

A STUDY ON APPLICATION OF BAYES' THEOREM IN APPIN TECHNOLOGY

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ABSTRACT

Mathematics is the only word that conquers the whole world. Mathematics comprises each and every concept that exists in this world. Statistics and probability are the two main concepts that are dealing with the statistical survey of this world. Of these two concepts, Probability has one of the Main applications of dealing with mathematics that is very much useful in real life applications. In this paper, Bayes' Theorem and its applications are discussed deeply with its application problems using the data which was collected for the company named Appin Technology during the industrial exposure training. This application helped me to give some useful ideas to the company to improve their production level.

1. INTRODUCTION

Bayes' theorem or Bayes' law describes the probability of an event. An Essay towards solving problems in the Doctrine of Chances is generally a work on theory of probability and it was published in the year 1763. Bayes' plays an important role in medical field, industries and in some companies. I have used this theorem in Appin technology which is an IT based company located in Coimbatore. From this company I have collected some previous year data to give an effective conclusion to the company.

2. BAYES' THEOREM

2.1 Statement Of Bayes' Theorem

Let A_1, A_2, \dots, A_n be n mutually exclusive and exhaustive events. Let B be an independent event such that $B \subset \bigcup_{i=1}^n A_i$ is the conditional probability of B given that A_i has already occurred, then

$$P(A_i|B) = \frac{P(B|A_i) P(A_i)}{\sum_{i=1}^n P(B|A_i)P(A_i)}$$

3. PROBLEM USING BAYES' THEOREM

3.1 Question

Consider an application development in a company for past two years. Applications in the company are basically classified into five categories as educational application, entertainment application, purchasing application.

In the year of **2016** company developed **20** educational applications, **14** entertainment applications and **4** purchasing applications.

In the year of **2017** company developed **18** educational applications, **17** entertainment applications and **9** purchasing applications.

There is equal probability in selecting application from the company for past two years.

Choose any application at random, what is the probability of the chosen application and that the application is chosen from the year 2017?

NOTE: To find the probability for all categories of application and to concentrate in the particular category which has least probability for best production of the company.

3.1.1 Solution

Steps for finding solution using Bayes’ theorem

STEP 1: Find the normal distribution from the given data

STEP 2: Calculate the conditional probability for the given data

STEP 3: Finally use the Bayes’ theorem to generate the solution

S.NO	YEAR		2016	2017
	APPLICATIONS			
1	Educational application		20	18
2	Entertainment application		14	17
5	Purchasing application		4	9

3.1.2 Given

Let A be application developed in the year 2016 and P(A) be the probability for the year 2016.
Let B be the application developed in the year 2017 and P(B) be the probability for the year 2017.

3.1.3 Steps

STEP 1: NORMAL DISTRIBUTION

First to find the normal distribution for both years (2016 and 2017)

Normal distribution for the year 2016 is

$$P(A) = \frac{\text{year 2016}}{\text{number of years}} = 1/2$$

Normal distribution for the year 2017 is

$$P(B) = \frac{\text{year 2017}}{\text{number of years}} = 1/2$$

STEP 2: CONDITIONAL PROBABILITY

EDUCATIONAL APPLICATION:

Let E be the educational application and P(E) be the probability for educational application
To find the probability of choosing the educational application in the year 2016.

$$P(E|A) = \frac{\text{Totalnumberofeducationalapplication}}{\text{Totalnumberofapplicationsintheyear 2016}} = 20/56$$

To find the probability of choosing the educational application in the year 2017

$$P(E|B) = \frac{\text{Totalnumberofeducationalapplication}}{\text{Totalnumberofapplicationsintheyear 2017}} = 18/64$$

ENTERTAINMENT APPLICATION:

Let D be the gaming application and P(D) be the probability for entertainment application
To find the probability of choosing the entertainment application in the year 2016.

$$P(D|A) = \frac{\text{Totalnumberofentertainmentapplication}}{\text{Totalnumberofapplicationsintheyear 2016}} = 14/56$$

To find the probability of choosing the entertainment application in the year 2017

$$P(D|B) = \frac{\text{Totalnumberofentertainmentapplication}}{\text{Totalnumberofapplicationsintheyear 2017}} = 17/64$$

PURCHASING APPLICATION:

Let F be the purchasing application and P(F) be the probability for purchasing application
To find the probability of choosing the purchasing application in the year 2016.

$$P(F|A) = \frac{\text{Totalnumberofpurchasingapplication}}{\text{Totalnumberofapplicationsintheyear 2016}} = 4/56$$

To find the probability of choosing the purchasing application in the year 2017

$$P(F|B) = \frac{\text{Totalnumberofpurchasingapplication}}{\text{Totalnumberofapplicationsintheyear 2017}} = 9/64$$

STEP 3: BAYES' THEOREM

EDUCATIONAL APPLICATION:

To find the probability for an educational application in the year 2017 i.e. P(B/E)

$$\begin{aligned}
 P(B|E) &= \frac{P(E|B) \cdot P(B)}{P(E|B) \cdot P(B) + P(E|A) \cdot P(A)} \\
 &= \frac{(18/64 \times 1/2)}{(18/64 \times 1/2) + (20/56 \times 1/2)} \\
 &= \frac{63}{143}
 \end{aligned}$$

Thus, the probability for an educational application in the year 2017 is 63/143

ENTERTAINMENT APPLICATION:

To find the probability for an entertainment application in the year 2017 i.e. P(B/D)

$$\begin{aligned}
 P(B|D) &= \frac{P(D|B) \cdot P(B)}{P(D|B) \cdot P(B) + P(D|A) \cdot P(A)} \\
 &= \frac{(17/64 \times 1/2)}{(17/64 \times 1/2) + (14/56 \times 1/2)} \\
 &= \frac{17}{33}
 \end{aligned}$$

Thus, the probability for an entertainment application in the year 2017 is 17/33

PURCHASING APPLICATION:

To find the probability for the purchasing application in the year 2017 i.e. P(B/F)

$$\begin{aligned}
 P(B|F) &= \frac{P(F|B) \cdot P(B)}{P(F|B) \cdot P(B) + P(F|A) \cdot P(A)} \\
 &= \frac{(9/64 \times 1/2)}{(9/64 \times 1/2) + (4/56 \times 1/2)} \\
 &= \frac{54}{95}
 \end{aligned}$$

Thus, the probability for the purchasing application in the year 2017 is 54/95

4. CONCLUSION

In the year 2017, purchasing application has the highest probability of 54/95 and educational application has the lowest probability of 63/143

By concentrating in educational application (lowest probability), the company will achieve the best production when compared to previous years.

Thus through this project I came to know that the Bayes' theorem is one the easiest method to find solution and helps to conclude the result for forthcoming years and prepare accordingly. This is also useful to compare the outcomes of a company between two year.

The problem which I have worked is purely based on IT field where different applications are developed in different fields.

Future work of Bayes' theorem is that the applications can be extended to some other field where there are any difficulties to predict the result. For example, we can try to apply Bayes' theorem in medical field to find the result in the diagnoses of deadly diseases.

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