

Appendix

List of Figures

- Figure 1-1 PSO Example zoomed version
- Figure 1-2 PSO Example
- Figure 1-3 Vector Representation of PSO Algorithm
- Figure 1-4 Roulette Wheel
- Figure 1-5 Convergence of population
- Figure 1-6 Illustration of simulated Annealing
- Figure 1-7 Illustration of simulated Annealing 1
- Figure 1-8 Illustration of simulated Annealing 2
- Figure 1-9 Illustration of simulated Annealing 3
- Figure 1-10 BPN Structure
- Figure 1-11 ANN Algorithm Illustration
- Figure 1-12 Illustration of SSE decreases with Iteration
- Figure 1-13 Fuzzy system
- Figure 1-14 Relationship between crisp value and Fuzzy membership value for the variable X
- Figure 1-15 Relationship between crisp value and Fuzzy membership value for the variable Y
- Figure 1-16 Relationship between crisp value and Fuzzy membership value for the variable Z
- Figure 1-17 Xinput as the crisp input for the variable X
- Figure 1-18 Xinput as the crisp input for the variable Y
- Figure 1-19 Defuzzification
- Figure 1-20 Relationship between the crisp value and fuzzy membership for the input variable X in the example

- Figure 1-21 Relationship between the crisp value and fuzzy membership for the input variable Y in the example
- Figure 1-22 Relationship between the crisp value and fuzzy membership for the input variable Z in the example
- Figure 1-23 Defuzzification in the example
- Figure 1-24 Illustration of Ant colony
- Figure 1-25 Matrix A (Ant colony)
- Figure 1-26 Matrix B (Ant colony)
- Figure 1-27 Iteration (vs) Best cost selected by the 4 ants
- Figure 2-1 Clustering example with four clusters
- Figure 2-2 Illustration of K-means algorithm
- Figure 2-3 Data along with the final centroids obtained by k-means algorithm
- Figure 2-4 Illustration of Fuzzy k-means algorithm
- Figure 2-5 Data and the final centroids obtained using Fuzzy k-means algorithm
- Figure 2-6 Illustration of change in the membership value in every iteration
- Figure 2-7 Illustration of Mean and Variance Normalization of the speech signal
-
- Figure 3-1 Hotelling transformation for binary image rotation
- Figure 3-2 Vector space along with Eigen vectors
- Figure 3-3 Vector space after KLT and the corresponding eigen vectors
- Figure 3-4 Projection Illustration
- Figure 3-5 Projection of the vector on the plane
- Figure 3-6 Gram-Schmidt Orthogonalization procedure
- Figure 3-7 Original signal used for Haar decomposition
- Figure 3-8 Approximation co-efficients obtained using Haar transformation
- Figure 3-9 Detail co-efficients obtained using Haar transformation
- Figure 3-10 Illustration of Inverse Haar transformation
- Figure 3-11 Original signal used for Daubechies 4 wavelet decomposition
- Figure 3-12 Approximation co-efficients at different levels
- Figure 3-13 Detail co-efficients at different levels
- Figure 3-14 Illustration of Inverse Daubechies 4 transformation
- Figure 4-1 Sample Ear images before and after normalization
- Figure 4-2 Eigen Ears corresponding to the largest Eigen values

- Figure 4-3 Ear image compression with the ratio 3.2:1 using Eigen basis
- Figure 4-4 Basis used for Ear Image Compression
- Figure 4-5 FIR Filter
- Figure 4-6 BPNN Filter structure
- Figure 4-7 Noise Filtering using BPNN
- Figure 4-8 Vector basis for Binary Image Rotation
- Figure 4-9 Binary Image Rotation
- Figure 4-10 Texture images - Cluster 1
- Figure 4-11 Texture images - Cluster 2
- Figure 4-12 Texture images - Cluster 3
- Figure 4-13 Texture images - Cluster 4
- Figure 4-14 Sample Front panel
- Figure 4-15 Original speech signals
- Figure 4-16 Mixed signals
- Figure 4-17 Separated speech signals using ICA
- Figure 4-18 Speech signal and Noise signal before mixing
- Figure 4-19 Mixed signals
- Figure 4-20 Retrieved speech and noise signals using ICA
- Figure 4-21 Sample photorealistic images
- Figure 4-22 Sample photographic images
- Figure 4-23 Audio signal before and after watermarking
- Figure 4-24 Original and watermarked signal in zoomed level
- Figure 4-25 Hidden and Retrieved Binary image

List of m-files

psogv.m
fl.m

geneticgv.m
fcn.m

sagv.m
minfcn.m

anngv.m
logsiggv.m

fuzzygv.m

antcolonygv.m
computecost.m

icagv.m

gmmmodelgv.m
clustercol.m
clusterno.m

kmeansgv.m
fuzzykmeansgv.m

meanvarnormgv.m

hotellinggv.m

gramgv.m

haartransgv.m
createhaarmatrix.m
haarinvtransgv.m
creatinvhaarmatrix.m

daub4trans.m
createdaubmatrix.m
daub4invtrans.m
createdaubinvmatrix.m

earpatgv.m
testinggv.m

earcompgv.m
compresseig.m
decompresseig.m

noisefiltanngv.m
dofilter.m

binimrotationgv.m

patclassgv.m
var2.m

igagv.m
igaimagegv.m
naturefeature.m
huevar.m
unif.m
entropy.m
relativesmooth.m
wavelet.m
skew.m
kurt.m

noiseicagv.m

photorealisticdetgv.m
phototest.m
assigncenno.m

audiowatermarkdb4gv.m
daub4water.m
gethiddenimage.m

Index

- Adaptive noise filtering using
 BPN, 145
- Ant colony optimization, 44, 45, 48
- Approximation co-efficients, 119,
 121–123, 128, 129, 159
- Artificial Genetic algorithm, 9
- Average Entropy, 159

- Binary image rotation, 150–152
- BPN structure, 24

- Chromosomes, 9, 11, 15–17
- Clustering, 68, 69, 81, 152, 155
- Clustering texture images, 152
- Cost function of energy state, 18, 19
- Covariance matrix, 56–60, 62, 68, 70,
 72, 87–90, 141
- Crisp value, 33–35, 38–40
- Cross over, 9–11, 16, 17, 161

- Daubechies-4 transformation, 127
- Denoising, 166, 169
- Detail co-efficients, 120–124,
 127–130, 159, 175
- Differential equation, 108

- Ear image data compression, 141, 143
- Ear pattern recognition, 135, 138
- Eigen basis, 91, 92, 117, 141, 142
- Eigen ear, 135–137

- Eigen vectors, 88, 91–93, 103, 105,
 106, 108, 118, 136, 141
- Euclidean distance, 70, 136, 153,
 158, 171
- Expectation – maximization
 algorithm, 70
- Expectation stage, 71, 72
- Exponential of matrix, 107

- Fourier transformation, 113, 114
- Fuzzy k-means algorithm, 79–83
- Fuzzy logic systems, 32, 33
- Fuzzy membership, 32–40

- Gaussian Mixture Model, 68, 72
- Global minima, 20, 21, 25
- Gram-Schmidt orthogonalization
 procedure, 100–103

- Haar transformation, 120–124,
 127, 128
- Hotelling transformation, 87–90

- Independent component analysis, 53,
 65, 166, 170
- Interactive genetic algorithm, 156, 160
- Intersection, 32, 36

- k-means algorithm, 77–83, 152, 153
- Kurtosis, 54–56, 60, 156, 160

- Local minima, 20, 21
- Logsig, 25, 29, 31, 32, 148, 149
- Low-level features, 152, 153, 156–159
- Maximization stage, 71, 72
- Mean and variance normalization, 84–86
- Minima location of the function, 119
- Mutation, 9–11, 157
- Orthonormal basis, 91, 101, 102, 113, 115, 118
- Orthonormal vectors, 100–102
- Particle swarm optimization algorithm (PSO), 1
- Pheromone matrix, 46–48
- Photographic images, 170–172
- Photorealistic images, 170, 171
- Positive definite matrix, 119
- Powers of matrix, 103
- Projection Matrix, 95, 97–99
- Pseudo inverse of matrix, 109, 110
- Relative smoothness, 159
- Roulette wheel selection, 10, 11
- Search engine, 156
- Sequence, 104–106
- Significant co-efficients, 102, 116
- Simulated annealing, 18, 19, 23
- Single Neuron Architecture, 25
- Singular Value Decomposition (SVD), 93, 109
- Skewness, 160
- Speech signal separation, 166
- SSE(Sum squared error), 28, 30
- System stability test using Eigen values, 118
- Tansig, 25, 29
- Transformation matrix, 112–118, 121, 122, 127, 142, 150
- Uniformity, 159
- Union, 32, 37
- Vector space, 91, 92, 96, 97, 100, 101, 113–115, 117, 141, 142, 150
- Watermarking, 175, 176
- Wavelet basis, 117, 118