📝NAÏVE BAYES CLASSIFIER ALGORITHM

* It is supervised learning algorithm, which is based on the bayes theorem and used for solving classification problems.
* It is mainly used in text classification that includes a high-dimensional training dataset.
* It is one of the simple and most effective classification algorithms which helps in the building the fast machine learning models that can make quick predictions.
* It is a probabilistic classified, which means it predicts based on the probability of an object.
* Some popular examples of naïve bayes algorithms are spam filtration, sentimental analysis, and classifying articles.

⚠️WHY IT IS CALLED NAÏVE

NAÏVE: it is called naïve because it assumes that the occurrence of certain feature is independent of the occurrence of other features. Such as if the fruits is identified on the bases of colour, shape, and taste, then the red, spherical, and sweet fruit is recognized as an apple. Hence each feature individually contributes to identify that it is an apple without depending on each other.

BAYES: it is called bayes because it depends on the principle of bayes theorem.

✍️BAYES THEOREM:

Bayes theorem is also known as bayes rule, bayes law, or Bayesian reasoning, which determines the probability of an event with uncertain knowledge.

Bayes theorem was named after the British mathematician Thomas Bayes. The Bayesian inference is an application of bayes theorem which is fundamental to Bayesian statistics.

It is a way to calculate the value of p(B|A) with knowledge of p(A|B).

Bayes theorem allows updating the probability prediction of an event by observing new information of the real world.

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👉Example: if the cancer corresponds to one age, then by using bayes theorem, we can determine the probability of cancer more accurately with the help of age.

Bayes theorem can be derived using product rule and conditional probability of event A with known event B:

As from product rule we can write:

P(A^B) =P(A|B) P(B) or

Similarly, the probability of an event B with known event A:

P(A^B) =P(B|A) P(A)

P(A|B) = ………………………(a)

The above equation (a) is called as Bayes rule or Bayes theorem. This equation is basic of most modern AI system for probabilistic inference.

P(A|B) ---> is called posterior which we need to calculate, and it will be read as probability of the hypothesis A when we have occurred an evidence B.

P(B|A) ---> is called likelihood, in which we consider that hypothesis is true, then we calculate the probability of the evidence.

P(A) ---> is called prior probability, probability of hypothesis before considering the evidence.

P(B) ---> is called marginal probability, pure probability of an evidence.

📝WORKING OF NAÏVE BAYES’ CLASSIFIER

EXAMPLE:

Problem: If the weather is sunny, then the player should play or not?

Solution: To solve this, first consider below dataset:

|  |  |  |
| --- | --- | --- |
| S.NO | Outlook | Play |
| 0 | Rainy | Yes |
| 1 | Sunny | Yes |
| 2 | Overcast | Yes |
| 3 | Overcast | Yes |
| 4 | Sunny | No |
| 5 | Rainy | Yes |
| 6 | Sunny | Yes |
| 7 | Overcast | Yes |
| 8 | Rainy | No |
| 9 | Sunny | No |
| 10 | Sunny | Yes |
| 11 | Rainy | No |
| 12 | Overcast | Yes |
| 13 | Overcast | Yes |
|  |  |  |

👉Frequency table for the weather conditions:

|  |  |  |
| --- | --- | --- |
| Weather | Yes | No |
| Overcast | 5 | 0 |
| Runny | 2 | 2 |
| Sunny | 3 | 2 |
| Total | 10 | 4 |

👉Likelihood table weather condition:

|  |  |  |  |
| --- | --- | --- | --- |
| Weather | Yes | No |  |
| Overcast | 5 | 0 | 5/14 = 0.35 |
| Runny | 2 | 2 | 4/14 = 0.29 |
| Sunny | 3 | 2 | 5/14 = 0.35 |
| All | 10/14 = 0.71 | 4/14 = 0.29 |  |

👉Applying bayes theorem

P(Yes|Sunny) = 3/10 = 0.3

P(Sunny) = 0.35

P(Yes) = 0.71

P(Yes|Sunny) = (P(Sunny|Yes) \* P(Yes))/P(Sunny)

= (0.3\*0.71)/0.35

= 0.60

P(Sunny|No) = 2/4 = 0.5

P(No) = 0.29

P(Sunny) = 0.35

P(No|Sunny) = (P(Sunny|No) \* P(N0))/P(Sunny)

= (0.5\*0.29)/0.35

= 0.41

So, as we see from the above calculation that P(Yes|Sunny) > P(No|Sunny).

Hence, on Sunny day, player can play the game.

✍️GENERAL FORMULA

P(Y|X1, X2, …, Xn) = (P(X1|Y)\* P(X2|Y)\*… P(Xn|Y))/( P(X1)\* P(X2)\*… P(Xn))