CSCI 6751 V1 | Artificial Intelligence

Quiz#1

Oct 14, 2025

Total 50 points **Time: 40 minutes**

GOOD LUCK ***Group 2***

Student Name & ID _____

1	2	Σ
/25	/25	/50

Question 1. (25 points)

We train a simple linear regression model: $y = ax + b$

Given data:

x	y
2	3
3	10

Initial parameters: a = 0, b = 0, Learning rate: $\eta = 0.1$

Loss function (MSE): $E(a, b) = (1/n) * \Sigma(yi-y\hat{}i)^2$,
where $\hat{y}_i = ax_i + b$ and n is number of samples; i.e. 2

Compute one iteration of Gradient Descent; i.e. show prediction, error, gradients, and updated values of w and b.

Solution:

Predictions:

$\hat{y}_1=0$, $\hat{y}_2=0$

Error:

$(\hat{y} - y)$ ---> $\hat{y}_1 - y_1 = 0\text{-}3 = -3$; $\hat{y}_2 - y_2 = 0\text{-}10 = -10$

$\partial E/\partial a = \frac{2}{n}(\sum(\hat{y}_i - y_i)x_i = 2/2[(0-3)(2) + (0-10)(3)] = -36$

$\partial E/\partial b = \frac{2}{n}(\sum(\hat{y}_i - y_i) = 2/2[(0-3) + (0-10)] = -13$

Updates (after one iteration):

$a_{new} = a_{old} - \eta \partial E/\partial a = 0\text{-}0.1*(-36) = 3.6$

$b_{new} = b_{old} - \eta \partial E/\partial b = 0\text{-}0.1*(-13) = 1.3$

Question 2. (25 points)

Fuzzy sets for Temperature:
- Low: triangular (0, 0, 20); Medium: triangular (15, 30, 40); High: triangular (35, 50, 50)

Fan speed outputs:
- Slow = 18; Medium = 55; Fast = 80

Rules:
1. IF Temperature is Low THEN Speed is Slow
2. IF Temperature is Medium THEN Speed is Medium
3. IF Temperature is High THEN Speed is Fast

(a) Compute the degree of membership of Temperature = 25°C in each fuzzy set (Low, Medium, High).
Show your calculations using the triangular membership functions.
(b) Using the centroid (weighted average) method, compute the defuzzified fan speed output.

Solution:
a)

Fuzzy Set	**Parameters**	μ(T=25)
Low	(0,0,20)	0
Medium	(20,30,40)	0.67
High	(35,50,50)	0

b) Given rule outputs: Rules → Speeds: Slow = 18, Medium = 55, Fast = 80

$$\text{Speed} = \frac{\sum(\mu_i \times \text{speed}_i)}{\sum \mu_i}$$

$$= \frac{(0)(18) + (0.67)(55) + (0)(80)}{0 + 0.67 + 0} = \frac{36.85}{0.67} = 55$$

Fan speed = 55