Then morphological filling was done and it was used to search for the regions bounded by closed contour. Thus the exudates patches were obtained. The optic disk center was obtained by the convergence of the blood vessels. The optic disk was obtained by subtracting the blood vessel extracted image from the exudates detected images. An accuracy of 92% was obtained for the detection of exudates using this method. The performance was measured and shows that higher peak signal to noise ratio can be obtained using the morphological operations.

Automated detection of optic disk, exudates, blood vessel extraction and also optic disk and exudates detection through the extraction of blood vessel were done using Matlab software. This thesis gives methods for the early detection of diabetic retinopathy using computer and paves the way for creating awareness during screening. The image obtained from the fundus camera during screening was fed to the computer and it shows whether the image is normal or affected by diabetes. In future, using this approach the microaneurysm and haemorrhages can also be detected by which many abnormalities in the retinal image can be analyzed.