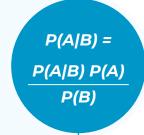
# Solving classification problems with naïve bayes



#### How does naïve bayes algorithm work?



- Naive Bayes classifier algorithm is based on a famous theorem called "Bayes theorem".
- It can help us find simple yet powerful solutions to many problems ranging from **text analysis** to **spam detection** and much more.

# Probability to describe how likely an event is to happen



A value between 0 and 1 represents the possibility of an event happening

0

Less likely to happen

1

Most likely to happen

# Bayes theorem is centered on conditional probability



#### What is conditional probability?

Conditional probability is the probability of an event 'A' happening given that another event 'B' has already happened.

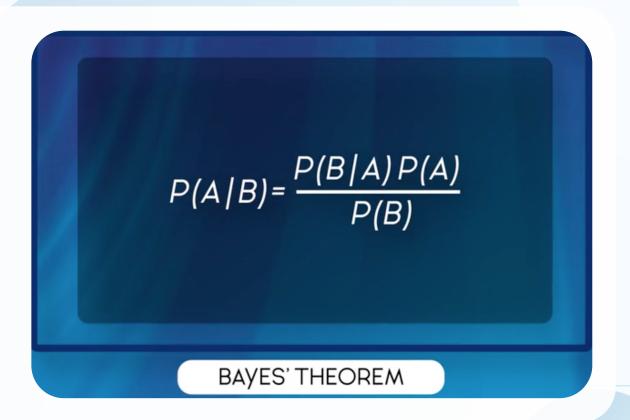
The Bayes theorem is an extension of conditional probability. It allows us in a sense to use reverse reasoning.

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$$
CONDITIONAL PROBABILITY

### **Understanding the Bayes theorem formula**



- Prior probability P(A) –
  The probability of just 'A' occurring
  - Posterior probability P(A|B) -
- The probability of event 'A' given that event 'B' occurs
- P(B|A) The probability of event B
   happening given that event A has occurred
- **P(B)** The probability of just B



### What makes Naïve bayes algorithm naïve?



When the model calculates the conditional probability of one feature given a class,



...it doesn't take into account the effect of any other feature.



...it assumes that features are independent from each other.



...it gives us the flexibility to describe the probability of each feature.

# The algorithm's naivety has some advantages & limitations





#### **Advantages**

- Quick & simple
- Produce good results with small amount of training data
- Used for benchmarking of a model
- Works well with continuous data by discretizing



#### **Disadvantages**

 In most real-world situations some of the features are likely to be dependent on each other, which might cause wrong results.

## Three types of naïve bayes classifiers in sklearn



#### Bernoulli

Used when data is binary like true or false, yes or no etc.

### Multinomial Naïve Bayes

Used when there are discrete values such as number of family members or pages in a book.

### Gaussian Naïve Bayes

Used when all features are continuous variables, like temperature or height.