Suggested Teaching Guidelines for
Practical Machine Learning
PG-DBDA September 2022

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 Developer 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

Session 1 & 2
- 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 & 4
- Clustering
- Hierarchical Clustering &K means
- Distance Measure and Data Preparation – Scaling & Weighting
- Evaluation and Profiling of Clusters
- Hierarchical Clustering
- Clustering Case Study
- Principal Component analysis

Session 5, 6 & 7
- Decision Trees
- Classification and Regression Trees
- Concept of Model Ensembling
- Random forest, Gradient boosting Machines, Model Stacking
- CAT Boost
- XG Boost

Session 8 & 9
- Bayesian analysis and Naïve bayes classifier
- Assigning probabilities and calculating results
- Discriminant Analysis (Linear and Quadratic)
- K-Nearest Neighbors Algorithm

Session 10
- º Association rules mining
- º Apriori

Session 11 & 12:
- º Linear Regression
- º Logistic Regression
- º Polynomial Regression
- º Stepwise Regression
- º Ridge Regression
- º Lasso Regression

  o ElasticNet Regression

Session 13:
- º Support vector Machines
- º Basic classification principle of SVM
- º Linear and Nonlinear classification (Polynomial and Radial)

Session 14 & 15:
- º Moving average, Exponential Smoothing, Holt's Trend Methods, Holt-Winters' Methods for seasonality
- º Autocorrelation (ACF & PACF), Auto-regression, Auto-regressive Models, Moving Average Models
- º ARMA &ARIMA

Session 16 & 17:
- º ML in Real Time
- º Algorithm Performance Metrics
- º ROC and AOC
- º Confusion Metrix
- º F1 Score
- º MSE and MAE

Session 18:
- º 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:
- º Anomaly detection
- º Point, Contextual and Collective Anomaly
- º Supervised and Unsupervised anomaly detection

Session 20:
- º DBSCAN Clustering

Session 21 & 22:
- º Introduction to NLP
- º Working with NLTK
- º Word2Vec
- º GloVe word vectors
- º Sentiment Classification

Session 23 & 24:
- º Introduction to Deep Learning
- º Introduction to Tensorflow and Keras
- º Introduction to Auto-encoders
- º Neural Network and its applications
- º Single layer neural Network
- º Activation Functions: Sigmoid, Hyperbolic Tangent, ReLu
- º Overview of Back propagation of errors

Session 25
Deep Learning Essentials
- º Early Stopping for Preventing Overfitting
- º Dropout
- º 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)
- º Classic Backpropagation

        º   Momentum Backpropagation
        º   ADAM
            ▪   L1 and L2 Regularization

Session 26 & 27
Convolutional Neural Network using PyTorch
- º Introduction to PyTorch Framework
- º Pytorch vs Tensorflow
- º Convolutional Concept
- º Inception Network
- º Transfer Learning
- º Data Augmentation
- º Object Detection
- º YOLO Algorithm (High-Level Overview)

Session 28 & 29
Recurrent Neural Network (RNN) using Pytorch
- º RNN Concept
- º Types of RNNs
- º Vanishing gradients with RNNs
- º Gated Recurrent Unit (GRU) - (High-Level Overview only)
- º Long Short-Term Memory (LSTM) - (High-Level Overview only)

Session 30
- º Introduction to AI
- º Applications of AI
- º Role of DNN and conventional ML in AI
- º Case Studies