

LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering
EE514/CS535 Machine Learning
Quiz 08 Solutions

Name: _____

Campus ID: _____

Total Marks: 10

Time Duration: 15 minutes

Question 1 (4 marks)

You are provided with inputs of dimension 4, $\mathbf{x} = [x^{(1)}, x^{(2)}, x^{(3)}, x^{(4)}]$ and $\mathbf{w} = [0.7, 0.6, 0.5, 0.3]$. With a threshold of 1.5, i.e., the label is -1 for $y < 1.5$ and 1 otherwise, give a label for each of the provided inputs. (You can use the next page to write your answers.)

instance	$x^{(1)}$	$x^{(2)}$	$x^{(3)}$	$x^{(4)}$	y
1	0	1	0	1	
2	0	0	0	1	
3	1	1	1	0	
4	1	0	1	0	

Solution:

$W = [0.7, 0.6, 0.5, 0.3]$, $X = [0, 1, 0, 1]$

$y = W^T * X = 0.9$. Label is -1

Same method for the rest of the inputs

$y = 0.3$. Label is -1

$y = 1.8$. Label is 1

$y = 1.2$. Label is -1

Rubric:

1 mark for each correct label

Question 2 (6 marks)

Given $P(\text{SPAM}) = 4/6$, $P(\text{NON-SPAM}) = 2/6$ and the following information, classify the given sentences as SPAM or NON-SPAM. (You can use the next page to write your solution)

Vocabulary	SPAM	NON-SPAM
send	1	1
us	1	1
your	2	1
OTP	3	1
account	2	1
compromised	2	1

(a) Here is the requested one time password: 1234. Don't share it with anyone.

Solution: $P(x||SPAM) = P(SPAM) =$
 $4/6 = 0.667$

$P(x||NON - SPAM) = P(NON - SPAM) =$
 $2/6 = 0.333$

It is likely Spam.

Rubric:

1 mark for each step.

1 mark for the solution if the steps are correct.

Note: You will not receive full marks unless all are steps are correct.

- (b) Dear Customer, your account was marked as compromised. Kindly sign into your account and reset the password. Please note that we will never ask you to send us your OTP or such details. Thank you

Solution: $P(x||SPAM) = P(your||SPAM) * P(account||SPAM) * P(compromised||SPAM) * P(your||SPAM) * P(account||SPAM) * P(send||SPAM) * P(us||SPAM) * P(your||SPAM) * P(OTP||SPAM) * P(SPAM) =$
 $2/11 * 2/11 * 2/11 * 2/11 * 2/11 * 1/11 * 1/11 * 2/11 * 3/11 * 4/6 = 5.43 * 10^{-8}$
 $(2/11)^6 * (1/11)^2 * 3/11 * 4/6 = 5.43 * 10^{-8}$

$P(x||NON-SPAM) = P(your||NON-SPAM) * P(account||NON-SPAM) * P(compromised||NON-SPAM) * P(your||NON-SPAM) * P(account||NON-SPAM) * P(send||NON-SPAM) * P(us||NON-SPAM) * P(your||NON-SPAM) * P(OTP||NON-SPAM) * P(NON-SPAM) =$
 $1/6 * 1/6 * 1/6 * 1/6 * 1/6 * 1/6 * 1/6 * 1/6 * 2/6 = 3.3 * 10^{-8}$
 $(1/6)^9 * 2/6 = 3.3 * 10^{-8}$

It is likely Spam.

Rubric:

1 mark for each step.

1 mark for the solution if the steps are correct.

Note: You will not receive full marks unless all are steps are correct.