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| **Course code** | **Machine Learning with Python** | **L** | **T** | **P** | **J** | **C** |
|  |  | **2** | **0** | **2** | **0** | **3** |
| **Pre-requisite** | **Nil** | **Syllabus Version** | | | | |
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| **Course Objectives:** | | | | | | |
| This course introduces the basics of machine learning using an approachable and well-known programming language, Python. It covers a broad set of operations including preparing and analyzing the datasets, segregating into training and testing, selecting appropriate models based on data, training the data by varying hyperparameters to achieve better results and to visualize the results for preferable understanding. | | | | | | |
| **Course Outcome:** | | | | | | |
| By the end of the course the students will be able to,   1. Analyze, pre-process, classify the dataset and select appropriate algorithm for training the model. 2. Train the machine learning model using chosen algorithm to predict/classify/cluster and produce information. 3. Able to ensemble multiple models in case of requirement for better results. 4. Choose appropriate metrics to check validity of trained models and create visualizations for better presentation. | | | | | | |
| **Student Learning Outcomes(SLO):** | | | | | | |
| 2. Having a clear understanding of the subject related concepts and of contemporary issues  5. Having design thinking capability  7. Having computational thinking (Ability to translate vast data in to abstract concepts and to understand database reasoning)  9. Having problem solving ability- solving social issues and engineering problems | | | | | | |
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| **Module** | **Topics** | **Hours** | **CO** |
| 1. | **Introduction to Machine Learning & Python** | 6 | 1 |
|  | Machine Learning – Introduction & applications – Learning Paradigms -Creating Environment (Python & Anaconda) – Introduction to NumPy, Pandas, SKlearn, pyplot, seaborn packages – Reading data files into Memory - Visualization |  |  |
| 2. | **Data Preprocessing** | 5 | 1 |
|  | Understanding datasets – Spitting datasets to training & testing - Data cleaning – Normalization – Correlation Analysis – Feature Selection – Feature Reduction – Learning curves – Cross validation - Machine Learning model |  |  |
| 3. | **Supervised Learning – I (Regression)** | 6 | 1,2,4 |
|  | Introduction – Linearity & Non-linearity - Linear Regression – Multi- Linear Regression – Gradient Descent – Evaluation of Model – Metrics supported – Implementation of Multi-Linear Regression – Variance-Bias tradeoff |  |  |
| 4. | **Supervised Learning – II (Classification)** | 8 | 1,2,4 |
|  | Introduction – Logistic Regression – Naïve Bayes – Decision trees – KNN classification – Perceptron (Theory, Implementation & evaluation) – Hyperparameters – Confusion matrix – F1 score – Visualization |  |  |
| 5. | **Support Vector Machines** | 3 | 1,2,4 |
|  | Introduction – Linear & Non-linear SVM – Kernel – Designing customized kernels – Hyperparameters |  |  |
| 6. | **Unsupervised Learning (Clustering)** | 5 | 1,2,4 |
|  | Elaboration – Partition based – Hierarchical – Density based - K-Means – KNN – K-Mode – K-Medoid – Evaluation metrics |  |  |
| 7. | **Ensemble Learning** | 5 | 3,4 |
|  | Introduction – Possibilities - Bagging – Boosting – Adaboost, XGBoost – Random Forest – Evaluation |  |  |
| 8. | **Essentials** | 2 | 1,2,3,4 |
|  | Repositories – Online resources – Execution platforms – Selection of algorithms - PCA |  |  |
| Total Hours | | 40 |  |
| **Teaching Pedagogy:**  Online Learning materials, Video Lectures and Case studies  Evaluation Criterion: Online Quiz, Digital Assignment, Case Study Analysis Report and Term End Examination | | | |
| **Reference Materials:**   1. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition,1997. 2. Ethem Alpaydin , " Introduction to Machine Learning ” , MIT Press, Prentice Hall of India, Third Edition 2014. 3. Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning using Python”, Wiley Publications, 2019. | | | |