Machine Learning I

(Janelia, Fall 2018)

Auditorium, except on Sept 25 when we move to Spectrum
Lectures Tuesdays 12 noon-1pm
Labs Tuesdays 4pm-6pm in Axon/Dendrite

Readings

Hands-On Machine Learning with Scikit-Learn and TensorFlow
Concepts, Tools, and Techniques to Build Intelligent Systems
By Aurélien Géron
http://shop.oreilly.com/product/0636920052289.do
https://github.com/ageron/handson-ml

Deep Learning with Python
by Francois Chollet
https://www.amazon.com/Deep-Learning-Python-Francois-Chollet/dp/1617294438
https://github.com/fchollet/deep-learning-with-python-notebooks

Must haves

1. Basic probability or statistics
2. Basic linear algebra and calculus
3. Some programming

Probably should haves

1. Intermediate linear algebra
2. Multivariable calculus
3. **Python & jupyter** (students should have this already set up on their laptops, right?)

Lectures

1. 9/11/2018 Introduction to machine learning (John Bogovic)
    a. probability theory and linear algebra (in the context of)
    b. (supervised) Basic linear regression example
    c. (unsupervised) Basic matrix factorization example
    d. LAB: Janelia cluster, python, jupyter, scikit.learn, keras/pytorch/tf (TA: .., .., ..,)
2. 9/18/2018 Supervised learning I (Regression and classification) (Srini Turaga)
    a. Linear classification (geometric intuition)
    b. Generalized linear modeling for regression and classification
    c. LAB: scikit.learn based supervised learning (TA: .., .., ..)
3. 9/25/2018 (Spectrum) Supervised learning II (deep learning) (Jan Funke)

a. Nonlinear classification (geometric intuition)
b. The XOR problem and the usefulness of a hidden layer
c. Backpropagation algorithm
d. LAB: tensorflow/pytorch (TA: Nils Eckstein, .., ..)

4. 10/2/2018 Unsupervised learning I (clustering) (Philipp Hanslovsky)
    a. K-means clustering
    b. Gaussian mixture models??
    c. Hierarchical clustering??
    d. DBSCAN??
    e. LAB: scikit.learn based clustering (TA: Amrita Singh, Carsen Stringer, ..)
5. 10/9/2018 Unsupervised learning II (matrix factorization & dimensionality reduction) (Carsen Stringer)
    a. PCA and FA
    b. NMF
    c. ICA
    d. Sparse coding
    e. LAB: scikit.learn based matrix factorization, t-SNE (TA: Amrita Singh, Carsen Stringer, ..)
6. 10/16/2018 Time series models (Marius Pachitariu)
    a. HMM
    b. Linear dynamical system + Kalman filter
    c. RNNs
    d. LAB: RNNs deep learning, scikit.learn HMM, Kalman filter (TA: Carsen Stringer, .., ..)