ML

LECTURE-14

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Naive Bayes Previous Year Question

- 1.Consider the following data set and predict the class of new instance X = {Slow, Rarely, No} using Naive Bayes classification algorithm.

Sl. No	Swim	Fly	Crawl	Class
1.	Fast	No	No	Fish
2.	Fast	No	Yes	Animal
3.	Slow	No	No	Animal
4.	Fast	No	No	Animal
5.	No	Short	No	Bird
6.	No	Short	No	Bird
7.	No	Rarely	No	Animal
8.	Slow	No	Yes	Animal
9.	Slow	No	No	Fish
10.	Slow	No	Yes	Fish
11.	No	Long	No	Bird
12.	Fast	No	No	Bird

- Ans :- P(A|B) = (P(B|A) * P(A))/ P(B)
- **Fish:**
- P(X | Fish) = P(Slow | Fish) * P(Rarely | Fish) * P(No | Fish)
- a)P(Slow | Fish) = (P(Fish | Slow) * P(Slow))/ P (Fish) = ((2/4) * (4/12)) / (3/12) = 0.66
- b)P(Rarely | Fish) = (P(Fish | Rarely) * P(Rarely))/ P (Fish) = ((0/1) * (1/12)) / (3/12) = 0
- c)P(No | Fish) = (P(Fish | No) * P(No))/ P (Fish) = ((2/9) * (9/12)) / (3/12) = 0.66
- Thus, P(X | Fish) = 0.66 * 0 * 0.66 = 0

Naive Bayes Previous Year Question

- **Animal:**
- P(X | Animal) = P(Slow | Animal) * P(Rarely | Animal) * P(No | Animal)
- d)P(Slow | Animal) = (P(Animal | Slow) * P(Slow))/ P (Animal) = ((2/4) * (4/12)) / (5/12) = 0.4
- e)P(Rarely | Animal) = (P(Animal | Rarely) * P(Rarely))/ P (Animal) = ((1/1) * (1/12)) / (5/12) = 0.2
- f)P(No | Animal) = (P(Animal | No) * P(No))/ P (Animal) = ((3/9) * (9/12)) / (5/12) = 0.6
- Thus, P(X | Animal) = 0.4 * 0.2 * 0.6 = 0.048

- **Bird:**
- P(X | Bird) = P(Slow | Bird) * P(Rarely | Bird) * P(No | Bird)
- g)P(Slow | Bird) = (P(Bird | Slow) * P(Slow))/ P (Bird) = ((0/4) * (4/12)) / (4/12) = 0
- h)P(Rarely | Bird) = (P(Bird | Rarely) * P(Rarely))/ P (Bird) = ((0/1) * (1/12)) / (4/12) = 0
- i)P(No | Bird) = (P(Bird | No) * P(No))/ P (Bird) = ((4/9) * (9/12)) / (4/12) = 1
- Thus, P(X | Bird) = 0 * 0 * 1 = 0
- **Since P(X|Animal) has highest value among P(X|Animal), P(X|Fish) and P(X|Bird) , Hence class of new instance is animal.**

Decision Tree Previous Year Question

- 1.Consider the following data set.

Color	Size	Act	Age	Inflated
Yellow	Small	Dip	Adult	F
Yellow	Large	Stretch	Adult	T
Yellow	Large	Stretch	Child	F
Yellow	Large	Dip	Adult	F
Yellow	Large	Dip	Child	F
Purple	Small	Stretch	Adult	T
Purple	Small	Stretch	Adult	T
Purple	Small	Stretch	Child	F
Purple	Small	Dip	Adult	F
Purple	Small	Dip	Child	F

- Calculate the information gain of each attribute. State which attribute should be used as the first root node based on the information gain parameter.

- **Ans:** From the total of 10 rows in our data-set S, there are 3 rows with the target value T and 7 rows with the target value F. The entropy of S is calculated as:

- Entropy(S) = - (3/10) * $\log_2(3/10)$ - (7/10) * $\log_2(7/10)$ = -0.3 * -1.737 - 0.7* -0.5146 = 0.88

Decision Tree Previous Year Question

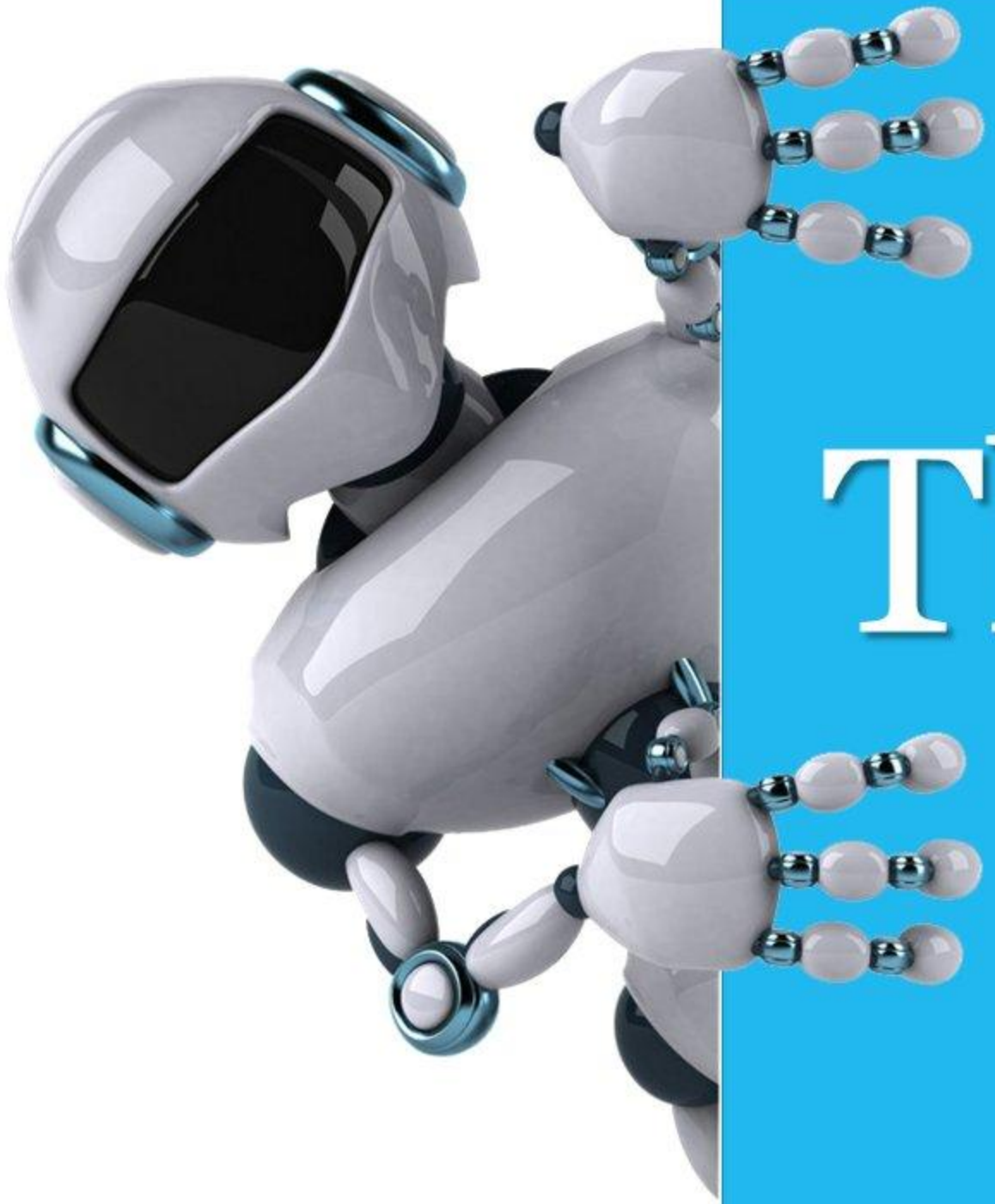
- **IG calculation for Color:**

- In this(Color) feature there are 5 rows having value Yellow and 5 rows having value Purple.
- In the 5 rows with Yellow for Color, there is 1 row having target value T and 4 rows having target value F.
- In the 5 rows with Purple, there are 2 rows having target value T and 3 rows having target value F.
- $|S| = 10$
- For v = Yellow, $|S_v| = 5$
- $\text{Entropy}(S_v) = - (1/5) * \log_2(1/5) - (4/5) * \log_2(4/5) = -0.2 * -2.322 - 0.8 * -0.3219 = 0.72$
- For v = Purple, $|S_v| = 5$
- $\text{Entropy}(S_v) = - (2/5) * \log_2(2/5) - (3/5) * \log_2(3/5) = -0.4 * -1.322 - 0.6 * -0.737 = 0.971$

- IG(S, Color) = Entropy(S) - (|Syellow| / |S|) * Entropy(Syellow) - (|SPurple| / |S|) * Entropy(SPurple)
- **$\therefore$ IG(S, Color) = 0.88 - (5/10) * 0.72 - (5/10) * 0.971 = 0.0345**

Decision Tree Previous Year Question

- Next, we calculate the IG for the features “Size”, “Act” and “Age”.
- **IG(S, Size) = 0.006**
- **IG(S, Act) = 0.396**
- **IG(S, Age) = 0.281**
- **Since the feature Act have the highest Information Gain it is used to create the root node.**



Thank you