List of Figures

1.1 Cross-sectional view of human eye. 1

1.2 Retina image captured by fundus camera. 3

2.1 Type of Similarity Measures 30

2.2 The image taken from DRIVE database: (a) Healthy retinal image (b) diabetic retinopathy infected retinal image and (c), (d) are the respective segmented ground truth retinal images 37

2.3 The image taken from STARE database: (a) Healthy retinal image (b) pathology infected retinal image and (c), (d) are the respective segmented ground truth retinal images 38

3.1 Proposed Model 48

3.2 For image taken from DRIVE data set (a) Original image (b) Selected green channel of input image (c) Gray-scale image (d) Proposed SDOG Matched Filter [204] Response image 49

3.3 For image taken from STARE data set (a) Original image (b) Selected green channel of input image (c) Gray-scale image (d) Proposed SDOG Matched Filter [204] Response image 50

3.4 Division of Co-occurrence matrix 52

3.5 Details of image taken from DRIVE data set (a) classified blood vessels from their backgrounds (b) blood vessel without isolated and misclassified pixels (c) after removing outer artifacts (d) complimented segmented image for comparison with the existing Ground Truth Image 54

3.6 Details of image taken from STARE data set (a) classified blood vessels from their backgrounds (b) blood vessel without isolated and misclassified pixels (c) after removing outer artifacts (d) complimented segmented image for comparison with the existing Ground Truth Image 55
3.7 Comparison of Accuracy for DRIVE database. 57
3.8 Comparison of TPR for DRIVE database. 58
3.9 Comparison of FPR for DRIVE database. 58
3.10 Comparison of Accuracy for STARE database. 59
3.11 Comparison of TPR for STARE database. 59
3.12 Comparison of FPR for STARE database. 60

4.1 (a) Gray scale retina image of '13_test.tif', (b) Gray scale retina image of '14_test.tif' 65
4.2 Cross-section intensity profile of the region marked in Figure 4.1(a) and (b) by selecting 80 pixels between two points are presented in (a) and (b) respectively 66
4.3 Approximate well shaped cross-section intensity profile of the region marked in Figure 4.1(a) and (b) by selecting 30 pixels between two points are presented in (a) and (b) respectively. 67
4.4 (a) Gaussian distribution Curve, (b) Cauchy pdf Curve, (c) Gumbel pdf Curve 68
4.5 Block Diagram of Proposed Approach 71
4.6 (a) Gray scale image of '20_test.tif' selected from DRIVE dataset (b) Contrast enhanced gray scale image of '20_test.tif' selected from DRIVE dataset (c) Gray scale image of 'im0082.ppm' selected from STARE dataset (d) Contrast enhanced gray scale image of 'im0082.ppm' selected from STARE dataset 73
4.7 Accuracy graph of proposed approach with respect to various combination of μ and β 77

4.8 Accuracy graph with respect to increasing length of piece-wise line segment 77

4.9 MFR image of '20_test.tif' taken from DRIVE data set 78

4.10 Details of image '18_test.tif' taken from DRIVE data set (a) classified blood vessels from their backgrounds (b) blood vessel without isolated and misclassified pixels (c) after removing outliers artifact (d) complimented segmented image for comparison with the existing Ground Truth Image 84

4.11 Details of image 'im0082.ppm' taken from STARE data set (a) classified blood vessels from their backgrounds (b) blood vessel without isolated and misclassified pixels (c) after removing outliers artifact (d) complimented segmented image for comparison with the existing Ground Truth Image 85

4.12 ROC Curve for DRIVE data set 86

4.13 ROC Curve for STARE data set 87

5.1 (a) Gray scale image of '20_test.tif' selected from DRIVE dataset (b) Contrast enhanced gray scale image of '20_test.tif' selected from DRIVE dataset 93

5.2 Block Diagram of proposed registration model. 94

5.3 Gray scale retinal image '11_test.tif' selected from DRIVE database represents two marked region with claret color and blue color. 95

5.4 (a) Cross-section intensity profile of the region marked by claret color in Figure 5.3 by selecting 30 pixels between two points, (b) Cross-section intensity profile of the region marked by blue color in Figure 5.3 by selecting 30 pixels between two points 96

5.5 40 interest points in segmented retinal image by using BRISK feature detection. 99

5.6 (a) represents 40 feature points of two segmented source retinal images, (b) represents 40 feature points of respective segmented target retinal image, (c) represents the respective matched feature points between source and target image pairs, (d) represents the registered retinal images of respective source and target image pairs 102
5.7 (a) represents 40 feature points of two segmented source retinal images, (b) represents 40 feature points of respective segmented target retinal image, (c) represents the respective matched feature points between source and target image pairs, (d) represents the registered retinal images of respective source and target image pairs 103
5.8 Comparative analysis of average performance measure (Average NCC). . 105
5.9 Comparative analysis of average computation time (Average Time in Sec.). 107