# Optimisation and Deep Learning

# Individual Assignment (100 Marks)

This assignment has two parts:

**Assignment 1** covers the Data Preparation & Pre-processing, and justification of the Neural Network algorithms for data analytic applications in real-world problems.

**Assignment 2** covers the application of deep learning methods with optimization concepts for practical solutions.

**Objective:** The main objective of this assignment is to find an optimal deep learning model for a problem supported by a historical data. This is an end-to-end project that addresses optimality in hyper parameter and model parameter selection using optimization procedures while building suitable deep learning models.

## Assignment 1 (40 marks)

### Task 1: Dataset & Algorithm selection (20 Marks)

Choose a suitable medium/large size secondary dataset from the suitable and possible open data resources. Critically analyze the dataset and suggest **two predictive neural network (deep learning) models** that may be suitable for your dataset and to discover the optimized solutions for the defined problem. Produce a comprehensive literature review on the past research work on the same or similar chosen problem. Justify your selection of such dataset on the suitability for this assignment.

### Task 2: Data Preparation (20 Marks)

Perform an Exploratory Data Analysis (EDA) on your dataset using the suitable tools and techniques. All the data preparation activities are expected to take place in detail and clearly reported.

## Assignment 2 (60 marks)

### Task 1: Model Building (30 Marks)

In this part of the assignment, build the deep learning model based on the selection suggested in Assignment 1 – Task 1. You are recommended to select different deep learning algorithms to work on. Conduct basic model initialization, training, and evaluation. Choose suitable training algorithm, evaluation metrics and build your basic model.

### Task 2: Model Tuning (10 Marks)

The model hyperparameters shall be tuned and validated. List and explain Meta / Hyper parameter of your model. Choose the optimal Meta parameters of your model using suitable searching techniques. You may use either grid search, random search or Keras Tuner methods. Design and fine tune the model to build the final model.

### Task 3: Model Evaluation & Discussion (10 Marks)

Select evaluation metrics and briefly describe them. Perform evaluation and present your results. Discuss and critically analyze your final predictive model.

### Task 4: Conclusion (10 Marks)

Produce a critical comparative analysis with the peer models including the comparison of the predictive models reviewed as the literature. Suggest how your results may be improved further.

### Report:

You shall submit your work in a report format. Each section should consist of necessary introduction, brief description of the chosen methods together with a justification of your choice, clear presentation of the results with appropriate graphics and/or tables and critical analysis. The report should include code snippets with comprehensive comments on the code. The notebook shall also include generated output. Iterative procedures shall have samples of generated output if not the full epochs.

### Submission:

You are expected to submit **a report** (.doc/.docx/.pdf), the Python code (.py or .ipynb) file(s) along with the data set via the MOODLE submission link.