



Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science and Engineering
Final Examination, Fall-2024

Course Code: CSE445, Course Title: Natural Language Processing

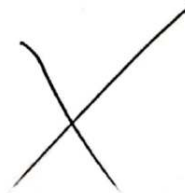
Level: 4 Term: 1 Batch: 61

Time: 2 Hours

Marks: 40

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	Describe topic modeling method with an example? Is topics modeling and topic distribution are same, Justify your answer?	[5]	CO2	
	b)	Explain the components of Recurrent Neural Network (RNN) architecture with a diagram. How does an RNN work?	[5]		
2.	a)	How does speech analysis provide insights into human behavior and communication, and what factors affect its accuracy and effectiveness?	[5]	CO2	
	b)	What tools are available for feature extraction from speech data, and which methods are used for noise reduction?	[5]		
3.	Consider the following dataset:				
		Text	Vector Representation	Label	
		"The movie was fantastic!"	[1, 0, 0, 1, 0, 1, 1, 0, 0, 1]	1	
		"I didn't enjoy the film."	[0, 1, 1, 0, 1, 0, 0, 1, 1, 0]	0	
		"Amazing plot and acting!"	[1, 1, 0, 1, 0, 1, 0, 0, 0, 1]	1	
		"A terrible waste of time."	[0, 0, 1, 0, 1, 0, 1, 1, 1, 0]	0	
Input Layer → Hidden Layer Weights (W_1):					
$W_1 = \begin{bmatrix} 0.3 \\ -0.2 \\ 0.6 \\ 0.1 \\ -0.4 \\ 0.5 \\ 0.2 \\ -0.1 \\ 0.7 \\ -0.3 \end{bmatrix}$ 					
A scalar bias for the hidden layer neuron $b_1 = 0.2$					
Hidden Layer → Output Layer Weight (W_2):					
$W_2 = [0.8]$					
A scalar bias for the output layer neuron $b_2 = -0.1$					
a)	Draw the neural network based on the input vectors and weight matrices.			[2]	CO3
b)	Predict the class for the vector [0,1,1,0,1,0,0,1,1,0]. Assume ReLU as the activation function for the hidden layer and SoftMax for the classification function.			[6]	
c)	Calculate the error using mean square error.			[2]	

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4.	Consider the following Neural Network:	
	The diagram shows a neural network with three layers: an input layer with nodes $X_1=0.35$ and $X_2=0.45$; a hidden layer with nodes h_{11} and h_{12}; and an output layer with nodes h_{21} and h_{22}. Weights are labeled on the connections: $w_1=0.1$ ($X_1 \rightarrow h_{11}$), $w_2=0.2$ ($X_1 \rightarrow h_{12}$), $w_3=0.3$ ($X_2 \rightarrow h_{11}$), $w_4=0.4$ ($X_2 \rightarrow h_{12}$), $w_5=0.5$ ($h_{11} \rightarrow h_{21}$), $w_6=0.6$ ($h_{11} \rightarrow h_{22}$), $w_7=0.7$ ($h_{12} \rightarrow h_{21}$), $w_8=0.8$ ($h_{12} \rightarrow h_{22}$), $w_9=0.9$ ($h_{21} \rightarrow \text{out}$), and $w_{10}=0.99$ ($h_{22} \rightarrow \text{out}$). Biases are indicated above the nodes: $b_1=1$ above h_{11}, $b_2=1$ above h_{21}, and $b_3=1$ above the output node. The output node is labeled $\text{out}=0.75$ and has a handwritten checkmark next to it.	
	When Activation and classification Function = $\text{Swish}(x) = \frac{x}{1+e^{-x}}$ If the learning rate is $\eta = 0.01$ calculate adjusted weight for w_9, w_5, w_{10}.	[10]
		CO3