



**GC University, Lahore**

**Department** **of** Computer Science

**Machine Learning** **2021-2025**

Credit Hours : 3+0

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| Instructor: Office: | **Dr.** **Muhammad Safyan** Room No. 114 | Email: Office Hours:  Extension: | safyanch@gcu.edu.pk Mon-Fri 8am – 4pm  270 |

**Course Description**

This course provides a broad introduction to machine learning and statistical pattern recognition. Topics include: supervised learning (generative/discriminative learning, parametric/non-parametric learning, neural networks, and support vector machines); unsupervised learning (clustering, dimensionality reduction, kernel methods); learning theory (bias/variance tradeoffs, practical advice); reinforcement learning and adaptive control. The course will also discuss recent applications of machine learning, such as to robotic control, data mining, autonomous navigation, bioinformatics, speech recognition, and text and web data processing.

Course is dedicated to Research and application

**Preliminary Syllabus**

* Introduction to machine Learning, Demos, Notation, Tools
* supervise vs unsupervised learning, Linear Regression, Model representation, cost function and its intuition, Gardient Descent and its intuition.
* Jupyter Notebook, Python and its practices
* Introduction t o Linear Algebra: matrices and vectors, Addition and Scalar Multiplication, Matrix vector multiplication, matrix multiplication properties, inverse and transpose of matrix,
* Practices of Pandas and NumPy Practice, Matplolib
* Regression with multiple feature, its gradient descent, polynomial Regression,
* Logistic Regression, its hypothesis, detecting decision boundary, cost function and gradient descent
* End to End Machine Learning Project-1
* Data Distributions: Error Analysis, Training vs validation vs Test data processing.
* Model Overfitting, Under fitting, Reducing overfitting with Regularization
* Model Evaluation Matrices: Accuracy, Precision , Recall, F1-Score, ROC curve. Adjusted R Score, Adjusted Mean R Score.
* Enpd to End Machine Learning Project-2
* Decision Tree, Random Forest, Bagging, Boosting, AdaBoost. Ensembled Model.
* Naïve Bayes Theorem, Naïve Bayes Classifiers.
* K-Mean Clustering
* Recommender System,
* Principal Component Analysis
* Neural Network(NN): Non Linear Hypothesis, how the neuron of the brain works, Model representation of NN, cost function , back propagation, Gradient check in NN.
* K-Mean Clustering

**Recommended Text Books**

1. Pattern Recognition and Machine Learning" by Christopher M. Bishop
2. Machine Learning" by Tom Mitchell 2017.

**Grading / Mark Scheme**

 10/15-Minute Quizzes:

 Assignments:

 Mid-Term Exam:

 Final Exam:

**Policy Matters**

 Assignments will be issued which will be due one week from the issue date.

 Quizzes may be conducted in class during the first 10-15 minutes, and late-comers will suffer.

 Missed quizzes cannot be retaken under any circumstances.

 Anyone found assisting or committing plagiarism in any assignment or quiz will have all their assignment and quiz marks cancelled.

 At least 80% attendance needs to be maintained in order to be allowed to sit the Final Exam.