Lab with Capstone Project- ML & DL Lab

Code: CS32142CS	Course Type: Prct.	Semester: I
Evolution Scheme (TA-MSE-ESE): 25-25-50	Total Marks: 100	L-T-P (Credits): 0-0-4 (2)

Pre-Requisites: Python Programming, Probability and Statistics, Linear Algebra, and basic knowledge of Machine Learning and Deep Learning.

Course Objective: s

1. Implement machine learning and deep learning workflows for real-world datasets using modern tools and frameworks.
2. Build and evaluate supervised, unsupervised, and neural-network-based models through guided mini-projects.
3. Develop practical skills in experimentation, hyperparameter tuning, demo preparation, code management, and technical reporting.
4. Execute a capstone project that demonstrates end-to-end problem-solving using ML/DL methods.

Course Outcomes: At the end of the course, the student will be able to

CO-1	Implement preprocessing, feature engineering, visualization, and baseline ML workflows for structured and unstructured datasets.
CO-2	Build and evaluate supervised and unsupervised learning models through guided implementation and comparative experimentation.
CO-3	Design, train, tune, and analyze deep learning models for classification, regression, and sequence or image tasks.
CO-4	Develop, demonstrate, document, and present a capstone ML/DL project using code repositories, experimental analysis, and technical reporting.

Course Articulation Matrix:

PO	PEO-1	PEO-2	PEO-3	PEO-4	PEO-5
CO-1	2	2	1	1	1
CO-2	3	3	1	1	2
CO-3	3	3	1	1	2
CO-4	3	2	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

List of Experiments:

Module A: Foundational Implementation

1. Python scientific stack for ML/DL: NumPy, Pandas, Matplotlib, scikit-learn, TensorFlow or PyTorch.
2. Data preprocessing: missing values, encoding, scaling, train-validation-test split.
3. Baseline supervised learning: linear/logistic regression, k-NN, decision trees.
4. Model evaluation: confusion matrix, precision, recall, F1-score, ROC-AUC, cross-validation.
5. Unsupervised learning: clustering and PCA.
6. Neural-network basics: MLP, backpropagation, optimization, regularization.

Module B: Three Guided Mini-Projects

1. Mini-Project 1: Building and Evaluating Classifiers
2. Mini-Project 2: Unsupervised Learning and Representation
3. Mini-Project 3: Neural Networks / Deep Learning Model

Module C: Capstone Project

1. Problem selection and literature scan.
2. Dataset collection or curation and exploratory analysis.
3. Model development and comparison.
4. Hyperparameter tuning and error analysis.
5. Final demo, repository submission, technical report, and presentation.

Learning Resources:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer.
3. Ethem Alpaydin, Introduction to Machine Learning, MIT Press.

Textbooks:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning.
3. François Chollet, Deep Learning with Python.
4. Sebastian Raschka, Yuxi Liu, Vahid Mirjalili, Machine Learning with PyTorch and Scikit-Learn