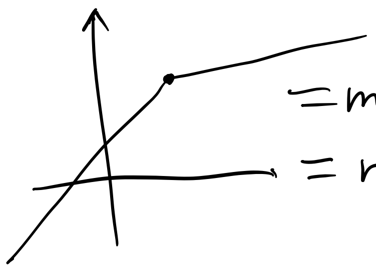
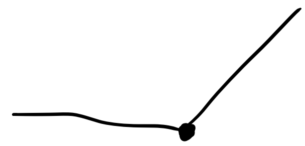
Q4, 7, 10, 13 (T13), ~~Q1~~, Q14, Q9. Q2, Q6, Q8

Q4: $L(w,b) := \max(0, 1-(w^T x_i + b)\, y_i)$. $\begin{bmatrix} x_i \\ y_i \end{bmatrix} = \begin{bmatrix} 5 \\ 0 \end{bmatrix}$. $\begin{bmatrix} w \\ b \end{bmatrix} = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$



$= \max(0, 1-(4 \times 5 - 1) \cdot 0)$

$= \max(0, 1)$.



$$\tilde{L}(w,b) := 1-(w^T x_i + b)\, y_i$$

based on which is max $\begin{cases} \dfrac{\partial \tilde{L}}{\partial w} = \dfrac{\partial L}{\partial w} \\ \dfrac{\partial \tilde{L}}{\partial b} = \dfrac{\partial L}{\partial b} \end{cases}$

$$\frac{\partial \tilde{L}}{\partial w} = -x_i\, y_i \overset{y_i=0}{=} 0$$

$$\frac{\partial \tilde{L}}{\partial b} = -y_i \overset{y_i=0}{=} 0$$

$$\begin{bmatrix} w_{updated} \\ b_{updated} \end{bmatrix} = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$$

$$L_{full} = \frac{1}{n} \sum_{i=1}^{n} \max(0, 1-(w^T x_i + b)\, y_i)$$

Q7:

$$\begin{bmatrix} X & X & X & X \\ X & X & X & X \\ X & X & X & X \\ X & X & X & X \end{bmatrix}$$

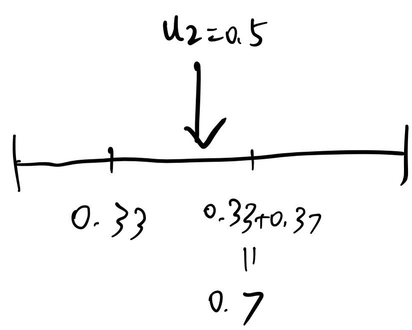
Q10 $\{21\ +,\ 44\ -\}$

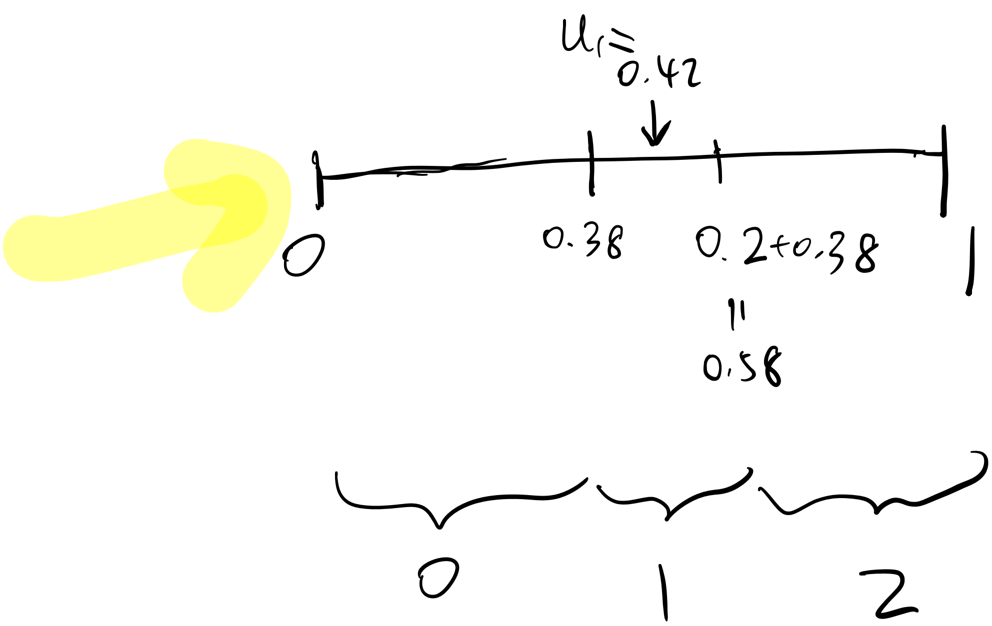
$\underbrace{+++\cdots}_{21}\ \underbrace{---\cdots}_{44}$ $\qquad \frac{44}{65}$.

Q13:

	0	1	2
0	0.38	0.2	0.42
1	0.33	0.37	0.3

$0.38+0.2+0.42=1$





Q14:

image
$$\begin{bmatrix} 8 & -2 & 10 \\ -4 & -3 & -5 \\ -1 & -8 & 5 \end{bmatrix}$$

$|\nabla_x|$ X-gradient filter - flip
$$\begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix}$$

$|\nabla y|$

$$|\nabla| = \sqrt{|\nabla x|^2 + |\nabla y|^2}$$

Horizontally
$$\begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix}$$

Vertically

y-filter flipped

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

1 2 1 → 121

"Naive Bayes":

Q9: X_1, X_2, X_3, X_4 is conditionally dependent given Y

$\mathbb{P}(Y)$ 2

$\mathbb{P}(X_1 \mid Y)$ $X_1 \mid Y=1$, $X_1 \mid Y=2$, $X_1 \mid Y=3$ — 5×3

$\mathbb{P}(X_2 \mid Y)$

⋮

} $\times 4$

$P_1, P_2, P_3, P_4, P_5, P_6 = 1 - P_1 - P_2 - P_3 - P_4 - P_5$

$5 \times 3 \times 4 + 2$

Q2: {22−, 44+}

+ ← {22−, 43+}

$\frac{44}{65}$

Q6: $\mathbb{P}(A \cap B) = \mathbb{P}(A)\mathbb{P}(B)$ ← def of independence

$\mathbb{P}(B) = \frac{\mathbb{P}(A \cap B)}{\mathbb{P}(A)} = \mathbb{P}(B|A)$

$\mathbb{P}(A|B) = \mathbb{P}(A)$

$\mathbb{P}(A) = \frac{\mathbb{P}(A \cap B)}{\mathbb{P}(B)} = \mathbb{P}(A|B)$

	A=0	A=1	
B=0	$\frac{5}{16}$	$\frac{3}{16}$	5 : 3
B=1	$\frac{5}{16}$	$\frac{3}{16}$	5 : 3

$\mathbb{P}(A=1) = \mathbb{P}(A=1, B=0) + \mathbb{P}(A=1, B=1) = \frac{3}{16} + \frac{3}{16} = \frac{6}{16}$

$\mathbb{P}(A=1 | B=1) = \frac{\mathbb{P}(A=1, B=1)}{\mathbb{P}(B=1)} = \frac{\frac{3}{16}}{\frac{1}{2}} = \frac{6}{16}$

Q8: $\mathbb{P}[\text{finish} | \text{forgot}]$

$= \frac{\mathbb{P}[\text{finish} \wedge \text{forgot}]}{\mathbb{P}[\text{forgot}]} = \frac{\mathbb{P}[\text{finish} \wedge \text{forgot}]}{\mathbb{P}[\text{forgot} \wedge \text{finish}] + \mathbb{P}[\text{forgot} \wedge \overline{\text{finish}}]}$

$\mathbb{P}[\text{forgot} \wedge \text{finish}] = \mathbb{P}[\text{finish}] \cdot \mathbb{P}[\text{forgot} | \text{finish}]$

Know: $\mathbb{P}[\text{forgot} \mid \text{finish}] = 0.87$

$$\mathbb{P}[\text{forgot} \mid \overline{\text{finish}}] = 0.4$$

$$\mathbb{P}[\text{finish}] = 0.96$$

$$\mathbb{P}[\text{forgot} \wedge \text{finish}] = \mathbb{P}[\text{finish}] \cdot \mathbb{P}[\text{forgot} \mid \text{finish}]$$

$$\mathbb{P}(O \wedge I) = \mathbb{P}(I) \cdot \mathbb{P}(O \mid I)$$

$$\mathbb{P}(O \mid I) = \frac{\mathbb{P}(O \wedge I)}{\mathbb{P}(I)}$$

$$\frac{0.87 \times 0.96}{0.87 \times 0.96 + 0.04 \times 0.4}$$

<u>Q12</u>: 36 + 47

Q3: $\mathbb{P}(\text{Yes}) = 0.94$

$$\mathbb{P}(\text{"Yes"}) = \mathbb{P}(H) + \mathbb{P}(T \cap \text{"wear"})$$

$$= \mathbb{P}(H) + \mathbb{P}(T) \cdot \mathbb{P}(\text{wear})$$

$$\mathbb{P}(\text{not wear}) = 1 - \mathbb{P}(\text{wear}) = 1 - \frac{0.44}{0.5}$$

Q11: $$H(B|A) = \mathbb{P}(A=T) \cdot H(\mathbb{P}(B|A=T))$$

$$+$$

$$\mathbb{P}(A=F) \cdot H(\mathbb{P}(B|A=F))$$

$\mathbb{P}(B|A=T)$: 1/1

$\mathbb{P}(B=T|A=T) = \frac{1}{2}$

$= \frac{1}{2}$

$\mathbb{P}(B|A=F)$: 4/2

$$H(B|A) = \frac{1}{4} \cdot (1) + \frac{3}{4} \cdot \left(-\frac{2}{3}\log_2\frac{2}{3} - \frac{1}{3}\log_2\frac{1}{3}\right)$$

$$H(P(B|A=T))$$

$$= -\frac{1}{2}\log_2\frac{1}{2} - \frac{1}{2}\log_2\frac{1}{2}$$

$$= \frac{1}{2} + \frac{1}{2}$$

$$= 1$$

Q10: 21+, 44−

⊖ $\frac{44}{65}$

Q2:

$$\frac{44}{66} acc_+ \times 1 + \frac{22}{66} acc_- \times 0$$

i + {43+, 22−}

65NN says i is a positive point