

AIGS1003 - Machine Learning

Assignment 1

Loyalist College of applied arts and technology

Submitted by: Ilan Goldfarb

Submitted to: Professor Babatunde Giwa, PhD

Question 1

Bayes' theorem:

$$P(Y|X) = \frac{P(X|Y)P(Y)}{P(X)}$$

In our case:

1. The Naive Bayes' assumption is that every variable is conditionally independent:

$$P(\text{sunny}|\text{"a cone of ice cream"}) = \frac{P(\text{"a cone of ice cream"}|\text{sunny})P(\text{sunny})}{P(\text{"a cone of ice cream"})}$$

$$P(\text{sunny}|\text{"a cone of ice cream"}) = P(a|\text{sunny})P(\text{cone}|\text{sunny})P(\text{of}|\text{sunny})P(\text{ice}|\text{sunny})P(\text{cream}|\text{sunny})P(\text{sunny})$$

2. The same goes for our second case:

$$P(\text{rainy}|\text{"a cop of coffee"}) = \frac{P(\text{"a cop of hot coffee"}|\text{rainy})P(\text{rainy})}{P(\text{"a cop of hot coffee"})}$$

$$P(\text{rainy}|\text{"a cop of coffee"}) = P(a|\text{rainy})P(\text{cop}|\text{rainy})P(\text{of}|\text{rainy})P(\text{hot}|\text{rainy})P(\text{coffee}|\text{rainy})P(\text{rainy})$$

The probability of both events occurring under the Naive Bayes assumptions is equal. This is because the probability of occurrence of each data point in the data set is equal, and thus the result of our equation is equal.

Sources:

Babatunde, Giwa, PhD, loss_activation, [PowerPoint Slides], Loyalist College. https://loyalistcollege.instructure.com/courses/8383/pages/naives-bayes?module_item_id=453519

Wikipedia. (2023, October 6) Bayes' theorem. In Wikipedia. https://en.wikipedia.org/wiki/Bayes%27_theorem