CE889 – Artificial Neural Networks Assignment

Autumn 2024

1. Objectives

- To translate the theoretical knowledge gained throughout the course into practise by designing and implementing a neural network capable of solving a dynamic environment problem.
- To provide a Deep Neural Network entry to a Kaggle Competition.

2. Deadline and Submission Requirements

Demonstration of the project:

Your demonstrations will take place **at the same time** during your lab session scheduled for **week 11** and will last ~15 minutes in total.

During the demonstrations students will be required to present their code in its finished state **(which you will send to us prior to the demonstration)**, explain its main features, answer questions relating to their work and the project, and discuss the performance of the neural networks. **You need to prepare slides explaining the features of your submissions while justifying your choices for the individual and group parts of your assignment.**

You will then need to submit your final code and the slides summarising your solution on Faser by the deadline provided by the School.

Failing to attend the demonstration will be graded with a Zero for the overall assignment grade.

3. Assessment Criteria

Performance (100%):

50% - The performance of your individual Neural Network.
50% - The performance of the Deep Neural Network in the Kaggle competition.

4. Important Information

- You must work **independently** on your individual neural network and this must be constructed using Python and use **no** additional libraries.
- You may use any programming language and libraries for the Deep Learning task.

- **Any late submission or not attending the demonstration will receive a Zero mark unless extenuating circumstances apply**.
- Your work must be sent to a GLA prior to your demonstration so that it can be tested on the demonstration day.

5. The Task

Individual task:
You are presented with a lander game which will randomly generate a landing zone and unsafe terrain. You will be required to safely land the ship without touching the unsafe terrain. Data will be generated following your completion of this task; you must use this data to successfully train your own neural network with the ability to complete the same task.

1) Design and implement a Feed-Forward Backpropagation neural network where:
    i. Inputs: X position to target, Y position to target
    ii. Outputs: Lander thruster, Lander turning
2) Train your neural network in your Python implementation (offline training ~100 epochs) with the data you have collected during your attempt at the lander game.
3) Test your neural network by running the most recent weights (just feed-forward) to see how the lander performs and compute **the Root Mean Squared Error**.

Deep Learning Task:
You are asked to provide a Deep Neural Networks entry to the Rossmann Stores sales Kaggle Competition **(https://www.kaggle.com/c/rossmann-store-sales).**
The competition aims to predict the Rossmann 1,115 stores sales across Germany.
You are asked to do the following:

1) Choose one of the available Deep Neural Network tools and develop a Deep Neural Network that will be trained over the supplied data to provide an entry for the Rossmann Stores Sales competition.
2) Provide your results over the supplied testing data.