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संगणक विज्ञान एंव अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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No:- Date:

CSX4225: Pattern Recognition Technique

L-T-P-Cr: 2-0-2-3

Pre-requisites: Linear algebra, Probability theory.

Objectives/Overview:

- To impart knowledge on basic principles of recognizing patterns using different machine learning techniques.
- To make students proficient in recognizing patterns using different supervised machine learning techniques.
- To impart the ability to develop various pattern recognition systems.

Course Outcomes – After completing this course, students should:

Sl. No	Course Outcome (CO)	Mapping to PO
1.	Basic concepts of probability distribution	PO1, PO2
2.	Different linear models of regression	PO1, PO2
3.	Concepts of different linear models of classification	PO1, PO2,PO3
4.	Concepts of various dimensionality reduction techniques	PO1, PO2,PO3
5.	Concepts and techniques of classifying patterns using Neural Network.	PO1, PO2, PO3, PO4, PO5
6.	Concepts and different kernels of Support Vector Machine and their usage in recognizing patterns.	PO1, PO2, PO3, PO4, PO5
7.	Concept and application of Bayesian network in pattern recognition.	PO1, PO2, PO3, PO4, PO5
8.	Concept and application of Hidden Markov Model in pattern recognition.	PO1, PO2, PO3, PO4, PO5

UNIT I: **Lectures: 4**

Introduction: Polynomial curve fitting, Probability theory, Model selection, Curse of dimensionality, Decision theory. **Probability distribution:** Binary variables, Multinomial variables, Gaussian distribution, Exponential family, Nonparametric methods.

UNIT II: **Lectures: 4**

Linear Models for Regression: Linear basis function models, The Bias-Variance Decomposition, Bayesian Linear Regression, Bayesian Model Comparison.

UNIT III: **Lectures: 5**

Linear Models for Classification: Discriminant functions, Probabilistic generative models, Probabilistic discriminative models.

UNIT IV: **Lectures: 5**

Dimensionality reduction: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Probabilistic PCA

UNIT V: **Lectures: 8**

Neural Networks: Feed-forward network functions, Network training, Error Backpropagation, Regularization in Neural Networks, Bayesian Neural Networks, Deep neural network – LSTM, BLSTM.

UNIT VI: **Lectures: 5**

Kernel methods: Dual representations, Constructing Kernels, Radial Basis Function networks, Gaussian Processes.

UNIT VII: **Lectures: 5**

Support Vector Machines: Optimal separation, Support Vector Machine Algorithm, Multi-class classification, SVM regression.

UNIT VIII: **Lectures: 6**

Graphical Models: Bayesian networks, Markov random fields, Hidden Markov Models-Forward algorithm, Viterbi algorithm, Baum-Welch algorithm, Gaussian mixture models**.**

Text Book/Reference Books:

1. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer.
2. Stephen Marsland, “.Machine Learning: An Algorithmic Perspective”, CRC Press.
3. Duda, Hart, Stork, “Pattern Classification”, Second edition, Willey India.