# 19CS31E3 - PATTERN RECOGNITION

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| **Course Category:** | Program Core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | Mathematics: basic understanding of differential and integral calculus, linear algebra and probability theory at least at the level of the course description of mathematics | **Sessional Evaluation:**  **Univ. Exam Evaluation:**  **Total Marks:** | 40  60  100 |
| **Objectives** | * Introduce the concepts of feature extraction, Bayesian decision theory, nearest-neighbor rules, clustering, support vector machines, neural networks, classifier combination, and syntactic pattern recognition techniques such as stochastic context-free grammars. * The course is part lecture and part seminar: students will present some course material to the class as well as complete and present a research paper. * In addition, programming assignments will provide students with practical experience in constructing pattern recognition systems such as optical character recognizers (OCR). | | |

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| **Course Outcomes** | Upon successful completion of the course, the students will be able to: | |
| CO1 | ● Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques. |
| CO2 | ● Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.. |
| CO3 | ● Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature. |
| CO4 | ● Apply pattern recognition techniques to real-world problems such as document analysis and recognition. |
| CO5 | ● Implement simple pattern classifiers, classifier combinations. |
| CO6 | ●Implement structural pattern recognizers |
| **Course Content** | UNIT – I  Introduction, Features, Feature Vectors, Classifiers, Supervised, Unsupervised and Semi-Supervised Learning.  UNIT – II  Introduction, Bayes Decision Theory, Discriminant Functions, Bayes Classification for Normal Distributions, Estimation of Unknown Probability Distributions: ML Parameter Estimation, MAP Estimation, Bayesian Inference, Maximum Entropy Estimation, Mixture Models, Non-Parametric Estimation, the Naïve-Bayes Classifier, the Nearest Neighbor Rule, Bayesian Networks..  UNIT – III  Introduction, Linear Discriminant Functions and Decisions, Hyper-planes, The Perceptron algorithm, Least Square Methods, Mean Square Estimation Revisited, Logistic Discrimination, Support Vector Machines for Separable Classes, SVM for Non-Separable Classes, SVM for Multiclass Case, ϑ-SVM  UNIT – IV  XOR Problem, Two Layer Perceptron, ThreelayerPerceptrons, Algorithms Based On Exact Classification Of Training Set, The Backpropagation Algorithm, Variation Of Bp Theme, Choice Of Cost Function, Choice Of Network Size, Generalized Linear Classifiers  UNIT – V  Probabilistic Neural Networks, SVM-Nonlinear Case, Beyond SVM Paradigm, Decision Trees, Combining Classifiers, Boosting, Class Imbalance Problem  UNIT –VI  Introduction, Proximity Measures, Number of Possible Clusterings, Categories of Clustering Algorithms, Sequential Clustering Algorithms, Agglomerative Algorithms, Divisive Algorithms, Hierarchical Algorithms for Large Datasets. | |
| **Text Books and References:** | **Text Books:**   1. Pattern Recognition by SergiosTheodoridis and KnostantinosKoutroumbas, Fourth Edition, Elsevier Publications, 2009,   **Reference Books:**   1. Pattern Recognition By Narasimhamurthy V Susheeladevi 2. Introduction To Pattern Recognization And Machine Learning By M Narasimhamurthy V Susheeladevi | |
|  | 1. [https://nptel.ac.in/courses](about:blank) 2. [https://freevideolectures.com/university/iitm](about:blank) | |