CBD Robotics

Machine Learning in Python

Week 1 (Unit 1 – Basics):

Session 1: Review essential parts of Python (Data collections, OO and SqlAlchemy)

Session 2: Database design & normalization, Postgresql

Project: Auction project

Week 2:

Session 1: Anaconda setup, Jupyter notebook, Pandas, numpy, scipy, statistics

Session 2: Probability distributions, hypothesis testing, t-test, p-value

Week 3:

Session 1: Visualizations (matplotlib, seaborn), ANOVA, MANOVA, F-test

Session 2: A/B test, A/A test, Bias, RFC experiment, parametric & non-parametric

Project: Analysis report (using statistical models)

Week 4 (Unit 2 – Supervised Learning)

Session 1: Data cleaning, Data Exploration, Feature Engineering, Multicollinearity

Session 2: Principal Component Analysis (PCA), Data Transformation, Feature Selection

Assignment: PCA computation

Week 5:

Session 1: Linear Regression, Multivariate Regression, Residue, Homoscedasticity

Underfitting

Session 2: Holdout, Cross Validation, Overfitting, Class Imbalance, Error Types (I &II), Partial Least Square Regression (PLSR), Gradient Descent Algorithm

Project: Melbourne Housing

Week 6:

Session 1: KNN, Naïve Bayes

Project: Amazon Reviews

Session 2: Decision Tree, Entropy, ID3 Algorithm, Random Forest, Gradient Boosting

Assignment: Constructing Decision Tree (by hand)

Week 7:

Session 1: Logistic Regression, Ridge Regression, Lasso Regression, feature selection using RFE, SelectKBest

Assignment: calculating beta coefficients for Ridge & Lasso (by hand)

Session 2: Support Vector Machine (SVM), Kernel Trick, Ada Boosting, Stochastic Gradient Boosting

Assignment: Constructing separating line in SVM (by hand)

Project: Airline Arrivals

Week 8 (Unit 3 – Unsupervised Learning):

Session 1: K-means, Clustering, Cluster Evaluation, Silhouette score

Session 2: Mean Shift, Spectral, Affinity

Project: Boston Marathon

Week 9 (Unit 4 – Deep Learning):

Session 1: Neural Network, Back Propagation

Assignment: Construct 2-layers ANN and calculate adaptive weight (by hand)

Session 2: Supervised and Unsupervised techniques in Neural Network

Week 10 :

Session 1: Deep Learning, CNN, RNN, Hidden Layer, Convolutional layer, Maxpooling layer, Sub-sampling layer

Assignment: Constructing CNN, RNN (by hand)

Session 2: TensorFlow and Nodes

Week 11:

Session 1: Keras, MNIST

Project: Image Recognition

Session 2: work on Image Recognition project

Week 12 (Unit 5 – Natural Language Processing):

Session 1: Accessing Corpus and lexical resource, Tokens, Lemmas, Sentences

Session 2: Parts of Speech, Dependencies, Entities, Spacy

Week 13:

Session 1: Bag of Words (BoW), BoW Features, supervised technique

Session 2: TF-IDF, Lament Semantic Analysis (LSA), Sentence Similarity

Assignment: calculate TF-IDF from text (by hand)

Week 14:

Session 1: Word2Vec, sense2vec, n-grams

Session 2: pLSA, Latent Dirichlet Allocation (LDA), Non Negative Matrix Factorization (NNMF)

Project: Thousand texts – author classification

Week 15 (Unit 6 – Computer Vision):

Session 1: OpenCV, Processing Video, Tracking

Session 2: Corner Detector, Feature Transform, Geotagged Images

Week 16:

Session 1: Homographies, Warping Images, Paranomas

Session 2: The Pinhole Camera, Camera Calibration, Augmented Reality

Assignment: Image Transformation computing (by hand)

Week 17:

Session 1: Multiview Reconstruction, Stereo Images, Moving Objects

Session 2: Segmentation using Clustering, Variational Methods, Expectation Maximization (EM) algorithm

Project: Face Recognition using Deep Learning

Week 18 (Unit 7 – Data Scraping):

Session 1: Scrapy

Session 2: API, Json, HTML scraping

Project: Temperature

Week 19 (Unit 8 – other topics):

Session 1: Big data, Hadoop

Session 2: Distributed Computing and Sparks

Week 20:

Session 1: Time Series, Stochastic Modeling, ARIMA

Session 2: Auto Regression, ARMA

Project: Stock price

Week 21:

Session 1: Markov Processes, Hidden Markov Random Field

Session 2: Restricted Boltzmann Machine, Autoencoders

Project: Feature Image Extraction

Week 22 & 23: Final Capstone project