17CS42E3- PATTERN RECOGNITION

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | Student must require the knowledge of mathematics including some of the areas such as Markov Models, Neural Networks, Vector Machines and Clustering Techniques. | **Sessional Evaluation:****Univ. Exam Evaluation:****Total Marks:** | 4060100 |
| **Objectives** | * Understand basic concepts in pattern recognition
* Gain knowledge about state-of-the-art algorithms used in pattern recognition research.
* Understand pattern recognition theories, such as Bayes classifier, Decision trees, Vector Machines and clustering methods.
* Apply pattern recognition techniques in practical problems.
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| **Course Outcomes** | Upon the successful completion of the course, the students will be: |
| CO1 | Able to get better exposure regarding the basics of data sets and data structures |
| CO2 | Study of algorithms creates awareness of solutions in databases, data reduction and prototype selection |
| CO3 | Ability to identify classifiers, estimation of probabilities, construction of BBN, basics of markov models and its applicability.  |
| CO4 | Ability to use decision trees for classification, splitting nodes, Overfitting and Pruning etc. |
| CO5 | Able to get the utilization of VM in Neural Networks and various methods of combining classifiers |
| CO6 | Study the basics and supporting role of clustering methods and exposure on an example application. |
| **Course Content** | **UNIT – I****PR Basics**: Introduction, Definitions, Data Sets and Different Paradigms.**Representation**: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature Extraction.**UNIT – II****Representation (Continued):** Feature Selection, Evaluation of Classifiers and Clustering.**Nearest Neighbour Based Classifiers**: Nearest Neighbour Algorithm, Variants of the NN Algorithm,Use of the Nearest Neighbour Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, and Prototype Selection.**UNIT – III****Bayes Classifiers**: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with the NNC, Naive Bayes Classifier, Bayesian Belief Network. **Hidden Markov Models**: Markov Models for Classification, Hidden Markov Models and Classification Using HMMs.**UNIT – IV****Decision Trees**: Introduction, Decision Trees for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Overfitting and Pruning, Example of Decision Tree Induction. **Support Vector Machines**: Introduction, Learning the Linear Discriminant Function.**UNIT – V****Support Vector Machines (Continued)**: Neural Networks, SVM for Classification. **Combination of Classifiers**: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers.**UNIT – VI****Clustering**: Why is Clustering Important, Hierarchical Algorithms, Partitional Clustering, and Clustering Large Data Sets.**Case Study- An Application of Handwritten Digit Recognition**: Description of the Digit Data, Pre-processing, Classification Algorithms, Selection of Representative Patterns and Results. |
| **Text Books and References** | **Text Book(s):**1. M. Narasimha Murty, V. Susheela Devi “Pattern Recognition-An Algorithmic Approach”, Springer- Universities Press, 2011.

**Reference Books:**1. “Pattern Recognition”, Second Edition by S.THEODORIDIS and K. KOUTROUMBAS, Elsevier Academic Press, 2003.
2. “ Pattern Classification” by Richard O Duda, Peter E. Hart and David G Stork, Wiley Publishers, 2001.
3. J. P. Marques de Sa “ Pattern Recognition: Concepts, Methods and Applications”, Springer Publishers, 2001.
4. Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches” by Menahem Friedman & Abraham Kandel, World Scientific Publishers, 2000.
5. Christopher M. Bishop “Pattern Recognition and Machine Learning”, Springer, 2006.
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| **E-Resources** | 1. <https://nptel.ac.in/courses>
2. <https://freevideolectures.com/university/iitm>
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