

ComS 474

Homework 4

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1) $\begin{pmatrix} 0.5 & 0.2 & 0.9 \\ -3 & -40 & 1.5 \end{pmatrix}$

2) $\begin{pmatrix} 1.6 & -36.5 \\ 2 & -41.5 \end{pmatrix}$ and $\begin{pmatrix} 1.6 & 2 \\ -36.5 & -41.5 \end{pmatrix}$

3) There is no product AB because their dimensions are not compatible.
Cols in A \neq # Rows in B

2) As the gutters span from $wx + w_b - 1$ to $wx + w_b + 1$, the size of the margin is $\frac{2}{\|w\|}$, and the size of each gutter is 1/2 that $\Rightarrow \frac{1}{\|w\|} = \frac{1}{\sqrt{w_1^2 + w_2^2}} = \frac{1}{\sqrt{1.8^2 + .075^2}} = \frac{1}{1.802} = 0.555$.

However, the professor has specified that d_1 and d_2 are both 1, so the equations for both gutters are: $wx + w_b \pm 1 = 0 \Rightarrow$

$$\begin{pmatrix} 1.8 \\ 0 \\ .075 \end{pmatrix} * x + 1 = -1$$

and

$$\begin{pmatrix} 1.8 \\ 0 \\ .075 \end{pmatrix} * x + 1 = 1$$

3) A point is inside the margin when $|wx + w_b| < 2d = |wx + 1| < 1.11$

$$(1) |(0.5, 0.25, 0.125) * \begin{pmatrix} 1.8 \\ 0 \\ .075 \end{pmatrix} + 1| = 1.909 > 1.11, \text{ so this sample is outside the margin.}$$

$$(2) |(0.4, 0.15, 0.225) * \begin{pmatrix} 1.8 \\ 0 \\ .075 \end{pmatrix} + 1| = 1.737 > 1.11, \text{ so this sample is outside the margin.}$$

$$(3) |(0.3, 0.75, 0.325) * \begin{pmatrix} 1.8 \\ 0 \\ .075 \end{pmatrix} + 1| = 1.564 > 1.11, \text{ so this sample is outside the margin.}$$

$$(4) |(0.2, 0.65, 0.425) * \begin{pmatrix} 1.8 \\ 0 \\ .075 \end{pmatrix} + 1| = 1.392 > 1.11, \text{ so this sample is outside the margin.}$$

4)

(1) If $y_i = 1$ and $w^T x_i + w_b \leq -1$, $y_i(w^T x_i + w_b) \leq -1$, disproving the condition.

(2) This condition holds for $y_i = 1$ and $w^T x_i + w_b \leq -1$ and for $y_i = -1$ and $w^T x_i + w_b \leq 1$.
Both of these sets of values when input into $y_i(w^T x_i + w_b) \leq -1$

(3) If $y_i = 1$ and $w^T x_i + w_b \leq -1$, $y_i(w^T x_i + w_b) \leq -1$, disproving the condition.

(4) This condition holds for $y_i = 1$ and $w^T x_i + w_b \leq -1$ and for $y_i = -1$ and $w^T x_i + w_b \leq 1$.
Both of these sets of values when input into $y_i(w^T x_i + w_b) \leq 1$

(5) If $y_i = 1$ and $w^T x_i + w_b \leq -1$, $y_i(w^T x_i + w_b) \leq -1$, disproving the condition.

(6) This condition holds for $y_i = 1$ and $w^T x_i + w_b \leq -1$ and for $y_i = -1$ and $w^T x_i + w_b \leq 1$.
Both of these sets of values when input into $y_i(w^T x_i + w_b) \leq 0$