We Create Reality Out of Dreams

UNIVERSITY OF SCIENCE AND TECNOLOGY CHITTAGONG (USTC)

Department of Computer Science & Engineering

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Answer Script

Course Code: 425

Course Title: Machine Learning

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Ans to Q no (Q1)

Author name, number of articles, ~~feature~~ number of articles and few others features performance matrix is ~~Evaluation matrix~~. Accuracy.

Ans to Q no (Q2)

model had depended on many things like Accuracy, precision and recall.

	positive	negative
predicted	True positive	False positive
	False negative	True negative

Above the chart it is not possible to get 100% prediction on test data.

Ans to Q no (Q3)

In machine learning, the learning rate is a tuning parameter in an optimization algorithm that determines the step size at each iteration while moving toward a minimum of a loss function.

or

In machine learning is frequently referred to as a black box. data goes in decisions come out but the process between input are opaque.
Otherside K nearest neighbors is one of the simplest technique of supervised learning. works with new case and data. We can say K neardood is blackbox.

Ans to Q no (04)

K-means algorithm where $K=2$
suppose there are ~~two~~ four points.
$A(10, 10)$ $B(20, 10)$,
$C(40, 30)$ $D(50, 40)$
initial centers are: $A(10, 10)$, $B(20, 10)$
$\therefore C_1 = (10, 10)$ and $C_2 = (20, 10)$.
we have to calculate the Euclidean distance between centers and objects. The

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distances

$A \rightarrow C_1 \sqrt{(10-10)^2+(10-10)^2}$

$B \rightarrow C_1 \sqrt{(20-10)^2+(10-10)^2} = 0$

$C \rightarrow C_1 \sqrt{(40-10)^2+(30-10)^2} = 10$

$D \rightarrow C_1 \sqrt{(50-10)^2+(40-10)^2} = 36.06$

$= 50$

again.

$A \rightarrow C_2 \sqrt{(10-20)^2+(10-10)^2} = 10$

$B \rightarrow C_2 \sqrt{(20-20)^2+(10-10)^2} = 0$

$C \rightarrow C_2 \sqrt{(40-20)^2+(30-10)^2} = 28.28$

$D \rightarrow C_2 \sqrt{(50-20)^2+(40-10)^2} = 42.45$

we obtain the following distance matrix.

0	10	36.06	50
10	0	28.28	42.43

neplace the value smaller with 1 other
0.

1	0	0	0
0	1	1	1

Ans to Q no (05)

K-medoids algorithm

nere have a simple example of K methoid
algorithm.

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Data objects

	A_1	A_2
O_1	2	6
O_2	3	4
O_3	3	8
O_4	4	7
O_5	6	2
O_6	6	4
O_7	7	3
O_8	7	4
O_9	8	5
O_{10}	7	6

for creating two cluster we have the chooren randomly two methoids.

Assign each object to the closest representative object.

Using manhattan metrix, we form following clusters

$$|a-c| + |b-d|$$

$O_1 \rightarrow C_1 \ |2-3| + |6-4| = 3$

$O_2 \rightarrow C_1 = 0$

$O_3 = C_1 \ |3-3| + |8-4| = 4$

$O_4 \rightarrow C_1 |4-3| + |7-4| = 4$

$O_5 \rightarrow C_1 \ |6-3| + |2-4| = 5$

$O_6 \rightarrow C_1 \ |7-3| + |4-4| = 4$

$O_7 \rightarrow C_1 |7-3| + |3-4| = 5$

$O_8 \rightarrow C_1 | 7-3| + |4-4| = 4$

$O_9 \rightarrow C_1 \ |8-3| + |5-4| = 6$

$O_{10} \rightarrow C_1 |7-3| + |6-4| = 6$

now,

$O_1 \rightarrow 0.7$

$O_2 \rightarrow 4$

$O_3 \rightarrow 8$

$O_4 \rightarrow 6$

$O_5 \rightarrow 3$

$O_6 \rightarrow 1$

$O_7 \rightarrow 1$

$O_8 \rightarrow 0$

$O_9 \rightarrow 2$

$O_{10} \rightarrow 2$

so, cluster 1 : {(2,6), (3,4) (3,8), (4,7)}

cluster 2 : {(6,2), (6,4), (7,3) (7,4), (8,5), (7,6)}

Total cost $(x, c) = \sum_{i=1}^{1} |x_1 - c_1|$ using the formula

Total cost $= (3+4+4) + (3+1+1+2+2)$

$= 20$

swap O_8 to O_7.

$C_2 = O_7 = (7, 3)$ & $C_1 = O_2 = (3, 4)$

using manhattan matrix again we will get

Total cost $= (3+4+4) + (2+2+1+3+3)$

$= 22$

$S = \cancel{20}\ 22 - 20$

$= 2$

$\therefore S > 0 \Rightarrow$ it is a bad idea to replace O_8 by O_7.

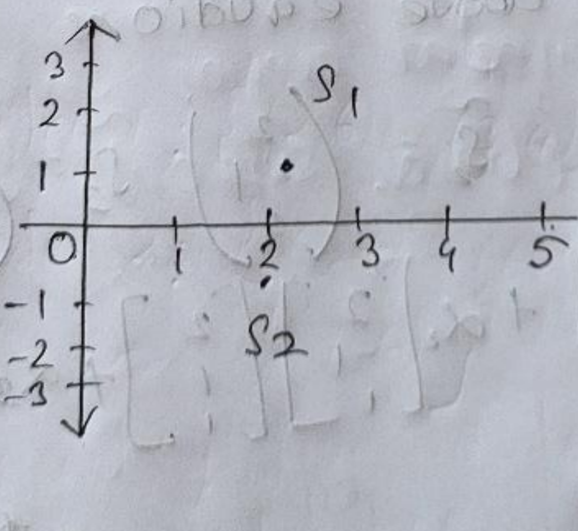
Ans to Q no (06)

~~kot~~.

mathematical example ~~of~~ for hierarchical algorithm on SVM.

SVM: Support vector Machine is a linear model for classification and regression problems

example, here, we select 3 support vectors to start with. They are S_1, S_2 and S_3.



$S_1 = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$

$S_2 = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$

$S_3 = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$

so, $\tilde{S}_1 = \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix}$ $\tilde{S}_2 = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}$, $\tilde{S}_3 = \begin{pmatrix} 4 \\ 0 \\ 1 \end{pmatrix}$

now we need to find three parameters α_1, α_2 and α_3.

$$\alpha_1 \tilde{S}_1 \cdot \tilde{S}_1 + \alpha_2 \tilde{S}_2 \cdot \tilde{S}_1 + \alpha_3 \tilde{S}_3 \cdot \tilde{S}_1 = -1 \text{ (+ve clas)}$$
$$= 1$$

$$\alpha_1 \tilde{S}_1 \cdot \tilde{S}_3 + \alpha_2 \tilde{S}_2 \cdot \tilde{S}_3 + \alpha_3 \tilde{S}_3 \cdot \tilde{S}_3 = +1 \text{ (+ve class)}$$

lets subtitute the values for $\tilde{S}_1$, $\tilde{S}_2$ and $\tilde{S}_3$ in the ~~aobe~~ above equations

$\tilde{S}_1 = \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix}$ $\tilde{S}_2 = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}$ $\tilde{S}_3 = \begin{pmatrix} 4 \\ 0 \\ 1 \end{pmatrix}$

$$\alpha_1 \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} + \alpha_2 \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix} \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} + \alpha_3 \begin{bmatrix} 4 \\ 0 \\ 1 \end{bmatrix} \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}$$
$$= \cancel{+}-1$$
$$= +1$$

After matrix multiplication we get

$6\alpha_1 + 4\alpha_2 + 9\alpha_3 = -1$

Similarly

$4\alpha_1 + 6\alpha_2 + 9\alpha_3 = -1$

$9\alpha_1 + 9\alpha_2 + 17\alpha_3 = +1$

$\alpha_1 = -3.25$

$\alpha_2 = -3.25$

$\alpha_3 = 3.5$

$y = mx + c$

$y = wx + b$ with $w = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ and

Offset $b = -3$.

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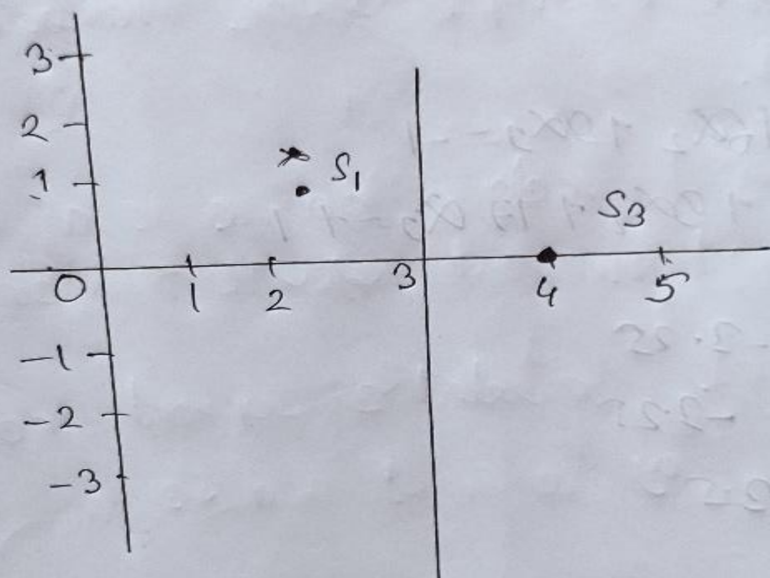

This is the expected decision surface of the SVM (Linear support vector machine).

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