

**SIR SYED UNIVERSITY OF ENGINEERING & TECHNOLOGY**
COMPUTER SCIENCE & INFORMATION TECHNOLOGY DEPARTMENT

BS Computer Science

COURSE INFORMATION SHEET

Session:	Fall-2023
Course Title:	Machine Learning
Course Code:	CS-466
Credit Hours:	3
Semester:	8 th
Pre-Requisite:	Nil
Instructor Name:	Mr. Shardha Nand & Ms. Rabiya Tahir shardhanand@ssuet.edu.pk
Email and Contact Information:	ratahir@ssuet.edu.pk Room No. HS-16
WhatsApp Group:	
Office Hours:	09:00-17:00
Mode of Teaching:	Synchronous/Asynchronous/Hybrid/Blended

COURSE OBJECTIVE:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using machine learning methods for solving practical problems.
- To gain experience of doing independent study and research.

COURSE OUTLINE:

Introduction and definition of machine learning, Goals and applications of machine learning, training & test data, feature selection, supervised learning, un-supervised learning, semi-supervised learning and reinforcement learning, regression analysis, linear regression, logistic regression, classification algorithms, decision tree, naïve bayes classification, k-nearest neighbor algorithm, random forest, gradient decent, support vector machine, neural networks, cross validation, unsupervised learning, clustering, natural language processing, deep learning and computer vision, Model Selection & Improvement, Cross Validation Introduction, Benefits of Cross Validation, K-fold Cross Validation Implementation, Hyper Parameter Tuning overview of algorithms and grouped by similarity, challenges and key considerations.

COURSE LEARNING OUTCOMES (CLOs):

CLO #	Course Learning Outcomes (CLOs)	PLO Mapping	Bloom's Taxonomy
1	Describe the characteristics of different algorithms of Machine Learning and identify the functionalities of these in Classification and prediction	PLO_2 (Knowledge for Computing Problem)	C2 (Understanding)
2	To be able to apply different machine learning techniques to identify problems and provide their solutions.	PLO_3 (Problem Analysis)	C3 (Applying)
3	To be able to analyze different algorithms to improve the performance of machine learning models.	PLO_3 (Problem Analysis)	C4 (Analyze)



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RELATIONSHIP BETWEEN ASSESSMENT TOOLS AND CLOs:

Assessment Tools	CLO1	CLO2	CLO3
Quizzes	3(12%)	3(7%)	4(14%)
Assignments	3(12%)	3(7%)	4(14%)
Mid	15(58%)	15(33%)	0
Final	5(19%)	25(54%)	20(71%)
Total	26(26%)	46(46%)	28(28%)

GRADING POLICY:

Assessment Tools	Percentage	Marks
Quizzes	10%	10
Assignments	10%	10
Midterm Exam	30%	30
Final Exam	50%	50
TOTAL	100%	100

Recommended Book:

- Hierons, R., 1999. Machine learning. Tom M. Mitchell. Published by McGraw-Hill, Maidenhead, UK, International Student Edition, 1997. ISBN: 0-07-115467-1, 414 pages. Price: UK£ 22.99, soft cover
- Muller, A.C. and Guido, S., 2017. Introduction to machine learning with Python. O'Reilly.
- Aurélien, G.É.R.O.N., 2017. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts. Tools, and Techniques to Build Intelligent Systems

Reference Books:

- Theobald, O., 2017. Machine learning for absolute beginners: a plain English introduction (Vol. 157). London, UK: Scatterplot press
- Francois, C., 2018. Deep learning with Python.

Benchmark:

1. International university link :

<https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/>

2. National university link :

<https://ces.lums.edu.pk/course-details.php?cid=127>



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LECTURE PLAN

Course Title: Machine Learning

Course Code: CS- CS-466

Week No.	Week Dates	Topics	Required Reading	Key Date
1	09-10-2023 To 13-10-2023	Introduction Introduction to Artificial Intelligence & Machine Learning. Types of Machine Learning (<i>supervised, Unsupervised, Semi Supervised, Reinforcement Machine Learning</i>), Applications of ML Programming for ML (Python, R). Introduction of Libraries (scikit-learn, etc). Intro to Dataset in ML Training & Testing Dataset. Explore the Dataset. Use of Kaggle.	C.M Chapter #1 Page#1-11 OT Page# 11	
2	16-10-2023 To 20-10-2023	Data Preprocessing Introduction Importance of Data Preprocessing Steps and Techniques in Data Preprocessing Data Cleaning, Data Integration, Data Reduction, Data Transformation, Data Discretization	C.M Chapter #3 Page#132	
3	23-10-2023 To 27-10-2023	Supervised Learning Algorithms for Unsupervised Learning. Regression Analysis Introduction & Overview of Regression. Type of Regression. Linear, Multi-Linear, Logistic Regression.	C.M Chapter #2 Page#25	Assignment#1
4	30-10-2023 To 03-11-2023	Classification Algorithms Types of Classification Algorithms. Evaluation of Algorithms by Confusion Matrix Case Study to understand Confusion Matrix	C.M Chapter #5 Page#279	
5	06-11-2023 To 10-11-2023	Decision Tree Algorithm: Overview of Decision Tree Algorithm. Working steps of ID3 Algorithm.	C.M Chapter #2 Page#70	Quiz #1



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6	13-11-2023 To 17-11-2023	Ensemble Bagging Boosting Overview. Implementation Difference between Decision Tree and Random Forest	C.M Chapter #2 Page#83	
7	20-11-2023 To 24-11-2023	Naïve Bayes Classification Overview of Naïve Bayes Algorithm. Working of NB & Gaussian Naïve Bayes. K-nearest neighbor Overview of KNN Working and Implementation	C.M Chapter #2 Page#40-68	
8	27-11-2023 To 01-12-2023	Gradient Decent Introduction, Importance and working Learning Rate Implementation Support Vector Machine Overview of SVM. Implementation of SVM.	T.M Chapter #4 Page#89 C.M Chapter#2 Page#98	
9	Midterm Examination (04-12-2023 to 09-12-2023)			
10	11-12-2023 To 15-12-2023	Deep Learning Introduction to Deep Learning Artificial Neural Networks Overview. Applications of ANN. Structure and need of ANN. Working and Architecture of ANN Component of Neural Network. Flow of Simple ANN. Implementation of ANN.	FC Chapter #1 Page, 4-27	<i>Assignment #2</i>
11	18-12-2023 To 22-12-2023	Computer Vision Introduction and Overview Convolutional Neural Network Introduction and Implementation of CNN Overview, Importance and Features of YOLO	FC Chapter#3 Page# 56-77	
12	25-12-2023 To 29-12-2023	Model Selection & Improvement Cross Validation Introduction. Benefits of Cross Validation. K-fold Cross Validation Implementation. Hyper Parameter Tuning	C.M Chapter#5 Page#252	<i>Quiz #2</i>
13	01-01-2024 To 05-01-2024	Unsupervised Learning Algorithms for Unsupervised Learning. Clustering Overview Types of Clustering (Hard/Soft). Difference b/w Supervised and Unsupervised Learning. Applications of Unsupervised Learning	C.M Chapter#3 Page#182	<i>Assignment #3</i>
14	08-01-2024 To 12-01-2024	Dimensional Reduction Principal Component Analysis (PCA). Introduction and Use of PCA. Implementation of PCA.	C.M Chapter#5 Page#140	<i>Quiz #3</i>



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15	15-01-2024 To 19-01-2024	Natural Language Processing Introduction Text Mining and NLP Application and Component of NLP Implementation	AG Chapter#14 Page#405	
16	22-01-2024 To 26-01-2024	Reinforcement Learning Introduction, Process and Examples Reward Maximization Markov Decision Process Understanding Q-Learning with Example Implementation Summary and Overview Algorithms grouped by Similarity Overview of ML Algorithms Recent Trends in ML Key Considerations and Challenges for ML	AG Chapter#16 Page#437	
Final Examination (30-01-2024 to 10-02-2023)				

C.M: C. Muller, **TM:** Tom M. Mitchell, **OT:** Oliver Theobald,
AG: Aurélien Géron, **FC:** Francois Cholet