KafrelSheikh University		Year: 4th Computer Engineering & systems
Faculty of Engineering		Academic Number : ECS4230
Electrical Engineering Department		Date: 27 / 6 / 2021
Final Exam, 2020 - 2021		Time: 3 Hours.
Subject: Elective course(3)		Full Mark: 70, 2 pages
"Neural network".		

This course must be able to satisfy the competencies for BASIC Electrical engineering discipline (Level B): B4 and the Computer Engineering and Systems competencies (Level C): C3 & C5.

Q1: Identify which of the following statements are True or False: [5 Marks]

1. If you increase the number of hidden layers in a Multi-Layer Perceptron, the classification error of test data always decreases. ( )

2. Increase in size of a convolutional kernel would necessarily increase the performance of a convolutional network. ( )

3. The number of classes determines the number of output neurons, while the number of input patterns determines the number of input neurons. ( )

4. Boltzmann law is practical for implementation. ( )

5. In a self- organizing map with input vectors of dimension m and k neurons in the map, there will be m^k weights. ( )

Q2: Choose the correct answer: [5 Marks]

1- **Which answer explains better the Full Connection?**

a) Full Connection acts by placing different weights in each synapse in order to minimize errors. This step can be repeated until an expected result is achieved.

b) Full Connection acts by placing different weights in each synapse in order to minimize errors. No iteration is needed, since we can get the best results in our first attempt.

c) It is the last step of CNN, where we connect the results of the earlier components to create a output.

d) It is a component that connects different algorithms in order to increase the accuracy.

2- **What is the difference between CNN and ANN?**

a) CNN has one or more layers of convolution units, which receives its input from multiple units.

b) CNN uses a simpler algorithm than ANN.

c) CNN is a easiest way to use Neural Networks.

d) They complete each other, so in order to use ANN, you need to start with CNN.

3- **In which neural net architecture, does weight sharing occur?**

a) Convolutional neural Network

b) Fully Connected Neural Network

c) Restricted Boltzmann machine

d) Both A and B

4- **What consist of Boltzmann machine?**

a) Fully connected network with both hidden and visible units

b) Stochastic update

c) Asynchronous operation

d) all of the mentioned

5- **When does a neural network model become a deep learning model?**

a) When you add more hidden layers and increase depth of neural network

b) When there is higher dimensionality of data.

c) When the problem is an image recognition problem

d) none of these

Q3- Answer the following questions [15 Marks]

1. Mention the Restricted Boltzmann machine. With use drawing.
2. What are the flexibility in recurrent neural Networks? With drawing.
3. How Does an LSTM Network Work?

Q4- (a) Derive in steps the Self Organizing Map (SOM) algorithm [5 Marks]

(b) Let the vectors to be clustered be (1,1,0,0); (0,0,0,1); (1,0,0,0); (0,0,1,1) the maximum number of clusters to be formed is m=2. [10 Marks]

Suppose the learning rate (geometric decrease) $\eta(0) = 0.6.$, $\eta(t+1) = 0.5 \, \eta(t)$. R=0, and the initial weights matrix:
$$\begin{bmatrix} 0.2 & 0.8 \\ 0.6 & 0.4 \\ 0.5 & 0.7 \\ 0.9 & 0.3 \end{bmatrix}$$

Q5- (a) What is Pooling on CNN, and How Does It Work? [4 Marks]

(b) In the grayscale image below that represent in 6x6 matrix, what the convolved feature matrix after using a filter 3x3 is shown below, with stride=1 [10 Marks]

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

Image

$$\begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

Convolution kernel

(c) Consider a 4 X 4 matrix as shown below: Applying max pooling on this matrix will result in a 2 X 2 output with a stride of 2. [4 Marks]

1	3	2	1
2	9	1	1
1	3	2	3
5	6	1	2

Q6- Consider the simple network below, Consider the simple network below: Assume that the neurons have a Sigmoid activation function and $\eta=0.01$ [12 Marks]

i. Perform a forward pass on the network.

ii. Perform a reverse pass (training) once (target = 0.5).

iii. Perform a further forward pass and comment on the result.

A= 0.35 0.1 0.8 0.3 output
B = 0.9 0.6 0.4 0.9
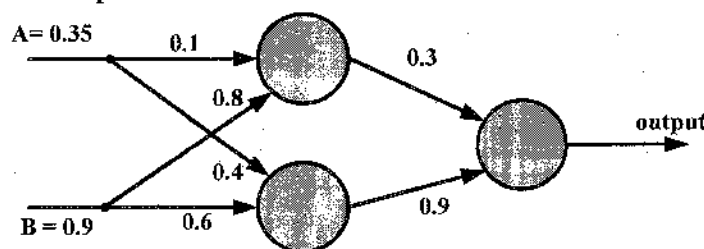
*************** With Best Wishes *****************

Dr. Wessam Fikry, Committee of Correctors and Testers