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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- 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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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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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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Session 30
Lecture

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