**Final Project**

Subject: Introduction to Machine Learning

**Question 1 (2.5 point):**

Present the optimization methods:

1. Gradient Descent (GD): Batch Gradient Descent; Stochastic Gradient Descent (SGD); Mini-Batch Gradient Descent
2. Momentum
3. Adagrad (Adaptive Gradient Algorithm)
4. RMSProp (Root Mean Square Propagation)
5. Adam (Adaptive Moment Estimation)

Write a program with a data set of your choice, test these methods and compare them.

**Question 2 (5 point):**

Stock Price Prediction Problem (Opening Price) Based on the Following Information:

* Opening price, closing price, and trading volume from previous days.
* Industry type of the stock.
* Time of the year (e.g., by day, by month).
* Some macroeconomic indicators: self-selected from reliable sources (e.g., GDP, price indices, etc.).

Tasks to Perform:

1. Experiment with the following methods:
   * Feedforward Neural Network
   * Recurrent Neural Network (RNN)
   * Other algorithms: Linear Regression, SVM, Decision Tree, Random Forest, etc.
2. Apply techniques to prevent overfitting and plot training graphs.
3. Evaluate the models and compare them, plotting the results.

**Question 3 (2.5 point):**

Study and Present a Deep Machine Learning Method:  
For example, Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), Transformer, etc.

and develop a program applying the chosen model to a classification problem.

**Submission Guidelines:**

* A PDF file containing the theoretical explanation.
* Python code files for training and testing.
* A data file containing the dataset.

**Notes:**

* You can do it individually or in groups (maximum 3 members per group).
* All group members must submit the assignment on the Elearning platform.
* All group members should work together and understand the entire assignment. Avoid dividing tasks where each member only understands their part.
* Any case of plagiarism will get 0.
* This is the report. Assignments must be presented neatly. Format violations and lack of care may incur a penalty of 10% to 50% of the total score.