S. B. JAIN INSTITUTE OF TECHNOLOGY, MANAGEMENT & RESEARCH, NAGPUR.

Practical No. 6

Aim: Implement Bayes theorem for given data.

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AIM: Implement Bayes theorem for given data.

OBJECTIVE/EXPECTED LEARNING OUTCOME:

The objectives and expected learning outcome of this practical are:

- To be able to understand the concept of Bayes theorem.
- To be able to solve problem based on Bayes theorem.

THEORY:

Bayes theorem: - Bayes' Theorem states that the conditional probability of an event, based on the occurrence of another event, is equal to the likelihood of the second event given the first event multiplied by the probability of the first event.

Bayes theorem is used to find the reverse probabilities if we know the conditional probability of an event.

Bayes' Theorem states the following for any two events A and B:

$P(A|B) = P(A)*P(B|A) / P(B)$

where:

· P(A|B): The probability of event A, given event B has occurred.

· P(B|A): The probability of event B, given event A has occurred.

· P(A): The probability of event A.

· P(B): The probability of event B.

For example, suppose the probability of the weather being cloudy is 40%. Also suppose the probability of rain on a given day is 20%.

Also suppose the probability of clouds on a rainy day is 85%.

If it's cloudy outside on a given day, what is the probability that it will rain that day?

Solution:

· P(cloudy) = 0.40
· P(rain) = 0.20
· P (cloudy | rain) = 0.85
· Thus, we can calculate:
· (rain | cloudy) = P(rain) * P (cloudy | rain) / P(cloudy)
· P (rain | cloudy) = 0.20 * 0.85 / 0.40
· P (rain | cloudy) = 0.425
· If it's cloudy outside on a given day, the probability that it will rain that day is 42.5%.

PROGRAM CODE:

```
def calculate_probability():
    # Given probabilities
    P_A1 = 5 / 365
    P_A2 = 1 - P_A1
    P_B_given_A1 = 0.9
    P_B_given_A2 = 0.1

    # Calculate P(B)
    P_B = (P_A1 * P_B_given_A1) + (P_A2 * P_B_given_A2)

    # Calculate P(A1|B) using Bayes' Theorem
    P_A1_given_B = (P_A1 * P_B_given_A1) / P_B

    return P_A1_given_B

# Calculate and print the probability
probability = calculate_probability()
print(f"The probability that it will rain on the day of Marie's wedding is: {probability:.4f}")
```

INPUT & OUTPUT:

```
P_A1 = 5 / 365
P_A2 = 1 - P_A1
P_B_given_A1 = 0.9
P_B_given_A2 = 0.1
```

```
PS D:\5th Semester\AI Lab\AI Code> & C:/Users/shrut/AppData/Local/Programs/Python/Py
es.py"
The probability that it will rain on the day of Marie's wedding is: 0.1111
PS D:\5th Semester\AI Lab\AI Code>
```

CONCLUSION: Thus, I successfully implement Bayes theorem for given data.

DISCUSSION QUESTIONS:

1. What is the correct formula for Bayes Theorem?
2. Which algorithm uses Bayes theorem?
3. When can we use Bayes theorem?
4. How is Bayes theorem used in real life?

REFERENCES:

· *https://byjus.com/maths/magic-square/*

· *https://www.geeksforgeeks.org/magic-square/* ·

https://mathworld.wolfram.com/MagicSquare.html