2024 Final

Artificial Intelligent and Machine Learning

Time: 1h30

Students are allowed to use their personal calculator

Exercise 1 (5 points)

Explain how the two methods for linear regression problem:

- Gradient descent
- Normal equation

Exercise 2 (5 points)

Given the training data for a linear regression problem, to predict the final score of a student in Machine Learning class, based on his/her score in programming and probability class. Starting at $\theta_0 = 0, \theta_1 = 1, \theta_2 = -1$, and learning rate α= 4. Calculate the coefficients after the first iteration with batch-gradient descent. Base on the coefficient you just found, calculate the prediction score of the fifth student.

Student	Score in Programing	Score in Probability	Score in Machine Learning
1	18	15	15
2	15	10	11
3	16	12	13
4	19	16	17
5	17	11	???

Exercise 3 (5 points)

Compute the , Accuracy and F-measure (F score) of the following confusion matrix

n=192	Predicted: 0	Predicted: 1
Actual: 0	TN 118	FP 12
Actual: 1	FN 47	TP 15

Exercise 4 (5 points)

Apply the Newton's method to find the value of the parameters theta after the first iteration, starting at $\theta_0 = 0, \theta_1 = 0$.

x	y
2	0
1	1
0	0
3	1

Given the following equation:

$$\Delta_\theta E = \frac{1}{m}\sum_{i=1}^{m}(h(x^{(i)}) - y^{(i)})x^{(i)} \qquad H = \frac{1}{m}\sum_{i=1}^{m}\left[h(x^{(i)})(1-h(x^{(i)})x^{(i)}(x^{(i)})^T\right]$$

$$\theta^{t+1} = \theta^t - \frac{J(\theta^t)}{J'(\theta^t)} = \theta^t - \frac{E'(\theta^t)}{E''(\theta^t)}$$
$$= \theta^t - H^{-1}\Delta_\theta E$$

Given some 2 by 2 matrix and the correspond inverse matrix

$$\begin{vmatrix} 4 & 6 \\ 6 & 15 \end{vmatrix} \Rightarrow \begin{vmatrix} \frac{5}{8} & -0.25 \\ -0.25 & \frac{1}{6} \end{vmatrix}$$

$$\begin{vmatrix} 2 & 6 \\ 6 & 12 \end{vmatrix} \Rightarrow \begin{vmatrix} -1 & 0.5 \\ 0.5 & \frac{-1}{6} \end{vmatrix}$$

$$\begin{vmatrix} 2 & 4 \\ 4 & 10 \end{vmatrix} \Rightarrow \begin{vmatrix} 2.5 & -1 \\ -1 & 0.5 \end{vmatrix}$$

$$\begin{vmatrix} 2 & 3 \\ 3 & 9 \end{vmatrix} \Rightarrow \begin{vmatrix} 1 & \frac{-1}{3} \\ \frac{-1}{3} & \frac{2}{9} \end{vmatrix}$$