Machine Learning Algorithms Lab		Semester	5
Course Code	**BCIL504**	CIE Marks	50
Teaching Hours/Week(L: T:P)	0:0:2	SEE Marks	50
Credits	01	Exam Hours	2
Examination type(SEE)	Practical		

Course outcomes:

At the end of the course the student will be able to:

1. Demonstrate proficiency in using Python libraries for machine learning tasks.
2. Develop the ability to carry out an end-to-end machine learning project.
3. Implement and evaluate various machine learning algorithms.
4. Apply dimensionality reduction techniques and understand their impact on machine learning models.
5. Implement unsupervised learning techniques for clustering.

Sl.No	CO's	Experiments
1	CO1	**Introduction to Python for Machine Learning** **Objective**: Install necessary libraries and set up the environment for machine learning in Python. **Tasks**:Install Anaconda (or another Python distribution suitable for data science). Create a new Python environment specifically for machine learning projects. Write a Python script to install numpy, pandas, matplotlib, scikit-learn, and tensorflow. Import these libraries and print their versions.
2	CO1 & CO2	**End-to-End Machine Learning Project** **Objective**: Work through a complete machine learning project. **Tasks**: Use a real-world dataset, perform data cleaning, feature engineering, model training, and evaluation.
3	CO3	**Implementing Bayesian Decision Theory** **Objective**: Implement Bayesian Decision Theory for classification. **Tasks**: Write a Python program to classify a given dataset using Bayesian Decision Theory.
4	CO3	**Classification Using MNIST Dataset** **Objective**: Implement a classifier for the MNIST dataset. **Tasks**: Train a binary classifier on the MNIST dataset and evaluate its performance using various metrics.
5	CO3	**Training and Evaluating Linear Regression Models** **Objective**: Implement linear regression and evaluate its performance.

		Tasks: Use a suitable dataset to train a linear regression model and evaluate its performance using metrics such as RMSE and R^2 score.
6	CO3	**Regularized Linear Models** **Objective**: Implement Ridge and Lasso regression. **Tasks**: Compare the performance of Ridge and Lasso regression on a dataset and analyze the effect of regularization.
7	CO4	**Dimensionality Reduction Techniques** **Objective**: Apply PCA and LDA for dimensionality reduction. **Tasks**: Implement PCA and LDA on a high-dimensional dataset and visualize the results.
8	CO3	**Support Vector Machines** **Objective**: Train and evaluate SVM classifiers. **Tasks**: Implement linear and kernelized SVMs on a given dataset and compare their performance.
9	CO3	**Decision Trees and Random Forests** **Objective**: Implement and evaluate decision trees and random forests. **Tasks**: Train a decision tree and a random forest classifier on a dataset, visualize the trees, and evaluate their performance.
10	CO5	**Clustering Algorithms** **Objective**: Implement various clustering algorithms. **Tasks**: Apply K-means, Spectral, and Hierarchical clustering on a dataset and compare the clustering results.

Suggested Learning Resources:

Textbook:

1. Introduction to Machine Learning by Ethem Alpaydin
2. Hands-on Machine Learning with Scikit-Learn and TensorFlow by Aurélien Géron

VirtualLabs(CSE):

1. **http://cse01-iiith.vlabs.ac.in/**

https://playground.tensorflow.org/

Code: BCI505 **Course: MACHINE LEARNING**
Credits: 3 **L:T:P - 3:0:0**
SEE: 50 Marks **CIE: 50 Marks**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	None
Learning objectives	1. Acquire theoretical Knowledge on setting hypothesis for pattern recognition. 2. Apply suitable machine learning techniques for data handling and to gain knowledge from it. 3. Evaluate the performance of algorithms and to provide solution for various real-world applications.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Explain the basic principles of Learning theories	Understanding
CO2	Explain the principles of dimensionality reduction and feature selection techniques	Apply
CO3	Develop a wide variety of supervised learning algorithms	Apply
CO4	Utilize decision trees and random forest algorithms judiciously, and choose appropriate unsupervised machine learning algorithms for unlabeled data.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2		2	2
CO2	-	3	-	-	2	-	-	-	-	-	-	2		2	2
CO3	-	-	2	2	-	-	-	-	-	-	-	2		2	2
CO4	-	-	-	3	3	-	-	-	-	-	-	2		2	2

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: The Machine Learning Landscape				
1.1	**The Machine Learning Landscape**: What Is Machine Learning (ML)? Uses and Applications with examples	2		
1.2	Types of Machine Learning, Main Challenges of Machine Learning, Testing and Validating.	2		
1.3	**End to End Machine Learning**: Working with Real Data	2		
1.4	Frame the Problem, Select the Performance Measure, Prepare the Data for ML Algorithms, Training and Evaluating the Data Set.	2		
1.5	**Bayesian Decision Theory**: Introduction, Classification.	2		

Module – 2: Classification and Training Models				
2.1	**Classification:** MNIST, Training Binary Classifier	2		
2.2	Performance Measures, Multiclass classification.	2		
2.3	**Training Models**: Linear Regression, Gradient Descent	2		
2.4	Regularized Linear Models – Ridge & Lasso Regression.	2		
Module – 3: Dimensionality Reduction and Support Vector Machines				
3.1	**Dimensionality Reduction**: The Curse of Dimensionality, Main Approaches for Dimensionality	2		
3.2	PCA, Linear Discriminant Analysis (LDA).	2		
3.3	**Support Vector Machines**: Linear SVM Classification, Nonlinear SVM	2		
3.4	VM Regression, Kernelized SVMs.	2		
Module – 4:Decision Trees				
4.1	**Decision Trees**: Univariate Trees: classification & Regression Trees, Training and Visualizing a Decision Tree	2		
4.2	Pruning, Rule Extraction from Trees, Learning Rules from Data, Making Predictions	2		
4.3	Estimating Class Probabilities, CART Training Algorithm, Computational Complexity	2		
4.4	Gini Impurity or Entropy? Regularization Hyperparameters, Multivariate Trees.	2		
Module – 5: Ensemble Learning and Unsupervised Learning				
5.1	**Ensemble Learning and Random Forests**: Voting Classifiers, Bagging and Pasting, Random Patches	2		
5.2	Random Subspaces, Random Forests, Boosting	2		
5.3	**Unsupervised Learning Techniques**: Clustering – K means, Spectral, Hierarchical	2		
	Total No. of Lecture Hours	**40**	**-**	**-**
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. Introduction to Machine Learning, Ethem Alpaydin, PHI Learning Pvt. Ltd, 3rd Edition, 2018.
2. Hands-on machine learning with Scikit-Learn and TensorFlow: concepts, tools, and techniques to build intelligent systems, Aurelien Geron, O'Reilly Media, 2019.

Reference Book:

1. Machine Learning, Tom Mitchell, McGraw Hill, 2013.
2. Probability and Statistics for Computer Scientists, Michael Baron, 3rd Edition, CRC press, 2019.

Online Resources:

1. https://nptel.ac.in/courses/106106139
2. https://www.coursera.org/programs/faculty-learning-program-iqr5x/specializations/ibm-intro-machine-learning?source=search