Syllabus

Week - 1: Introduction
(Wed Jan 29, 2020 10:00 AM - 12:30 PM)

Introduction
1. Overview of Topic and Course
2. Introduction to the Tools
3. Key Concepts

Textbooks

(VP) Python Data Science Handbook

(AG) Hands-On Machine Learning with Scikit-Learn and Tensorflow

(DL) Deep Learning Book [link]

Readings

VP Chapters 1-4
AG Chapter 1
DL Chapter 5

Week - 2: Supervised Learning: Regression
(Wed Feb 05, 2020 10:00 AM - 12:30 PM)

Supervised Learning: Regression
1. Recipe for ML
2. Linear Regression
3. Training; Validations/Cross Validation

Readings

AG Chapter 2
Week - 3: Supervised Learning: Classification
(Wed Feb 12, 2020 10:00 AM - 12:30 PM)

Supervised Learning: Classification

1. Logistic Regression
2. Categorical variables
3. Alt data: image, text

Readings

AG Chapter 3

Week - 4: Becoming a successful Data Scientist
(Wed Feb 19, 2020 10:00 AM - 12:30 PM)

Feature Engineering, Transformations

1. Transformations

Readings

AG Chapter 4

Week - 5: Other Classical Models
(Wed Feb 26, 2020 10:00 AM - 12:30 PM)

Other Classical Models

1. Decision Trees
2. Ensembling, Random Forests
3. Bagging and Boosting
4. Naïve Bayes
5. Support Vector Machines

Readings

AG Chapters 5,6,7

Week - 6: Interpretation and Optimization
(Wed Mar 04, 2020 10:00 AM - 12:30 PM)
Interpretation, Optimization, Missing data

1. Interpreting the coefficients
2. Data imputation
3. Gradient Descent and its variants

Readings
AG Chapter 4

Week - 7: Unsupervised Learning
(Wed Mar 11, 2020 10:00 AM - 12:30 PM)

Unsupervised Learning

1. Matrix factorization
2. Principal Components Analysis and dimensionality reduction
3. Clustering
4. Recommender Systems; Collaborative Filtering

Readings
AG Chapter 8

Week - 8: Classical ML Wrap-up and Intro to Deep Learning
(Wed Mar 18, 2020 10:00 AM - 12:30 PM)

1. Wrap up Classical Machine Learning
2. Optimization of Loss functions: Gradient Descent
3. Introduction to Deep Learning

Spring Break, no class
(Wed Mar 25, 2020 10:00 AM - 12:30 PM)

Week - 9: Introduction to Deep Learning
(Wed Apr 01, 2020 10:00 AM - 12:30 PM)

Introduction to Neural Networks

1. Motivation, History
2. Fully connected networks
3. Activation functions
4. Computation Graphs
5. TensorFlow, keras

Readings

AG Chapters 9, 10

Week - 10: Autoencoders and Generative ML
(Wed Apr 08, 2020 10:00 AM - 12:30 PM)

Autoencoders and Generative ML

1. Vanilla Autoencoders
2. Variational Autoencoders
3. Latent space representation

Readings

AG Chapter 15

Week - 11: Training Neural Networks
(Wed Apr 15, 2020 10:00 AM - 12:30 PM)

Training Neural Networks

1. Vanishing and Exploding gradients
2. Initialization
3. Regularizers, Dropout
4. Normalization

Readings

AG Chapter 11

DL Chapters 6,8

Week - 12: Convolutional Neural Networks
(Wed Apr 22, 2020 10:00 AM - 12:30 PM)

Convolutional Neural Networks

1. One and two dimensional convolutions
2. Interpretation
3. **Readings**

AG Chapter 13

DL Chapter 9

**Week - 13: Recurrent Neural Networks**
(Wed Apr 29, 2020 10:00 AM - 12:30 PM)

**Recurrent Neural Networks**

1. Vanilla RNN
2. LSTM
3. Generative RNN

**Readings**

AG Chapter 14

DL Chapter 10

**Week - 14: Other topics**
(Wed May 06, 2020 10:00 AM - 12:30 PM)

**Other Topics**

1. Natural Language Processing

2. Adversarial examples

3. Auto differentiation

**Readings**

AG Chapters 14, Appendix D

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Timezone: America/New_York

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