ELEC 425 - Fall 2021
Machine Learning and Deep Learning
Lab 3 - Week 10

Welcome to ELEC 425 Lab Session where you will learn machine learning by practicing. For this lab, you are expected to form your own team with 2-3 students to work together on the lab questions. A team should not have more than 3 students. Working on your own is fine, but we encourage collaboration and discussion to solve the lab questions.

If your team can solve the lab questions without further help, you do not have to attend the lab session. Otherwise, we encourage you to attend the lab session in person, and TAs can help you there. If you go the lab session, you can either show your results to TAs to get your marks (3 marks) in the lab session, or you can choose to submit your solutions later on onQ.

Every team has until **9pm Thursday November 18th** to submit the solutions on onQ. You can submit any time—before, during, or after the lab session (**3:30-5:30pm Tuesday November 16th**). Each team only needs to make one shared submission. If you have received your marks in the in-person lab, you do not have to submit your solutions on onQ.

In your submission, include a file named **students.txt**, which contains all students' names and student numbers of your team. Zip all your code, including the code we provided to you and that you modified, plus the students.txt file, to one zip file named as follows:

Fisrtname-Lastname1_Firstname-Lastname2_Firstname-Lastname2.zip

For example, if your team has Isabella Trudeau, Frank Cook, and Peter Martin as the members, you should name the file as Isabella-Trudeau_Frank-Cook_Peter-Martin.zip.

Programming with a Feed-Forward Neural Network

Lab 3 provides hands-on practice on feed-forward neural networks. To use neural networks to solve a specific task, you often need to define a network architecture based on the task itself and your experience. In this lab, we will use the feed-forward architecture specified in Figure 1.

We will use 1000 data points as our training data. Each data point has two features x_1 and x_2, as well as an output t, which is a real number. We will use the 1000 data points to train the feed-forward network to fit the data. We will visualize the training process in a 2D space using x_1 and y but ignore x_2. You job in this lab is:

- Download *lab3.zip* from *Week 10* on onQ and upzip it.
- Open activation.m and finish the code according to the comments; check lecture slides if needed.
- Open activation_gradient.m and finish the code according to the comments; check lecture slides if needed.

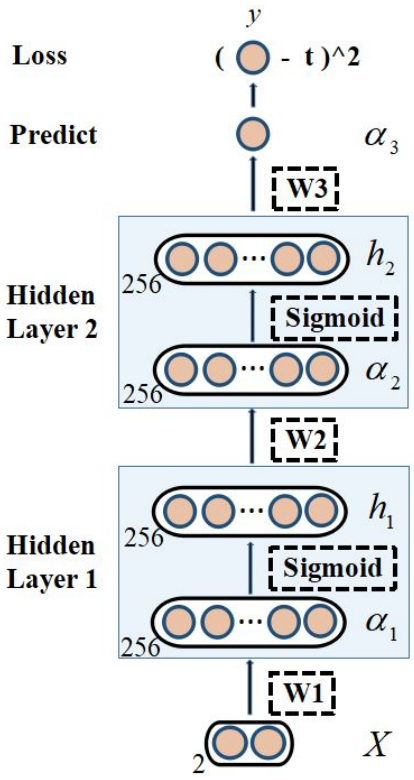

Figure 1: The feed-forward network used in this lab.

- Open feedforward_net_sigmoid.m, read the code, search "add some code below", and finish the code according to the comments. Finish all code that is missing. If needed, refer to lecture slides.

- Run feedforward_net_sigmoid.m and show your results to our TA. Or submit your code on onQ.

After the lab, you are still encouraged to read the code more carefully, change the batch size, learning rate, and number of hidden units in the model.