Question 1 CIT-223-022/2021

(a) ~~NAME: SAMUEL~~ BACHELOR OF SCIENCE IN COMPUTER SCIENCE

LEARNING AND ADAPTIVE SYSTEMS

CAT 1

(b) Machine Translation is the process of using artificial intelligence to automatically translate text from a given language to another. It uses rules and dictionaries with high accuracy models.

QUESTION 2

(a) Entropy and Information Gain.

(i) Outlook

Entropy (S) = $-(P_\theta \log_2 P_\theta + P_\theta \log_2 P_\theta)$

Occurrences = 17

Positive = 11

Negative = 6

$= -\left(\frac{11}{17}\log_2\frac{11}{17} + \frac{6}{17}\log_2\frac{6}{17}\right)$

$= 0.937$

~~Information Gain~~:

(ii) Entropy of each attribute.

(i) Outlook

(a) Sunny = NO = ~~3~~ 4, Yes = ~~3~~ 4 $= \left(\frac{4}{8}\log_2\frac{4}{8} + \frac{4}{8}\log_2\frac{4}{8}\right) = 1$

(ii) Overcast = NO = 0, Yes = 4 $= \left(\frac{4}{4}\log_2\frac{4}{4} + \frac{0}{4}\log_2\frac{0}{4}\right) = 0$

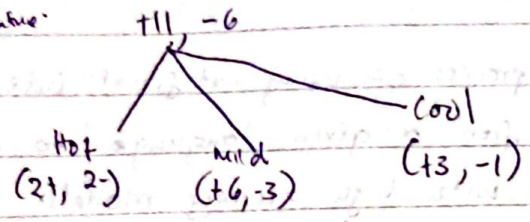
(iii) Rain = Yes = 3, NO = 2 $= -\frac{3}{5}\log_2\frac{3}{5} + \frac{2}{5}\log_2\frac{2}{5} = 0.971$

(iv) Information Gain = Entropy - $\sum$ Yes (S, OR)

Information gain = $0.937 - \left(\frac{8}{17}(1) + \frac{4}{17}(0) + \frac{5}{17}(0.971)\right)$

$= 0.1803$

Temperature:



Total = 0.928

Gain = 0.9365 - 0.928

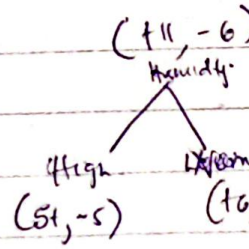
$= 0.0085$

Hot $= \left(\frac{-2}{4}\log_2\frac{2}{4} - \frac{3}{4}\log_2\frac{2}{4}\right)\frac{4}{17} = 1$

Mild $= \left(\frac{-6}{9}\log_2\frac{6}{9} - \frac{3}{9}\log_2\frac{3}{9}\right)\frac{9}{17} = \frac{9}{17} = 0.9163$

cool $= \left(\frac{-3}{4}\log_2\frac{3}{4} - \frac{1}{4}\log_2\frac{1}{4}\right) = 0.8113$

Humidity

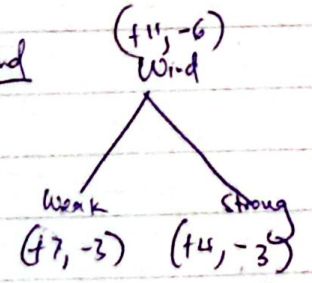


Entropy $= -\frac{6}{7}\log_2\frac{6}{7} - \frac{1}{7}\log_2\frac{1}{7} = 0.592$

Gain $= 0.937 - \left(\frac{10}{17} \times 1\right) + \left(\frac{7}{17} \times 0.592\right)$

$= 0.1053$

Wind



Entropy $= -\frac{7}{10}\log_2\frac{7}{10} - \frac{3}{10}\log_2\frac{3}{10} = 0.8813$

Strong $= -\frac{4}{7}\log_2\frac{4}{7} - \frac{3}{7}\log_2\frac{3}{7} = 0.985$

Gain $= 0.937 - \left(\frac{10}{17} \times 0.8813\right) + \left(\frac{7}{17} \times 0.985\right) = 0.0101$

Decision tree: