Outline of Digital Image Processing

(2023V2)

Chapter 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| Image |  |  |  |  |
| Digital Image |  |  |  | Yes |
| Pixel |  |  |  |  |
| Image Resolution |  |  |  | Yes |

Chapter 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| Image Formation Model | Yes |  |  |  |
| Spatial Resolution | Yes |  |  |  |
| Intensity Resolution |  |  |  |  |
| 4-Neighbors | Yes |  |  | Yes |
| D-Neighbors | Yes |  |  | Yes |
| 8-Neighbors | Yes |  |  | Yes |
| 4-adjacency |  |  |  |  |
| 8-adjacency |  |  |  |  |
|  |  |  |  |  |
| Digital Path |  |  |  |  |
| Closed Digital Path |  |  |  |  |
| Foreground & Background | Yes |  |  |  |
| Inner Border | Yes |  |  | Yes |
| Outer Border | Yes |  |  | Yes |
| Euclidean distance | Yes |  |  | Yes |
| City-block distance | Yes |  |  | Yes |
| Chessboard distance | Yes |  |  | Yes |
| Arithmetic Operation: Addition | Yes |  | Yes | Yes |
| Arithmetic Operation: Subtraction | Yes |  | Yes | Yes |
| Arithmetic Operation: Multiplication | Yes |  | Yes | Yes |
| Arithmetic Operation: Div | Yes |  | Yes | Yes |
| Averaging K different noisy images | Yes |  | Yes |  |
| Mix Operation | Yes |  | Yes | Yes |
| Single pixel operation | Yes |  |  |  |
| Neighborhood operation | Yes |  |  |  |
| Spatial Transform |  |  |  |  |
| Forward Mapping | Yes |  |  |  |
| Inverse Mapping | Yes |  | Yes | Yes |
| Affine Transform | Yes |  |  | Yes (Matrix) |
| Scaling Transform | Yes |  |  | Yes |
| Rotation Transform | Yes |  |  | Yes |
| Translation Transform | Yes |  |  | Yes |
| Flip H Transform | Yes |  |  | Yes |
| Flip V Transform | Yes |  |  | Yes |
| Composted Affine Transform | Yes |  | Yes | Yes |
| Nearest Neighborhood Interpolation | Yes |  | Yes | Yes |
| Bilinear Interpolation | Yes |  | Yes | Yes |
|  |  |  |  |  |

Chapter 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| Intensity Transform | Yes |  |  | Yes |
| Spatial Filtering | Yes |  |  | Yes |
| Image Enhancement |  |  |  |  |
| Image Negative | Yes |  |  | yes |
| Gamma Transformations | Yes |  | yes | yes |
| Contrast stretching | Yes |  |  | Yes |
| Thresholding | Yes |  |  | yes |
|  |  |  |  |  |
| Brightness Transformation | Yes |  |  | yes |
| Histogram | Yes |  |  | Yes |
| Histogram Equalization |  | yes | yes | yes |
| Average Blur | Yes |  | yes | Yes |
| Gaussian Blur | Yes |  | yes | yes |
| Salt and pepper noise |  |  |  |  |
| Median Filter |  | yes | yes | yes |
| Laplacian | Yes |  | yes | yes |
| Sharpening Filter | Yes |  | yes | yes |
| Unsharp Masking | yes | yes | yes | yes |
| Gradient | Yes |  |  | yes |
| Magnitude of Gradient | Yes |  |  | Yes |
| Direction of Gradient | Yes |  |  | yes |
| Sobel Mask | Yes |  |  | yes |
| Combining Spatial Enhancement Methods |  |  | Yes |  |
|  |  |  |  |  |

Chapter 4/5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| 2D-DFT |  |  |  |  |
| 2D-IDFT |  |  |  |  |
| FFT Shift |  | yes |  | yes |
| Separability of 2D-DFT |  | yes | yes |  |
| Filtering in the Frequency Domain | Yes | yes |  |  |
| Homomorphic Filtering |  | yes | yes |  |
| Low pass/High pass |  |  |  | Yes(Create filter H) |
| Band reject | Yes |  | Yes | Yes |
| Notch Reject | Yes |  | yes | Yes |
| Band pass | Yes |  |  | Yes |
| Notch pass | Yes |  |  | Yes |
|  |  |  |  |  |
| Inverse Filtering | yes |  |  |  |
|  |  |  |  |  |

Chapter 6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| RGB Model | Yes |  | Yes | Yes |
| HSI Model | Formula of I(R,G,B)  S(R,G,B) |  | Yes |  |
| HSV Model | Formula of V(R,G,B)  S(R,G,B) |  |  |  |
| Pseudo color Image Processing |  |  | Yes | Yes |
| Full Color Image Processing  (RGB) Model |  |  | Yes | Yes |
| Full Color Image Processing (HIS/HSV)  Brightness Channel Processing  Saturation Channel Processing |  | Yes | Yes |  |
| Color Matrix   1. RGB =>Gray 2. Brightness Adjust 3. Saturation Adjust 4. Color Balance | Yes |  | Yes | Yes |

Chapter 9

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| Erosion | Yes |  | Yes | Yes |
| Dilation | Yes |  | Yes | Yes |
| Open | Yes |  | Yes | Yes |
| Close | Yes |  | Yes | Yes |
|  |  |  |  |  |

Chapter 10

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| Image Segmentation |  |  |  |  |
| Detection of Isolated Point | Yes |  |  | yes |
| Line Detection | yes |  |  |  |
| Edge Models |  |  |  |  |
| image gradient | yes |  |  | yes |
| Magnitude of gradient vector | Yes |  |  | Yes |
| Direction of gradient vector | Yes |  |  | Yes |
| Gradient operator (basic) | Yes |  |  | Yes |
|  |  |  |  |  |
| Prewitt operator | Yes |  |  | Yes |
| Sobel operator | Yes |  |  | Yes |
| Edge detection (thresholding) |  | Yes |  | Yes |
| Edge detection (zero crossing) |  | Yes |  | Yes |
| Marr-Hildreth edge detector |  | Yes |  | YES |
| Canny edge detector |  | Yes |  |  |
| intensity thresholding | Yes |  |  | Yes |
| Basic Global Thresholding |  | Yes |  |  |
| Connected-component labeling |  | Yes | yes | Yes |
|  |  |  |  |  |

Chapter 11

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concept | Formula or filter mask | Algorithm Step | Application | Programming |
| Hough Transform (Line Detection) | Yes | Yes | Yes | Yes |
| Hough Transform (Circle Detection) | Yes | Yes | Yes |  |