*Suggested Teaching Guidelines for*

# Practical Machine Learning

# PG-DBDA September 2021

**Duration: Duration: 60 hours theory and 60 hours Lab**

**Objective:**Practicing Machine Learning Algorithms

**Prerequisites:**Good knowledge of Python Programming and Statistics

**Evaluation method:**
Theory exam– 40%
Lab Exam - 40%
Internal exam- 20%

**List of Books / Other training material**

**Textbook:**

1. Introduction to Machine Learning with Python - A Guide for Data Scientists, Muller Andreas / Shroff Publishers

**Reference Book:**

1. Machine Learning with R by Brett Lantz
2. Machine Learning for Big Data: Hands- On for Developwer by Jasaon Bell, Wiley
3. Machine Learning: Hands-on for Developers and Technical Professionals
4. Machine Learning: A Bayesian and Optimization Perspective
5. Introduction to Machine Learning, Third Edition
6. R in Action, Robert Kabakoff

Note:

- Pytorch Framework should be taught in Lab Hours

**Note: Each session having 2 Hours**
**Session 1 & 2**
**Lecture**

- What is machine learning?
- Algorithm types of Machine learning
- Supervised and Unsupervised Learning
- Uses of Machine learning
- Evaluating ML techniques
- Introduction to Scikit Learn
- Performing ML using Scikit Learn

**Session 3 and 4**
**Lecture**

- Clustering
- Hierarchical Clustering &K means
- Distance Measure and Data Preparation – Scaling & Weighting
- Evaluation and Profiling of Clusters
- Hierarchical Clustering

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# Practical Machine Learning

## PG-DBDA September 2021

- Clustering Case Study
- Principal Component analysis

**Session 5, 6 & 7**
**Lecture**

- Decision Trees
- Classification and Regression Trees
- Concept of Model Ensembling
- Random forest, Gradient boosting Machines, Model Stacking
- CAT Boost
- XG Boost

**Session 8 & 9**
**Lecture**

- Bayesian analysis and Naïve bayes classifier
- Assigning probabilities and calculating results
- Discriminant Analysis (Linear and Quadratic)
- K-Nearest Neighbors Algorithm

**Session 10**
**Lecture**

- Association rules mining
- Apriori

**Session 11 & 12:**
**Lecture**

- Linear Regression
- Logistic Regression
- Polynomial Regression
- Stepwise Regression
- Ridge Regression
- Lasso Regression
- ElasticNet Regression

**Session 13:**
**Lecture**

- Support vector Machines
- Basic classification principle of SVM
- Linear and Nonlinear classification (Polynomial and Radial)

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# Practical Machine Learning

# PG-DBDA September 2021

**Session 14&15:**

**Lecture**

- Moving average, Exponential Smoothing, Holt's Trend Methods, Holt-Winters' Methodsfor seasonality
- Autocorrelation (ACF & PACF), Auto-regression, Auto-regressive Models, Moving Average Models
- ARMA &ARIMA

**Session 16& 17:**

**Lecture**

- ML in Real Time
- Algorithm Performance Metrics
- ROC and AOC
- Confusion Metrix
- F1 Score
- MSE and MAE

**Session 18:**

- Recommendation Systems
  - Data Collection & Storage, Data Filtering
  - Collaborative Filtering
  - Factorization Methods
  - Evaluation Metrics: Recall, Precision, RMSE, Mean Reciprocal Rank, MAP at K, NDCG

**Session 19:**

- Anomaly detection
- Point, Contextual and Collective Anomaly
- Supervised and Unsupervised anomaly detection

**Session 20:**

- DBSCAN Clustering

**Session 21 &22:**

**Lecture**

- Introduction to NLP
- Working with NLTK
- Word2Vec
- GloVe word vectors
- Sentiment Classification

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# PG-DBDA September 2021

**Session 23& 24:**
**Lecture**

- Introduction to Deep Learning
- Introduction to Tensorflow and Keras
- Introduction to Auto-encoders
- Neural Network and its applications
- Single layer neural Network
- Activation Functions: Sigmoid, Hyperbolic Tangent, ReLu
- Overview of Back propagation of errors

**Session 25**
**Lecture**
**Deep Learning Essentials**

- Early Stopping for Preventing Overfitting
- Dropout
- Training Methods for Neural Network (High-Level Overviews only)
  - Update of weights with single training set element, Batch Training, Mini-batch Training, Stochastic Gradient Descent
  - Training Methods for Neural Network (High-Level Overviews only)
- Classic Backpropagation
- Momentum Backpropagation
- ADAM
  - L1 and L2 Regularization

**Session 26 & 27**
**Lecture**
**Convolutional Neural Network using PyTorch**

- Introduction to PyTorch Framework
- Pytorch vs Tensorflow
- Convolutional Concept
- Inception Network
- Transfer Learning
- Data Augmentation
- Object Detection
- YOLO Algorithm (High-Level Overview)

**Session 28 & 29**
**Lecture**
**Recurrent Neural Network (RNN) using Pytorch**

- RNN Concept
- Types of RNNs
- Vanishing gradients with RNNs
- Gated Recurrent Unit (GRU) - (High-Level Overview only)
- Long Short-Term Memory (LSTM) - (High-Level Overview only)

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# PG-DBDA September 2021

**Session 30**
**Lecture**

- Introduction to AI
- Applications of AI
- Role of DNN and conventional ML in AI
- Case Studies