Johns Hopkins Engineering

Applied Machine Learning for Mechanical Engineers

Popular Supervised Machine Learning Techniques, Part 1, D

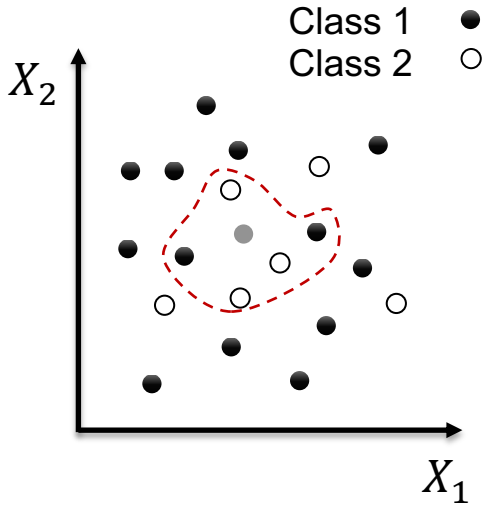
JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Other Supervised Algorithms

- By the end of this lecture, you will be able to:
  - Briefly describe other supervised algorithms such as:
    - K-Nearest Neighbor (KNN)
    - Recurrent Neural Networks (RNN)
    - Long Short-Term Memory (LSTM)

Other Supervised Algorithms

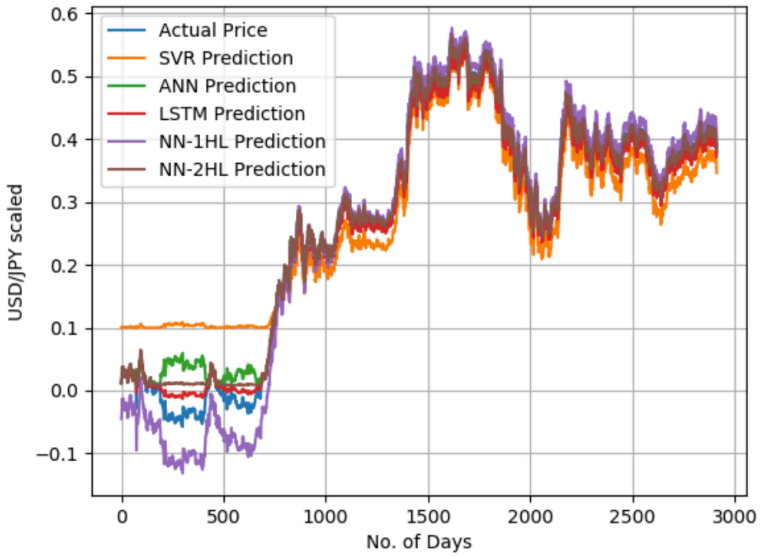
- K-Nearest Neighbor (KNN)
  - Assign a new data (e.g. testing) to the most frequent category amongst the K nearest datapoints
  - Being amongst the K “nearest” could be measured by Euclidean distance or other forms of distance



$K = 5$ Nearest data points

Other Supervised Algorithms

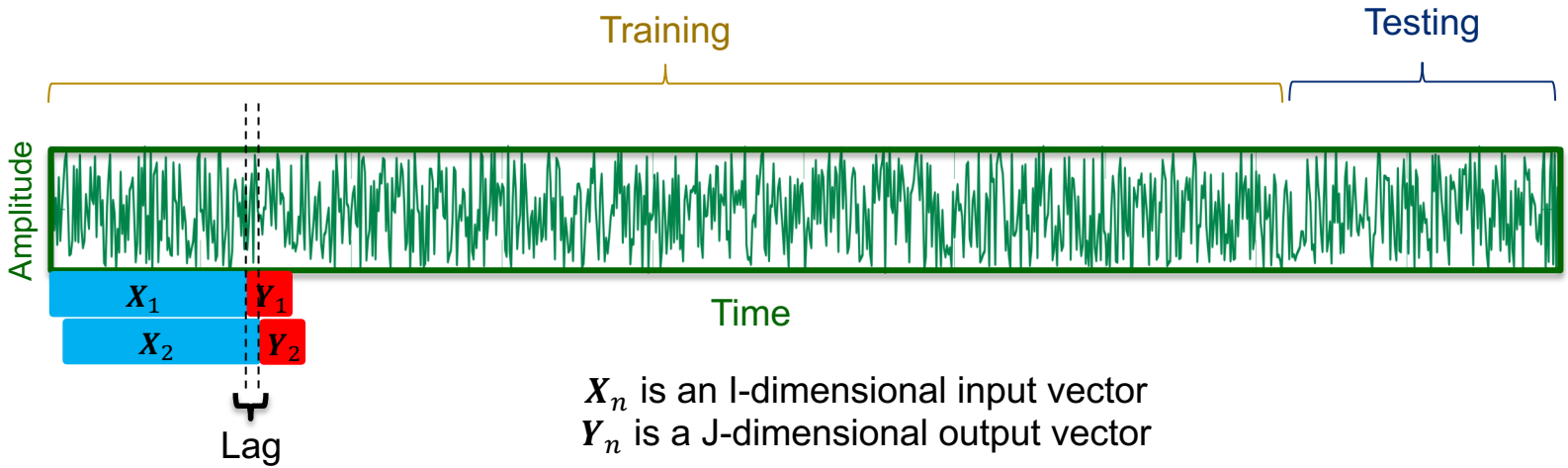
- Recurrent Neural Networks (RNN)
  - RNNs address problems with temporal data:
    - Natural Language Processing (NLP)
    - Signals (e.g. stocks, vibration records, displacement records)
    - Videos
    - Speech
  - Predicting the future sequence (prices, system response, etc.)



Nagpure, A. R. (2019). Prediction of multi-currency exchange rates using deep learning. *International Journal of Innovative Technology and Exploring Engineering*, *8*(6), 316-322.

Other Supervised Algorithms

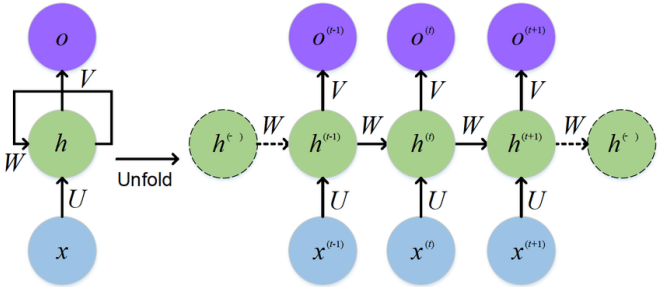
- Recurrent Neural Networks (RNN)
  - RNNs address problems with temporal data:
  - Divide the signal into sub-signals with a duration and estimate a future duration of the signal



X_n is an I-dimensional input vector
Y_n is a J-dimensional output vector

Other Supervised Algorithms

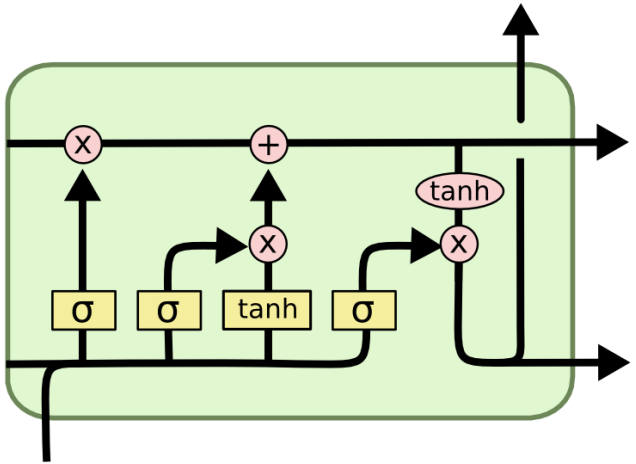
- Recurrent Neural Networks (RNN)
  - RNNs address problems with temporal data:
  - Outputs (a portion of outputs) of a datapoint is part of the inputs of the next datapoint
  - Vanishing and exploding gradient problem for long sequence of data using ReLU and tanh activation functions due to generating extraneous new information by increasing the sequence length.



https://www.researchgate.net/figure/The-standard-RNN-and-unfolded-RNN_fig1_318332317

Other Supervised Algorithms

- Recurrent Neural Networks (RNN)
  - Long Short-Term Memory (LSTM) to address RNN issues
  - The main idea is about identifying what information we are going to pass through the network for learning instead of all (we allow the network to remember and forget information intentionally)
  - We just pass information that are necessary to be passed (needs a learning algorithm)



https://towardsdatascience.com/predicting-stock-prices-using-a-keras-lstm-model-4225457f0233
https://colah.github.io/posts/2015-08-Understanding-LSTMs/

Overview of Machine Learning in General

- In this lecture, you learned about:
  - K-Nearest Neighbor (KNN)
  - Recurrent Neural Networks (RNN)
  - Long Short-Term Memory (LSTM)
- In the next module, we will practice popular supervised machine learning techniques over available programming packages