Course Code	BIO542
Course Name	Machine Learning for Biomedical Applications
Credits	4
Course Offered to	UG/PG
Course Description	This course is designed for students having wide range of background like biology, medical science, pharmacology, bioinformatics, computer science. This course is divided in following three sections; i) Major challenges in the field of biomedical science, ii) Introduction/implementation of machine learning techniques for developing prediction models, and iii) solving biomedical problems using machine learning techniques. This course will be help students in developing novel methods for solving real-life problems in the field of biological and health sciences. Attempt will made to bridge gap between students and world class researchers, studentds will be exposed to highly accurate methods based on machine learning techniques (research papers).

Pre-requisites

Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requisite(other)
None	None	Basic knowledge of statistics and programming

*Please insert more rows if required

Post Conditions

CO1	CO2	CO3	CO4
Understanding prediction/ classification/ clustering realated challenges in biomedical and health scinece.	How to develop prediction models using major learning techniques like SVM, ANN, Random Forest, KNN	Generating features for biomolecules and biomedical images. Selecting best features/dimension reduction/PCA for developing models.	Measuring performance of methods and cross-validation techniques for in silico valiadtion of methods.

Weekly Lecture Plan

Week Number	Lecture Topic	COs Met	Assignment/Labs/Tutorial
1	Introduction to biomedicals science, challenges in health and bimedical informatics	CO1	Creation of datasets from raw data
2	Classification of bimolecules (DNA, RNA, Proteins)	CO1,CO3	Software packages for implementing machine learning techniques
3	Concept of disease biomarkers	CO1, CO3	Scripts for generation, manipulation and selection of features
4	Designing of subunit vaccines (prediction of b-cell epitopes)	CO1,CO3	Developing models using SVM-light and weka
5	Logics behind major machine learning techniques (SVM, ANN, HMM, KNN, Random Forest)	CO2	Presentation of research articles
6	Implemenation of machine learning techniques for developing prediction and classification models (Supervised & Unsupervised) and parameter optimization	CO2	
7	Feature generation from biomedical images, biomolecules and genomic information	CO1, CO2, CO3	
8	Feature selection techniques, feature stability and manipulation	CO1, CO2, CO3	
9	Creation of non-redundant/clean datasets from raw information	CO1,CO4	
10	Benchmarking, measuring performance (ROC, MCC, precision) & Evaluation of Models (internal, external validation)	CO1, CO3, CO4	
11	Development of models for disease forcasing, Cancer biomarkers & therapeutic biomolecules	CO1, CO2, CO3, CO4	
12	Case study of research papers based on machine learning models	CO1, CO2, CO3, CO4	
13	Assignment of real-life problems for developing highly accutae models.	CO1, CO2, CO3, CO4	

*Please insert more rows if required

Assessment Plan

Type of Evaluation	% Contribution in Grade
Mid-sem	30
End-sem	30
Project	30
Paper presentation	10

*Please insert more row for other type of Evaluation

Resource Material

Type	Title
Textbook	Cancer Drug Resistance: Volume 1395 of series Method in Molecular Biology
Textbook	Immunoinformatics: Volume 409 of series Method in Molecular Biology
Reference	Machine Learning in Action by Peter Harrington
Reference	Machine Learning by Tom M. Mitchel