Part IV

List of Figures
List of Figures

1.1 A pinhole camera model. ................................................................. 3
1.2 The geometry of a pinhole camera. .................................................. 3

2.1 (a) Original image SCOE-1 (300 × 225). (b) Translated image SCOE-2 (300 × 225). (c) Correlation plot for SCOE 1 and SCOE 2. ............... 14
2.2 (a) Lily flowers. (b) Template of Lily flowers. (c) Padmask of Lily template. (d) Lily template matched with lily flowers. ......................... 14
2.3 (a) Original image SCOE-1(300 × 225). (b) Translated image SCOE-2 (300 × 225). (c) Cross power spectrum. ................................. 16
2.4 Mosaic of VR images from H1 to H 15. ........................................... 17
2.5 (a) MRI image of brain. (b) PET image of same brain. (c) Fused image. ................................................................. 19

3.1 (a) SCOE-1(300 × 225). (b)SCOE-2 (300 × 225). (c) Features extracted from image SCOE-1(300 × 225). (d) Features extracted from image SCOE-2(300 × 225). (e) Correlation plot for SCOE 1 & SCOE 2 by extracting features. 23
3.2 (a) Original image Jup-1 (256 × 256). (b) Translated image Jup-2(256 × 256). (c) Counter extracted from Jup-1. (d) Counter extracted from Jup-2. (e) Mosaic of Jup-1 and Jup-2. .......................... 24
3.3 (a) Original image Berry1 (256 × 256). (b) Berry2 rotated by 90° (256 × 256). ................................................................. 25
3.4 (a) Clown 1 original image(adopted from MATLAB toolbox)(600 × 400). (b) Clown 2 original image stretched and rotated (600 × 400). (c) Image corrected by projective transformation. .................. 25
3.5 (a) Edges extracted from SCOE-1(300 × 225). (b) Edges extracted from SCOE-2 (300 × 225). (c) Cross power spectrum for SCOE 1 and SCOE 2 in frequency domain. ................................................. 27
3.6 (a) Image of earth taken from satellite (600 × 600). (b) Rotated image of the same scene (600 × 600). (Figures adopted from MATLAB toolbox). (c) Registered images in same coordinate system. (d) Registered image overlaid on original image. ................................................................. 28
3.7 Two-dimensional orthogonal Wavelet decomposition. ....................... 29
3.8 (a)Original image SCOE-1(300 × 225). (b)Translated image SCOE-2(300 × 225). (c) Wavelet decomposition at level 2 by Harr Wavelet for SCOE-1. (d) Wavelet decomposition at level 2 by Harr Wavelet for SCOE-2. ....... 30
3.9 Sample images from Track-1 to Track-15 (256 × 256). .................. 31
3.10 IR mosaic of images from Track-1 to Track-15. ............................... 31
3.11 Sample images of Saraswati College of Engg, Kharhar from SCOE-1 to SCO6. ................................................................. 32
3.12 Mosaic of images. ........................................................................... 33
3.13 Sample images from H-1 to H-15 of Hiranandani complex, Mumbai (256 × 256). ................................................................. 34
4.1 (a) The image of size $(500 \times 500)$ with 256 gray levels. (b) Histogram of image.

4.2 (a) Synthetic image of size $(500 \times 500)$ with 256 gray levels. (b) Histogram of image.

4.3 (a) Uday (256 X 256). (b) Uday rotated by $5^\circ$. (c) Uday rotated by $20^\circ$. (d) Uday with rotated neck. (e) Joint histogram a Vs a. (f) Joint histogram a Vs b. (g) Joint histogram a Vs c. (h) Joint histogram a Vs d.

4.4 (a-c) Sample images SCOE-1, SCOE-2 and SCOE-3. (d) $I(A, B)$ as a function of misregistration for SCOE 1 and SCOE 2. (e) $I(A, B)$ as a function of misregistration for SCOE 1 and SCOE 3. (f) Mosaic of SCOE1 and SCOE2. (g) Mosaic of SCOE1 and SCOE3 in multiple spectrums.

4.5 (a) Image in thermal infrared bands $(450 \times 450)$. (b) Template in near infrared $(150 \times 150)$. (c) Matched template $(150 \times 150)$.

4.6 Sample images Hir-1 to Hir-2 Hiranandani Kharghar.

4.7 Mosaic of images from Hir1 to Hir-5.

4.8 (a) MRI image $(230 \times 230)$ rotated by $4^\circ$. (b) CT image $(512 \times 512)$. (c) Registered CT image $(233 \times 233)$.

4.9 (a) Prutha image $(230 \times 230)$. (b) Prutha image $(512 \times 512)$ rotated by $6^\circ$. (c) Registered Prutha image $(231 \times 231)$.

4.10 Forming a vector from corresponding pixels in a stack of images of the same size.

4.11 (a) Arbitrary object in $x_1-x_2$ coordinate system. (b) Origne of new coordinate system coordinate system. (c) After Hotelling transform, the object is aligned with its principle axes.

4.12 (a) MRI image of brain $(400 \times 400)$. (b) Translated and rotated version of same image $(400 \times 400)$. (c) Hotelling transform of the image a. (d) Hotelling Transform of the images b.

4.13 (a) Sample image $(50 \times 50)$. (b) Template $(25 \times 25)$. (c) Matched template $(25 \times 25)$.

4.14 Graphical depiction of Eigenvalues at $x=1$ to 25 and at $y=25$.

4.15 Geometry of Radon Transform.

4.16 (a) Reference image. (b) Radon Transform of image (a). (c) Image (a) rotated by $5^\circ$. (d) Radon Transform of image (c). (e) Profile of original image and rotated image together.

4.17 (a) Original image scaled by factor 2. (b) Radon Transform of image (a). (c) Profile of original image and scaled image together.

4.18 (a) Original image translated in X-dir. (b) RT of image (a). (c) Profile of original image and translate image. (d) Original image translate in Y-dir. (e) RT of image (d). (f) Profile of original image and translated image. (g) Original image translate in X-Y dir. (h) RT of image (g). (i) Profile of original image and translated image.

4.19 Geometry of Radon Transform.

4.20 (a) Original Lena Image $(256 \times 256)$. (b) Deformed Lena image. (c) Recovered Lena image with scale=0.8, rotation=25, translation along x-axis=35, translation along y-axis=35.

4.21 Mosaic of VR images from H1 to H15.

4.22 Mosaic of IR images from Track-1 to Track-14.
5.1 (a) Pixel level fusion. (b) Feature Level Fusion. (c) Decision Level Fusion. . . 57
5.2 PCA merger. ................................................................. 58
5.3 (a) Reference image in VR band (256 x 256). (b) Image in IR band (256 x 256). (c) Fused image. ................................................ 60
5.4 (a) PET. (b) MRI. (c) Reference. (d) PCA fused. (d) FFT fused. (f) Average fused. (g) Radon fused image. ..................... 66
5.5 (a) SPECT image. (b) MRI image. (c) Reference image. (d) PCA fused. (e) Average fused. (f) FFT fused. (f) Radon fused. .... 67
5.6 (a) VR image. (b) IR image. (c) Reference image. (d) Average fused. (e) PCA fused. (f) FFT fused. (g) Radon fused image. .... 68
5.7 (a) IR image. (b) VR image. (c) Reference image, adopted from reference 85. (d) Radon fused. (e) Average fused. (f) FFT fused. (g) PCA fused image. ... 70

6.1 Wavelet multi-dimensional fusion. ............................................................... 73
6.2 (a) PET image. (b) MRI image. (c) Reference image of brain. ................. 77
6.4 Graphical depiction of Table-6.1. ......................................................... 79
6.5 Graphical Representation of Table-6.2. .................................................... 80
6.6 (a) SPECT image. (b) MRI image. (c) Reference image of brain. .......... 81
6.8 Graphical depiction of Table-6.3. ......................................................... 82
6.9 Graphical Depiction of Table-6.4. ............................................................. 83
6.10 (a) VR image. (b) IR image. (c) Reference fused image. .................. 84
6.12 Graphical Depiction of Table-6.5. ......................................................... 86
6.13 Graphical Depiction of Table-6.6. ............................................................. 87
6.14 (a) IR Truck. (b) VR Truck. (c) Reference fused image adopted from reference 85. ......................................................... 88
6.16 Graphical Depiction of Table-6.7. ............................................................. 89
6.17 Graphical Depiction of Table-6.8. ............................................................. 90