IDG049-01
Final Exam
21 June 2021

Your Name and Honor Code Signature

1. Write your name and UIN below:

    Name: _____

    UIN: _____

2. Please sign the honor code. Your exam will NOT be graded without your signature.

    "On my honor, as a KIT Engineering Student, I have neither given nor received unauthorized aid on this academic work."

    Signature: _____

Directions

This exam consists of 6 problems for a total of **100 /100** points. The number of total page is 8 pages. **Check your exam now to make sure you have all the problems.** Work as many problems as you can before the end of the exam.

You can use MATLAB on this exam. **However, you must clearly show your work including Matlab source code, graph, calculation and all formulas used in your solution**. Your work needs to be such that someone could reproduce your answer. **No credit will be given for a problem where this is not the case.**

Show all work in the spaces provided and make certain that you apply the notation we have been using. In order to receive full or partial credit **your work must be clear and neat.**

Grading Grid

Problem 1 _____ out of 20
Problem 2 _____ out of 20
Problem 3 _____ out of 30
Problem 4 _____ out of 20
Problem 5 _____ out of 10

Total _____ out of 100

[Problem 1] - (20 points)

Consider a deep neural network with 3 hidden layers. Suppose that the input is Y_i and the final output is Y_m.

$$Y_i \rightarrow Y_j \rightarrow Y_k \rightarrow Y_l \rightarrow Y_m$$

From the input, the activation functions follow "sigmoid / softmax/relu/softmax". Let the target be Y.
Formulate each update rule of weight W_{ml}, W_{lk}, W_{kj} and W_{ji}, respectively.

[Problem 2] - (20 points)

Consider a Matlab program. This program has two buttons("load" and "color change"), one table and two graphs. When you click "load", the program loads an excel file ("examdata.xlsx" in the course homepage), and the contents are displayed in a table. Simultaneously, the figure is plotted in a graph. Then, when you click "color change", the plot's color is changed and it is displayed in the second graph.
Implement a Matlab program using "app designer". Submit the program with program images.

[Problem 3] - (30 points)

Implement a deep neural network with four hidden layers, using Matlab. The objective of the program is to classify "A","B","C","D" and "E". Each character is in each excel file (e.g., a.xlsx, b.xlsx, ….). The program has one button ("load"). When the button is clicked, the program read the excel files and the training is performed. <u>You can't use "deepNetworkDesigner". You must implement your deep neural network for yourself.</u>
In your program, your UI have to show these:

- Parameters
- Final training error
- Training errors (graph)
- Accuracy (graph)

Submit your program <u>with explanations</u>.

[Problem 4] - (20 points)

In your program for Problem 3, add "dropout" functionality. <u>Show its code and submit explanations explicitly.</u>

[Problem 5] - (20 points)

There are a number of "non-overfitting method" for deep learning. Develop your own "non-overfitting method" and explain its characteristics, algorithm and pros/cons.