Pattern Recognition - Video course

COURSE OUTLINE

Introduction and mathematical preliminaries - What is pattern recognition?, Clustering vs. Classification; Applications; Linear Algebra, vector spaces, probability theory, estimation techniques.

Classification: Bayes decision rule, Error probability, Error rate, Minimum distance classifier, Mahalanobis distance; K-NN Classifier, Linear discriminant functions and Non-linear decision boundaries.

Fisher's LDA, Single and Multilayer perceptron, training set and test sets, standardization and normalization.

Clustering: Different distance functions and similarity measures, Minimum within cluster distance criterion, K-means clustering, single linkage and complete linkage clustering, MST, medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.

Feature selection: Problem statement and Uses, Probabilistic separability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, (l,r) algorithm.

Feature Extraction: PCA, Kernel PCA.

Recent advances in PR: Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy.

COURSE DETAIL

Module.No	Modules / Topics	No.of Hours	Professor's Name
1	**Introduction and mathematical preliminaries**		
	What is Pattern recognition; Applications and Examples	1	Prof.C.A.Murthy
	Clustering vs. Classification; Supervised vs. unsupervised	1	Prof.Sukhendu Das
	Relevant basics of Linear Algebra, vector spaces	2	Prof.Sukhendu Das
	Probability Theory basics	1	Prof.C.A.Murthy

NPTEL

http://nptel.iitm.ac.in

Computer Science and Engineering

Pre-requisites:

Vector spaces and Linear Algebra; Algorithms.

Probability theory; Statistics.

Additional Reading:

C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Hyperlinks:

1. http://www.ph.tn.tudelft.nl/PRInfo/
2. http://kdd.ics.uci.edu/
3. http://morden.csee.usf.edu/nnc/index1.html
4. http://www.iapr.org/

Coordinators:

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		Basics of Estimation theory	1	Prof.C.A.Murthy
		Decision Boundaries, Decision region / Metric spaces/ distances	1	Prof.C.A.Murthy
		Mathematical Assignments	2 slides	
2		**Classification**		
		Bayes decision rule, Error probability	2	Prof.C.A.Murthy
		Examples	1	Prof.C.A.Murthy
		Normal Distribution	1	Prof.Sukhendu Das
		Linear Discriminant Function (equal covariance matrices)	1	Prof.Sukhendu Das
		Non-linear Decision Boundaries (unequal covariance matrices)	2	Prof.Sukhendu Das
		Mahalanobis Distance	1	Prof.Sukhendu Das
		K-NN Classifier	1	Prof.Sukhendu Das
		Fisher's LDA	1	Prof.Sukhendu Das
		Single Layer Perceptron	2	Prof.Sukhendu Das
		Multi-layer Perceptron	2	Prof.Sukhendu Das
		Training set, test set; standardization and normalization	1	Prof.C.A.Murthy
		List of Assignments	2-3 slides	

3	**Clustering**			
	Basics of Clustering; similarity / dissimilarity measures; clustering criteria.	1	Prof.C.A.Murthy	
	Different distance functions and similarity measures	1	Prof.C.A.Murthy	
	Minimum within cluster distance criterion	1	Prof.Sukhendu Das	
	K-means algorithm;	1	Prof.Sukhendu Das	
	Single linkage and complete linkage algorithms, MST	3	Prof.C.A.Murthy	
	K-medoids, DBSCAN	1	Prof.C.A.Murthy	
	Data sets - Visualization; Unique Clustering; No existence of clusters	1	Prof.C.A.Murthy	
	Assignments	2 slides		
4	**Feature selection**			
	Problem statement and Uses; Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, (l,r) algorithm;	4	Prof.C.A.Murthy	
	Probabilistic separability based criterion functions, interclass distance based criterion functions	2	Prof.C.A.Murthy	
5	**Feature Extraction**			
	PCA + Kernel PCA	3	Prof.Sukhendu Das	

6	**Recent advances in Pattern Recognition**		
	Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy techniques, and real-life examples	2	Prof.Sukhendu Das, Prof.C.A.Murthy
	Total	42	

References:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.

2. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.

3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.