CE889 – Artificial Neural Networks Assignment

Autumn 2018

1. Objectives

☑ To put the theoretical knowledge gained from the course into practice by designing and implementing a neural network for a real world application on a mobile robot
☑ To Work in Groups of 3 to provide a Deep Neural Network entry to a Kaggle Competition.
☑ To produce a report detailing the design and implementation steps of the developed neural networks.

2. Deadline and Submission Requirements

Report:

The report should be submitted according to the deadline provided by the school.

- It should be between 3000 and 5000 words long (excluding the code).
- It should be written in such a way that it is clear, concise, and easy to read.
- It should include the code of the neural network at the end (preferably as Appendix).

☑ Write your name and the code of the course module clearly on the first page of your report.

Demonstration in the Robot Arena:

The demonstration will take place in **your lab session in Week 11**. The demonstration is expected to last for ~15 minutes. Within this time slot, the student should be ready to explain the main features of the robot neural network and the deep neural network, answer some questions about the main aspects of his/her work, and show the performance of the robot and the Kaggle competition performance.

3. Assessment Criteria

The mark is to be finalized on the basis of the following criteria:

- The performance of the robot in the lab demonstration and the performance of the Deep Neural Network in the Kaggle Competition (50%).
- Research and Literature Survey (25%).
- The quality of the write up of the report (25%).

4. Notes

- You should work independently for the Robot Neural Network and in your allocated group for the Deep Neural Network Kaggle competition.
- Late penalty is **zero mark** unless special circumstances are approved.

5. The Challenge (the specified task)

Task 1: Robot Neural Network Controller
One of the Pioneer mobile robots that are used during the lab sessions is deployed in an unstructured environment. **You are asked to do the following:**

1- Design and implement a Feed-Forward Backpropagation neural network where:
   a. Inputs: left distance reading, front distance reading
   b. Outputs: left motor speed, right motor speed
2- Train your neural network in your C++ implementation (offline training ~100 epochs) with the data you have collected during a left-edge following behaviour at a desired distance.
3- Test your neural network by running the most recent weights (just feed-forward) on the robot for 20 seconds to evaluate the performance and compute the Root Mean Squared Error. (The errors are calculated using the same training dataset in 2. So you should find the nearest input set [x_1 and x_2] to your current distance readings to calculate the output error).

Task 2: Deep Neural Kaggle Competition Entry

You are asked to work in your allocated group of 3 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 Networks tools and develop a Deep Neural Network that will be trained over the supplied training data to provide an entry for the Rossmann Stores Sales competition.
2- Provide your results over the supplied testing data.

In the report you should:

1) Present literature review
2) Describe your robot neural network algorithm and deep neural network system in detail
3) Explain how you decided on the various parameters of the robot neural network and the deep neural network
4) Explain and analyse the achieved results and experiments
5) Analyse the strengths and weaknesses of your system based on your experiments; and suggest the possible improvements to your neural network
6) Infer conclusions (preferably with links to your literature review)
7) Provide references
8) Include the code of the implementation of your robot neural network.