

Week 7 Lab – Naive Bayes

Task 1: Accident Prediction

Objective:

To calculate the probability of an accident (Yes or No) using the Naive Bayes classifier for

$X = (\text{Rain}, \text{Good}, \text{Normal}, \text{No})$.

Total instances = 10

Accident = Yes $\rightarrow 5$

Accident = No $\rightarrow 5$

Prior Probabilities:

$P(\text{Accident} = \text{Yes}) = 0.5$

$P(\text{Accident} = \text{No}) = 0.5$

Likelihoods when Accident = Yes:

$P(\text{Rain}|\text{Yes}) = 1/5 = 0.2$

$P(\text{Good}|\text{Yes}) = 1/5 = 0.2$

$P(\text{Normal}|\text{Yes}) = 1/5 = 0.2$

$P(\text{No}|\text{Yes}) = 2/5 = 0.4$

$P(X|\text{Yes}) = 0.2 \times 0.2 \times 0.2 \times 0.4 = 0.0032$

$P(\text{Yes}|X) = 0.0032 \times 0.5 = 0.0016$

Likelihoods when Accident = No:

$P(\text{Rain}|\text{No}) = 2/5 = 0.4$

$P(\text{Good}|\text{No}) = 3/5 = 0.6$

$P(\text{Normal}|\text{No}) = 2/5 = 0.4$

$P(\text{No}|\text{No}) = 4/5 = 0.8$

$P(X|\text{No}) = 0.4 \times 0.6 \times 0.4 \times 0.8 = 0.0768$

$P(\text{No}|X) = 0.0768 \times 0.5 = 0.0384$

Since $P(\text{No}|X) > P(\text{Yes}|X)$, the classifier predicts that an accident will NOT

occur.

Task 2: Weather-Based Game Prediction

Objective:

To classify whether to play based on weather conditions using Naive Bayes.

Given $X = (\text{Sunny}, \text{Hot}, \text{High}, \text{False})$

Total instances = 14

Play = Yes $\rightarrow 9$

Play = No $\rightarrow 5$

Prior Probabilities:

$$P(\text{Yes}) = 9/14 = 0.64$$

$$P(\text{No}) = 5/14 = 0.36$$

Likelihoods when Play = Yes:

$$P(\text{Sunny}|\text{Yes}) = 2/9 = 0.2$$

$$P(\text{Hot}|\text{Yes}) = 2/9 = 0.2$$

$$P(\text{High}|\text{Yes}) = 3/9 = 0.3$$

$$P(\text{False}|\text{Yes}) = 6/9 = 0.67$$

$$P(X|\text{Yes}) = 0.00804$$

$$P(\text{Yes}|X) = 0.00804 \times 0.64 = 0.0051$$

Likelihoods when Play = No:

$$P(\text{Sunny}|\text{No}) = 3/5 = 0.6$$

$$P(\text{Hot}|\text{No}) = 2/5 = 0.4$$

$$P(\text{High}|\text{No}) = 4/5 = 0.8$$

$$P(\text{False}|\text{No}) = 2/5 = 0.4$$

$$P(X|\text{No}) = 0.0768$$

$$P(\text{No}|X) = 0.0768 \times 0.36 = 0.028$$

Since $P(\text{No}|X) > P(\text{Yes}|X)$, the classifier predicts that the game will NOT be

played.