1953902 高扬帆
28.

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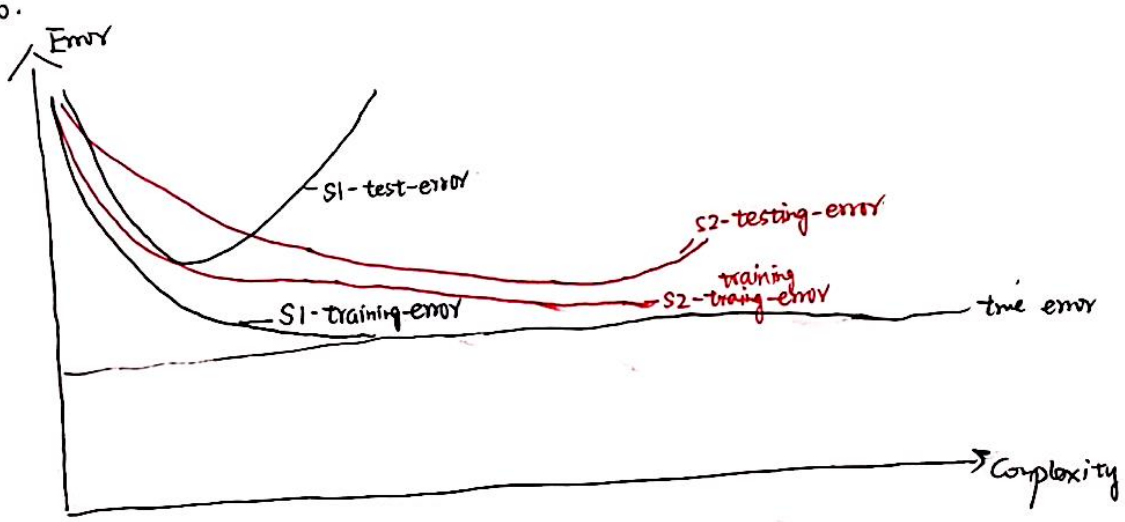
26.



I have to explain the diagrams in a these aspects:

a. ① As the true error is ~~intrinsic~~ inherent, ~~the~~ all of the ~~tes~~ errors won't be less than this

② As the size of S1 is much smaller than S2, the training error is much easier to converge due to overfitting. meanwhile, the test error is also ~~easier~~ earlier to increase due to overfitting.

27.

(1). Rea Recall, because it is much more serious when there is an FN than there is an FP as ~~it is~~ tumor is fatal. if it is retreated late.

(2) confusion matrix:

pred. / label	0	1
0	4	1
1	2	3

TP=3 ; TN=4; FP=1 ; FN=2

$$\text{Precision} = \frac{TP}{TP+FP} = \frac{3}{4} = 0.75$$

$$\text{Recall} = \frac{TP}{TP+FN} = \frac{3}{5} = 0.6$$

$$\text{F1-score} = \frac{2PR}{P+R} = \frac{2}{3} \doteq 0.667$$

28.

$P(\text{Buy Computer}=\text{yes}) = \frac{9}{14}$ $P(\text{Buy Computer}=\text{No}) = \frac{5}{14}$

$P(\text{age}<=30 \mid \text{Buy Computer}=\text{yes}) = \frac{2}{9}$ $P(\text{Age}<=30 \mid \text{Buy computer}=\text{no}) = \frac{3}{5}$

$P(\text{income}=\text{medium} \mid \text{Buy Computer}=\text{yes}) = \frac{4}{9}$ $P(\text{income}=\text{medium} \mid \text{Buy Computer}=\text{no}) = \frac{2}{5}$

$P(\text{Student}=\text{yes} \mid \text{Buy Computer}=\text{yes}) = \frac{6}{9} = \frac{2}{3}$ $P(\text{No Student}=\text{yes} \mid \text{Buy Computer}=\text{no}) = \frac{1}{5}$

$P(\text{credit-rating}=\text{excellent} \mid \text{Buy Computer}=\text{yes}) = \frac{1}{3}$ $P(\text{credit-rating}=\text{excellent} \mid \text{Buy a Computer}=\text{no}) = \frac{3}{5}$

the probability of buying a computer $= \frac{9}{14} \times \frac{2}{9} \times \frac{4}{9} \times \frac{2}{3} \times \frac{1}{3} = \frac{8}{567}$

the probability of not buying a computer is $= \frac{5}{14} \times \frac{3}{5} \times \frac{2}{5} \times \frac{1}{5} \times \frac{3}{5} = \frac{9}{875}$

as $\frac{8}{567} > \frac{9}{875}$, so the prediction is Buy Computer = yes.

2.

(1): $H(\text{Eyecolor} \mid \text{Weight=N}) = \left(\frac{2}{5}\log_2\frac{2}{5} + \frac{3}{5}\log\frac{3}{5}\right) = \left(\frac{2}{5}\times(-1.32) + \frac{3}{5}\times(-0.73)\right) = 0.958 \approx 0.966$ $\left(\log\frac{3}{5} = \log 0.2 + \log 0.3 + \log 10 \approx -0.73\right)$

(2) Without dividing: $E(\text{Output}) = 1$ where $E(\cdot)$ stood for Entropy.

With dividing by weight: $\text{Gain} = 1 - \left[\frac{1}{2}\left(\log\frac{2}{5}\log\frac{2}{5} + \frac{3}{5}\log\frac{3}{5}\right) + \frac{1}{2}\left(\log\frac{3}{5}\log\frac{3}{5} + \frac{2}{5}\log\frac{2}{5}\right)\right] = 0.034$

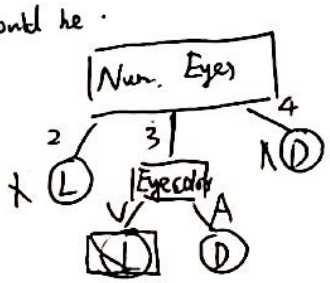
With dividing by Eye color $\text{Gain} = 1 + \left[\frac{1}{2}\left(\log\frac{4}{5}\log\frac{4}{5} + \frac{1}{5}\log\frac{1}{5}\right) + \frac{1}{2}\left(\frac{4}{5}\log\frac{4}{5} + \frac{1}{5}\log\frac{1}{5}\right)\right] =$

$\approx 0.8 \times \frac{4}{5} \times 0.3 \approx 0.28$

With dividing by Num. Eyes $\text{Gain} = 1 + \left[\frac{3}{10}\times 0 + \frac{3}{10}\times 0 + \frac{4}{10}\times\left(\frac{1}{2}\log\frac{1}{2} + \frac{1}{2}\log\frac{1}{2}\right)\right] = 0.6$

So the root is Num. Eyes.

(3) The decision tree should be:



(4): the training set error is 0.

(1) a. the size shall be 5×5

b. The number of independent params in C1 shall be: $5\times5\times3$ $(5\times5\times1+1)\times6 = 5\times5\times1\times6 = 156$

c. The number of independent params in C3 shall be $(5\times5\times1+1)\times16 = 5\times5\times1\times16 = 416$

d. The number of independent param. in F6 shall be $120\times84+1 = 10081$

(2)

I The result[2,1] (0,0) (1,1) stub first element of this shall be

$1\times2+2\times0+2\times1+0\times0+1\times1+2\times2+3\times1+0\times0+1\times2 = 15$

The other elements shall be surely calculated: The result is

$$\begin{bmatrix} 15 & 16 \\ 6 & 15 \end{bmatrix}$$

(3) The average of the feature map is: $\frac{6\times4}{16} = 1.5$

so the vector output is:

$[1.5, 1.5, 1.5, 1.5]^T$