

Biometrics - Video course

COURSE OUTLINE

Introduction of Biometric traits and its aim, image processing basics, basic image operations, filtering, enhancement, sharpening, edge detection, smoothing, enhancement, thresholding, localization. Fourier Series, DFT, inverse of DFT.

Biometric system, identification and verification. FAR/FRR, system design issues. Positive/negative identification. Biometric system security, authentication protocols, matching score distribution, ROC curve, DET curve, FAR/FRR curve. Expected overall error, EER, biometric myths and misrepresentations.

Selection of suitable biometric. Biometric attributes, Zephyr charts, types of multi biometrics. Verification on multimodel system, normalization strategy, Fusion methods, Multimodel identification.

Biometric system security, Biometric system vulnerabilities, circumvention, covert acquisition, quality control, template generation, interoperability, data storage. Recognition systems: Face, Signature, Fingerprint, Ear, Iris etc.

COURSE DETAIL

Lecture Number	Topics
1	Introduction of biometric traits and its aim, Image processing/pattern recognition/statistics, Error types.
2	Image processing basic: what is image, acquisition, type, point operations, Geometric transformations.
3	Linear interpolation, brightness correction, histogram.
4	Basic image operations: Convolution, linear/non-linear filtering, Gaussian, Median, Min, gray level reduction.
5	Special filters, enhancement filter, Edge detection, derivatives, Laplacian, unsharp masking, high boot filtering, sharpening special filtering, Edge detection.
6	First and second derivative, steps in edge detection, smoothing, enhancement, thresholding, localization, Robert's method, Sobal's method, Pervitt and sobal, Laplacian of Gaussian, Zero crossing.
7	Canny edge detection, Fourier Series, DFT, inverse of DFT.
8	Biometric system, authentication, physiological and behavioral properties,



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Computer Science and Engineering

Pre-requisites:

Data structures,
Algorithms

Coordinators:

Prof. Phalguni Gupta
Department of Computer
Science and
Engineering IIT Kanpur

	properties of biometric system, application areas.
9	PCA, Eigen vectors and values, 2D-PCA, generalization to p-dim, covariance and correlation, algebra of PCA, projection of data.
10	Identification/verification, Threshold, Score distribution, FAR/FRR, System design issues.
11	Positive/negative identification, Biometric system security, Authentication protocols, Authentication methods.
12	Matching, null and alternative hypothesis h_0 , h_1 , Error type I/II, Matching score distribution, FM/FNM, ROC curve, DET curve, FAR/FRR curve.
13	Comparing two systems using ROC curve, Expected overall error, EER, available best error rates, cost function, biometric myths and misrepresentations, negative authentication, trade-offs b/w security and convenience.
14	Selection of suitable biometric, Biometric attributes, Zephyr charts, types of multi biometrics.
15	Verification on multimodel system, normalization strategy, Fusion methods, Multimodel identification, Biometric system security.
16	Biometric system vulnerabilities, circumvention, covert acquisition, quality control, template generation, interoperability, data storage.
17	Signature recognition system, cropping, enhancement, signature parameters, matching and decision, recognition.
18	Discrete Harr wavelet transform, Face detection, feature template, matching.
19	Fingerprint recognition, Enhancement, Thinning, minutiae, CN number, matching.
20	Ear and Iris recognition, why ear, image acquisition, cropping ear and iris, normalization, matching and decision.

References:

1. **Digital Image Processing using MATLAB**, By: Rafael C. Gonzalez, Richard Eugene Woods, *2nd Edition, Tata McGraw-Hill Education 2010*
2. **Guide to Biometrics**, By: Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, *Springer 2009*
3. **Pattern Classification**, By: Richard O. Duda, David G. Stork, Peter E. Hart, *Wiley 2007*