

Course No	Title of the course	Course Structure	Pre-Requisite
COCSC17	Machine Learning	3L-0T-2P	
<b>COURSE OUTCOMES (CO)</b> <ol style="list-style-type: none"> <li>1. To understand the machine learning approach towards solving problems</li> <li>2. To learn about and develop different ML models and evaluate them</li> <li>3. To apply the ML models for various learning tasks in biotechnology and other domains</li> </ol>			
<b>UNIT I - Introduction:</b> Definition of learning systems, Importance of Data in ML, Workflow of ML, Types of learning models - supervised, unsupervised and reinforcement learning models, Regression and Classification tasks, Challenges in ML: Avoiding over-learning, Curse of dimensionality, Feature selection and Reduction and Tuning hyperparameters, Applications of ML			
<b>UNIT II: Regression and Classification models:-</b> Regression - Linear Regression – introduction, types of LR, and model assumptions, Linear Regression gradient descent learning, Model Estimation, Performance metrics - R-Square and adjusted R-Square, L1 and L2 Regularization. Classification - Logistic Regression – log-odds, odds ratio, Logit function, Performance metrics for classification - Cross-entropy, Confusion matrix – Recall, Precision, Accuracy, F1 measure, specificity, ROC-AUC curves. K Nearest Neighbor for classification and regression			
<b>UNIT III - Supervised, Unsupervised, Reinforcement and Ensemble learning models:</b> Supervised - Decision trees, Entropy, Information gain, ID3 algorithm for DTs, Regularization – pruning and stopping DT growth methods, Gini Index for CART algorithms, Bias and variance error. Unsupervised: K-means clustering. Reinforcement: Q-learning Ensemble Learning – Bagging, Random Forest, Adaboost.			
<b>UNIT IV - Generative and Discriminative learning models:</b> Generative - Bayesian Classification, Naïve-Bayes Classifier, Bayesian Networks. Discriminative - Support Vector Machines, Characteristics, Maximum Margin Hyperplane, Optimization, Kernel Functions, X-OR classification			
<b>UNIT V - Neural Learning and advanced architectures:</b> Neural Learning - Artificial Neural Network versus Biological Neural networks - Perceptron, Multi-Layer Feed Forward Neural Network, Back Propagation. Advanced architectures (depending on time and interest): Deep Neural Networks – Convolutional Neural Networks, Recurrent Neural networks, Long Short Term Memory (LSTM), GAN/ Attention networks/ BERT/ other evolving ML models			
<b>PRACTICALS (7)</b> <ol style="list-style-type: none"> <li>1. Linear regression</li> <li>2. Logistic Regression</li> <li>3. Decision Trees</li> <li>4. Bayesian Learning</li> <li>5. KNN</li> <li>6. K-means</li> <li>7. CNN</li> </ol>			
<b>SUGGESTED READINGS</b> <b>Books</b> <b>Websites for Tutorials</b>			

A meeting was held on 31<sup>st</sup> of August, 2021.

