Jahangirnagar University

Department of Computer Science and Engineering

PMSCS Semester Final Examination, Fall 2023

PMSCS 677: Artificial Neural Networks

Full Marks: 60 **Duration: 3 hours**

[There are seven (7) questions. Answer any five (5) questions.]

1. (a) What are the different types of learning used in artificial neural networks? Explain the tanh and Softmax activation functions along with their usual applications. 6

   (b) Draw the schematic diagram of an ADALINE and also a MADALINE. Mention an important application of ADALINE/MADLINE. 6

2. (a) Describe the gradient-based MSE training algorithm for a Perceptron. 6

   (b) Briefly describe the working process of a generative adversarial network (GAN). 6

3. (a) Describe the learning algorithm of a back-propagation neural network. 6

   (b) Write down the working process of a CNN. Draw the basic block diagram of a CNN. 6

4. (a) Explain the following from a deep CNN perspective: (i) Parameter and hyperparameter (ii) Overfitting and underfitting 6

   (b) Consider the following patterns that are stored in an auto-associative Hopfield memory. Write down its connection (correlation) matrix. 6

   A_1=[-1, -1, -1, 1, 1] , A_2=[-1, 1, -1, 1, 1], A_3=[1, 1, 1, -1, 1].

   Also, write down its recall equation for a given input pattern.

5. (a) Explain Hebbian learning with an example. 6

   (b) What is the main limitation of single-layer Perceptron? Describe it using an example. Also, discuss a mechanism to overcome it. 6

6. A SOM network has 5 input units and 2 output units. It is trained using the following training samples: 12

   i1: (1, 1, 0, 0, 0)
   i2: (0, 0, 0, 1, 1)
   i3: (1, 0, 0, 0, 0)
   i4: (0, 0, 1, 1, 1)

   Use the updated weight after a single iteration as a final weight to classify the samples into clusters. What will be the clusters for the above four samples? Assume learning rate η=0.4. If a new sequence (1, 0, 0, 1, 0) is applied then which cluster it belongs to?

7. Consider Kosko's BAM has stored the following pattern pairs. 12

   X1=[1, -1, -1, -1, -1, 1] Y1=[-1, -1, 1],
   X2=[-1, 1, 1, -1, -1, -1] Y2=[1, -1, -1],
   X3=[-1, -1, 1, -1, 1, 1] Y3=[1, 1, -1]

   If a testing pattern X_2 is given to the network, then show the output pattern using Kosko's algorithm.

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