Assignment 5

1) Suppose you want to build a decision tree. What is the initial entropy of target value taste?

→ Answer

Calculating the probability

$P(taste = meh) = 5/10$

Also,

$P(taste = yummy) = 5/10$

Then,

$$H(taste) = -5/10 \log_2 5/10 - 5/10 \log_2 5/10$$

$$= 1.0$$

2) Consider that Visual defects is chosen as the root of decision tree. What is the information gain?.

→ Answer

For visual defects

$P(\text{visual defects} = \text{some}) = 3/10$

$P(\text{visual defects} = \text{none}) = 4/10$

$P(\text{visual defects} = \text{many}) = 3/10$

For taste,

$\text{Taste} = [\text{meh}: 5, \text{yummy}: 5]$

$\text{Taste}_{\text{some}} = [\text{meh}: 3, \text{yummy}: 0]$

$\text{Taste}_{\text{none}} = [\text{meh}: 2, \text{yummy}: 2]$

$\text{Taste}_{\text{many}} = [\text{meh}: 0, \text{yummy}: 3]$

We know,

$H(\text{Taste} \mid \text{Visual defects}) =$

$\text{Entropy}(\text{Taste}) - (3/10 \ \text{Entropy}(\text{Taste}_{\text{some}})$
$+ \ 4/10 \ \text{Entropy}(\text{Taste}_{\text{none}}) + 3/10 \ \text{Entropy}$
$(\text{Taste}_{\text{many}}))$

Then,

$\text{Entropy}(\text{Taste}_{\text{none}}) = -\left(2/4 \log_2 2/4 + 2/4 \log_2 2/4\right)$
$= 1.0$

$\text{Entropy}(\text{Taste}_{\text{some}}) = -\left(3/3 \log_2 3/3 + 0/3 \log_2 0/3\right)$
$= 0$

$\text{Entropy}(\text{Taste}_{\text{many}}) = -\left(0/3 \log_2 0/3 + 3/3 \log_2 3/3\right)$
$= 0$

Now,

~~Entropy (Taste)~~

$$H = 1.0 - \left(3/10\ (0) + 4/10\ (1.0) + 3/10\ (0)\right)$$

$$= 1.0 - (0 + .4 + 0)$$
$$= 1 - 0.4$$
$$= 0.6$$

∴ Information Gain = 0.6.

3) What is entropy H(Taste|Visual Defect == Some) and entropy H(Taste|Visual Defect == None)?

→ Answer

H(Taste|Visual defect some)

$$= -(3/3 \log_2 3/3 + 0/3 \log_2 0/3)$$
$$= 0$$

Also,

H(Taste|Visual defect none)

$$= -(2/4 \log_2 2/4 + 2/4 \log_2 2/4)$$

$$= 1.0$$