HARROW INDEPENDENT COLLEGE
School of Mathematics, Science & Economics

Deep Learning with TensorFlow

4 – Day (4 Saturdays) workshop

Artificial Intelligence and Deep Learning are the current buzzwords amongst academics, businesses and other industries. Deep Learning has the ability to transform many parts of modern life as recent innovations show. TensorFlow is a 2nd Generation API of Google's open source software library for Deep Learning.

The course is designed as a 4 – day (4 Saturdays) workshop and providescomprehensive knowledge in Deep Learning and hands-on experience in TensorFlow. The workshop is targeted for developers, hackers, academic researchers, graduate & postgraduate students, data scientists or data analysts who already know about machine learning and have experience in Programming.

Prerequisites:

- Programming experience (preferably in Python and/or sound knowledge in C++/C#/Java)
- Basic machine learning knowledge
- Basic Statistics, Linear Algebra and Calculus

Day 1

09:30 - 10:00 Registration and Networking Breakfast

10:00 - 11:30 Introduction to Neural Networks

This session provides learners with the fundamental background of Neural Networks including origin, theoretical framework, its various paradigms and applications.

11:30 - 12:00 Lab Session 1: Single Layered Perceptron using Python

The lab session guides the learners to develop a simple neuron (Perceptron) to solve linear classification problems with core Python. The aim of the session is to give learners a comparative understanding of development between core Python and Python with TensorFlow.

12:00 - 12:15 Coffee Break

12:15 - 01:00 Introduction to Backpropagation Learning

This session provides learners with theoretical background of backpropagation learning algorithm and its implementation over multilayer Neural Networks.

01:00 02:00 Lunch

02:00 - 03:00 Lab Session 2: Multilayered Perceptron (MLP) using Scikit-learn

This session guides the learners to develop a simple MLP using Scikit-learn. The aim of the session is to give learners a comparative understanding of development between Scikit-learn and TensorFlow.

03:00 - 04:00 Lab Session 3: Introduction to TensorFlow

The lab session provides learners with the theoretical background of TensorFlow and let's get learner up and running with TensorFlow. The end of the session the learner will learn the basic features and components of TensorFlow and TensorFlow Data Flow Graph, and how to develop a simple application with TensorFlow.

04:00 - 04:15 Coffee Break

04:15 - 05:00 Lab Session 4: MLP using TensorFlow

The lab session is extension of lab session 2 and 3, to Introduce how to implement a simple MLP with TensorFlow. The end of the session the learner will learn how to develop computational graph of MLP and implementation of learning algorithm with TensorFlow, of course the training and validating the MLP.

Day 2

09:30 - 10:00 **Registration and Networking Breakfast**

10:00 - 11:00 **Introduction to Deep Learning**

The session will cover the fundamental theory behind the Deep Learning techniques with topics ranging from sparse coding/filtering, autoencoders, convolutional Neural Networks and deep belief nets.

11:00 - 11:45 **Architecture of Deep Feedforward Neural Networks (DFNN)**

The session will provide detail explanation of the architecture of DFNN and demonstrate visual and mathematical representation of DFNN.

11:45 - 12:00 **Coffee Break**

12:00 - 01:00 **Lab Session 5: Developing Computational Graph of DFNN using TensorFlo**w

This lab session is the extension of lab session 4 which builds on the simple MLP computational graph into very large or deep feed-forward network computational graph.

01:00 02:00 **Lunch**

02:00 - 03:15 **Lab Session 6: Implementing DFNN using TensorFlow**

The lab session extends the lab session 5 and implements learning algorithm with TensorFlow. It further demonstrates how to train the model and validate to check the accuracy of the model.

03:15 - 03:30 **Coffee Break**

03:30 - 05:00 **Mini-Project 1: Developing Classification Model with DFNN and TensorFlow**

A case study with a dataset will be provided to the learners and they are expected to use the skill they have learnt from all the lecturers and the lab sessions. The learners should work independently, however support and guidance will be provided to them to successfully complete the mini-project.

Day 3

09:30 - 10:00 **Registration and Networking Breakfast**

10:00 - 11:00 **Introduction to Convolutional Neural Networks (CNN)**

The session provides learners with clear understanding of CNN and how the CNN differs from other Neural Network paradigms. It also explains how CNN based applications work.

11:00 -11:45 **Architecture of CNN**

The session will provide detail explanation of the architecture of CNN and demonstrate visual and mathematical representation of CNN.

11:45 - 12:00 **Coffee Break**

12:00 - 01:00 **Lab Session 7: Developing Computational Graph of CNN using TensorFlow**

The lab session guides the learners to develop a CNN using TensorFlow. The aim of the session is to give learners hands on experience of developing CNN computational graph using TensorFlow.

01:00 02:00 **Lunch**

02:00 - 03:15 **Lab Session 8: Implementing CNN using TensorFlow**

The lab session extends the lab session 7 and implements learning algorithm with TensorFlow for CNN computational graph. It alsodemonstrates how to train the model and validate to check the accuracy of the model.

03:15 - 03:30 **Coffee Break**

03:30 - 05:00 **Mini-Project 2: Developing Image Classification Model with CNN and TensorFlow**

A case study with a dataset will be provided to the learners and they are expected to use the skill they have learnt from all the previous lecturers and the lab sessions. The learners should work independently, however support and guidance will be provided to themfor the successful completion of the mini-project.

Day 4

09:30 - 10:00 **Registration and Networking Breakfast**

10:00 - 11:00 **Introduction to Recurrent Neural Networks (RNN)**

The session provides learners with clear understanding of RNN and how the RNN differ from other neural network paradigms. It will also explain how RNN based applications work.

11:00 - 11:45 **Architectures of RNN**

The session will provide detail explanation of the architecture of RNN and demonstrate visual and mathematical representations of RNN.

11:45 - 12:00 **Coffee Break**

12:00 - 01:00 **Lab Session 9: Developing Computational Graph of RNN using TensorFlow**

The lab session guides the learners to develop a RNN using TensorFlow. The aim of the lab session is to give the learners hands on experience of developing RNN computational graph using TensorFlow.

01:00 02:00 **Lunch**

02:00 - 04:00 **Lab Session 10: Implementing RNN using TensorFlow**

The lab session extends the lab session 9 and implements learning algorithm with TensorFlow for RNN computational graph. Furthermore, it will show how to train the model and validate to check the accuracy of the model.

04:00 - 04:15 **Coffee Break**

04:15 - 05:00 **Mini-Project 3: Developing NLP Model with RNN and TensorFlow**

A case study with a dataset will be provided to the learners and they are expected to use the skill they have learnt from all the previous lecturers and the lab sessions. The learners should work independently, however support and guidance will be provided to them for the successful completion of the mini-project.