

TIPE 1 : JAWABAN SINGKAT

1. a. 3-Nearest Neighbor : YA

c. Linear SVM : TIDAK

b. Decision Tree : YA

d. SVM dengan Kernel RBF : YA

2. a) high bias / high variance

c) low bias / low variance

b) high bias / low variance

d) low bias / high variance

TIPE 2 : URAIAN

3. a) Root node : $S = [374Y, 426N]$

→ Entropy

$$H(S) = -\left(\frac{374}{800}\right) \log_2\left(\frac{374}{800}\right) - \left(\frac{426}{800}\right) \log_2\left(\frac{426}{800}\right) = 0,99$$

→ Information gain

1) Ukuran

$$S_{\text{besar}} = [190Y, 160N] = H(S) = -\left(\frac{190}{350}\right) \log_2\left(\frac{190}{350}\right) - \left(\frac{160}{350}\right) \log_2\left(\frac{160}{350}\right) = 0,99$$

$$S_{\text{kecil}} = [184Y, 266N] = H(S) = -\left(\frac{184}{450}\right) \log_2\left(\frac{184}{450}\right) - \left(\frac{266}{450}\right) \log_2\left(\frac{266}{450}\right) = 0,97$$

$$IG(S, \text{Ukuran}) = 0,99 - \left(\frac{350}{800}\right) \cdot 0,99 - \left(\frac{450}{800}\right) \cdot 0,97 = 0,0112$$

2) Orbit

$$S_{\text{jauh}} = [215Y, 285N] = H(S) = -\left(\frac{215}{500}\right) \log_2\left(\frac{215}{500}\right) - \left(\frac{285}{500}\right) \log_2\left(\frac{285}{500}\right) = 0,98$$

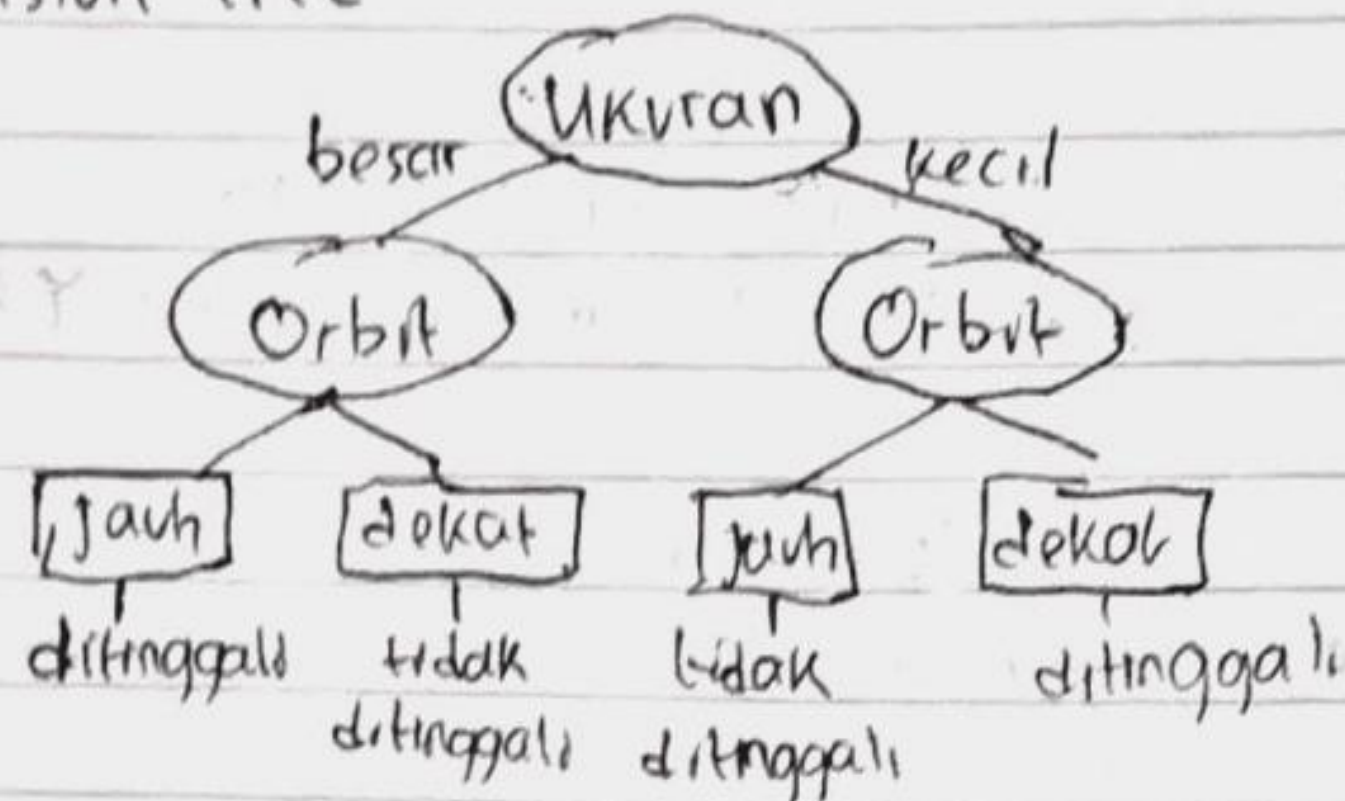
$$S_{\text{dekat}} = [159Y, 141N] = H(S) = -\left(\frac{159}{300}\right) \log_2\left(\frac{159}{300}\right) - \left(\frac{141}{300}\right) \log_2\left(\frac{141}{300}\right) = 0,99$$

$$IG(S, \text{Orbit}) = 0,99 - \left(\frac{500}{800}\right) \cdot 0,98 - \left(\frac{300}{800}\right) \cdot 0,99 = 0,0062$$

$IG(S, \text{Ukuran}) > IG(S, \text{Orbit})$ maka root node berikutnya Ukuran

- Jika Ukuran besar dan orbit jauh maka ditinggali
- Jika Ukuran besar dan orbit dekat maka tidak ditinggali
- Jika Ukuran kecil dan orbit jauh maka ~~tidak~~ tidak ditinggali
- Jika Ukuran kecil dan orbit dekat maka ditinggali

3) b) Decision Tree



4) a)

	Demam	Mual	Diare	Gemetar	$D(U, I_i)$	Ranking	Kondisi
D1	0	0	0	0	$\sqrt{2}$	1	Sehat
D2	1	0	0	0	$\sqrt{3}$	4	Influenza
D3	2	0	0	1	$\sqrt{5}$	6	Influenza
D4	2	1	1	0	$\sqrt{6}$	7	Tifus
D5	1	0	1	0	$\sqrt{4}$	5	Tifus
D6	0	1	1	0	$\sqrt{2}$	2	Radang usus
D7	1	1	1	0	$\sqrt{3}$	3	Radang usus
U	0	1	0	1			

Hasil dari 3NN adalah Radang usus

Hasil dari 5NN adalah Radang usus

b) $P(\text{Sehat}) = \frac{1}{7}$ $P(\text{Tifus}) = \frac{2}{7}$
 $P(\text{Influenza}) = \frac{2}{7}$ $P(\text{Radang usus}) = \frac{2}{7}$

$P(\text{Demam} = \text{tidak} | \text{Sehat}) = \frac{1}{7}$ $P(\text{Demam} = \text{tidak} | \text{Radang usus}) = \frac{1}{7}$
 $P(\text{mual} = \text{Ya} | \text{Tifus}) = \frac{1}{7}$ $P(\text{mual} = \text{Ya} | \text{Radang usus}) = \frac{2}{7}$
 $P(\text{Diare} = \text{tidak} | \text{Sehat}) = \frac{1}{7}$ $P(\text{Diare} = \text{tidak} | \text{Influenza}) = \frac{2}{7}$
 $P(\text{Gemetar} = \text{Ya} | \text{Influenza}) = \frac{1}{7}$

Sehat : Influenza : Tifus : Radang usus
 $\frac{1}{7} \times \frac{1}{7} \times \frac{1}{7} : \frac{2}{7} \times \frac{2}{7} \times \frac{1}{7} : \frac{2}{7} \times \frac{1}{7} : \frac{2}{7} \times \frac{1}{7} \times \frac{2}{7}$
 $\frac{1}{343} : \frac{4}{343} : \frac{2}{49} : \frac{4}{343}$

Tifus > Radang usus > Influenza > Sehat

Prediksi Tifus //

5) a) Persamaan

$$(1) -1(w_1 \cdot 1 + w_2 \cdot 4 + b) \geq 1$$

$$-w_1 - 4w_2 - b \geq 1$$

$$(2) -1(w_1 \cdot 2 + w_2 \cdot 3 + b) \geq 1$$

$$-2w_1 - 3w_2 - b \geq 1$$

$$(3) 1(w_1 \cdot 4 + w_2 \cdot 5 + b) \geq 1$$

$$4w_1 + 5w_2 + b \geq 1$$

$$(4) 1(w_1 \cdot 5 + w_2 \cdot 6 + b) \geq 1$$

$$5w_1 + 6w_2 + b \geq 1$$

→ Persamaan (1) dan (2) jadi (5)

$$-w_1 - 4w_2 - b \geq 1 \quad | \times 2 | \quad -2w_1 - 8w_2 - 2b \geq 2$$

$$-2w_1 - 3w_2 - b \geq 1 \quad | \times 1 | \quad -2w_1 - 3w_2 - b \geq 1$$

$$-5w_2 - b \geq 1$$

→ Persamaan (2) dan (3) jadi (6)

$$-2w_1 - 3w_2 - b \geq 1 \quad | \times 2 | \quad -4w_1 - 6w_2 - 2b \geq 2$$

$$4w_1 + 5w_2 + b \geq 1 \quad | \times 1 | \quad 4w_1 + 5w_2 + b \geq 1$$

$$-w_2 - b \geq 3$$

→ Substitusi (1) (4)

$$(1) -w_1 - 4(0,5) - b = 1$$

$$-w_1 - 2 - b = 1$$

$$-w_1 - b = 3$$

$$(4) 5w_1 + 6(0,5) + b = 1$$

$$5w_1 + 3 + b = 1$$

$$5w_1 + b = -2$$

→ Eliminasi (1) dan (4)

$$-w_1 - b = 3$$

$$5w_1 + b = -2$$

$$4w_1 = 1$$

$$w_1 = 0,25$$

→ Substitusi persamaan (1)

$$-w_1 - 4w_2 - b \geq 1$$

$$-(0,25) - 4(0,5) - b = 1$$

$$-0,25 - 2 - b = 1$$

$$-2,25 - b = 1$$

$$-b = 3,25$$

$$b = -3,25$$

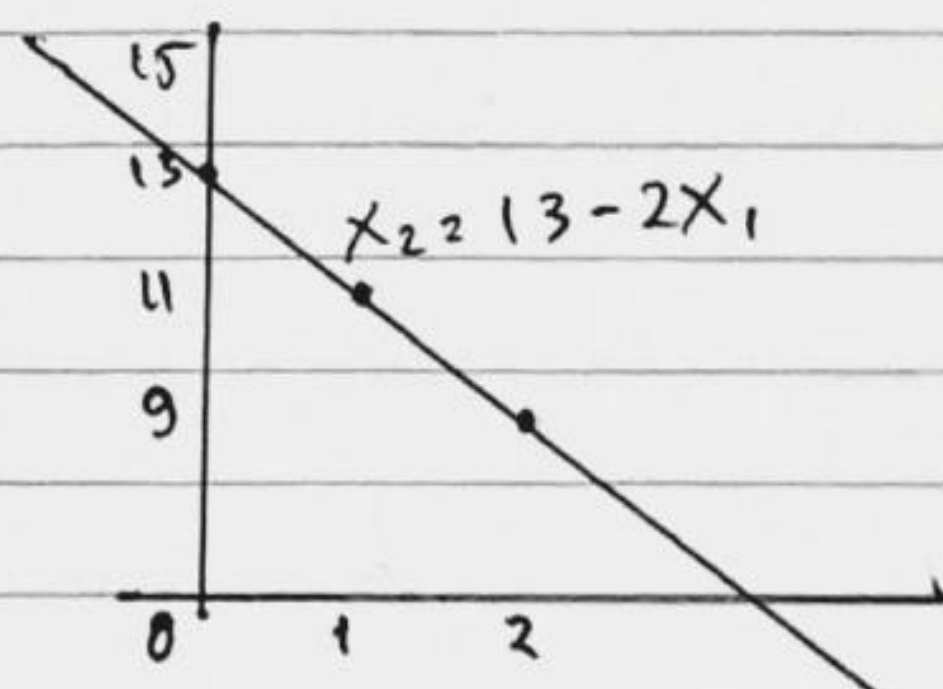
X_1	$X_2 = 13 - 2X_1$
-2	17
-1	15
0	13
1	11
2	9

b) $w_1 x_1 + w_2 x_2 + b = 0$

$$0,25x_1 + 0,5x_2 + (-3,25) = 0 \quad \text{dikali } 0,25$$

$$x_1 + 2x_2 - 13 = 0$$

$$x_1 = 13 - 2x_2$$



6) a) P: Positif N: Negatif

Confusion Matrix

		Predicted class		
		P	N	
Actual class	P	5	1	C = 6
	N	2	2	D = 4
		A = 7	B = 3	T = 10

$$TP = 2$$

$$TN = 5$$

$$FP = 1$$

$$FN = 2$$

$$b) \text{ Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} = \frac{2 + 5}{2 + 5 + 1 + 2} = \frac{7}{10} = 70\%$$

$$\text{Error rate} = 1 - \text{Accuracy} = 1 - \frac{7}{10} = \frac{3}{10} = 30\%$$

$$c) \text{ Sensitivity} = \frac{TP}{TP + FN} = \frac{2}{2 + 2} = \frac{2}{4} = 50\%$$

$$\text{Specificity} = \frac{TN}{FP + TN} = \frac{5}{1 + 5} = \frac{5}{6} = 83\%$$

d) (1) Accuracy dari prediksi pasien menderita kanker yaitu $\frac{7}{10} = 70\%$

(2) Precision dari pasien yang benar menderita kanker dari keseluruhan prediksi yaitu $\frac{TP}{TP + FP} = \frac{2}{2 + 1} = \frac{2}{3} = 66\%$

(3) Sensitivity dari pasien yang diprediksi kanker dibandingkan keseluruhan pasien yang sebenarnya menderita kanker yaitu $\frac{TP}{TP + FN} = \frac{2}{2 + 2} = \frac{1}{2} = 50\%$