Introduction to Deep Learning

Welcome to the fascinating world of Deep Learning!

So far we have reviewed the major categories of machine learning models under supervised, unsupervised and semi-supervised categories. One of the primary necessities of machine learning models is well engineered features to find accurate patterns in the underlying data. While finding the best ranked features is possible using machine learning models, if the most representative features are not captured, the model outcome will be significantly poor. This is where deep learning models can be significantly helpful to automatically extract global and local level features to enable highly accurate pattern recognition and classification.

So to summarize, machine learning models are highly resourceful for explainability combined with domain knowledge. In the absence of domain knowledge and with huge volumes of data, deep learning models can be preferred.

A. *Deep Learning Concepts*

Deep Neural network is defined by any artificial neural network model with more than a single layer between the input and output layers. Typically deep learning models were created to produce end-to-end pipelines without the need for manual feature engineering in situations where there is a plethora of data. So deep learning models enable data driven decision making. Deep neural networks can be used in the supervised and unsupervised setting (auto-encoders) and have found significant usage for application areas involving computer vision and natural language processing.

This week you will get introduced to deep learning models as an extension to neural networks. *There are several videos that are marked OPTIONAL*, which can be skipped for faster learning experience, but reviewing them would help enhance deeper conceptual understanding. Going forward, each week we will cover some deep learning concepts for specific applications. *This week's application is classification using convolutional neural network models.*

The Deep learning videos this week onwards have been distilled to create a summary cheat sheet per topic (instead of video slides) that will be provided each week going forward. Also this week, we will look at some tensorflow libraries for visualizing trained weights using TF_explain and GRADCAM libraries.

Week 5 will have slightly higher load of video content (4 hours of video) and this load will keep reducing till week 7. However, going forward we will have only 1 offline coding assignment to level the learning loads!

B. *Week 5 Learning Objectives:*

- To understand the concepts of Deep Neural networks as a conceptual extension to Neural Networks.
- To understand the basic parameters, hyper-parameters and concepts around deep learning models
- To understand the basics of convolutional neural networks (CNNs)
- To review case studies of certain deep neural networks applied for computer vision tasks.
- To learn how to train and test standard deep CNNs on real life applications.