

# Weekly Report 2- Naive Bayes

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## Introduction

Naive Bayes is a supervised learning algorithm which predicts the most probable class. It is very useful in text classification. Some of the applications include spam filtration, sentiment analysis, etc.

## Why the name Naive Bayes?

It is called Bayes because it estimates the bayesian probability of a class. Let us assume a data point  $x$  has  $n$  features  $A_1, A_2, \dots A_n$ . The posterior probability  $P(C|A_1, A_2, \dots A_n)$  where  $C$  denotes class is given by bayes theorem:

$$P(C|A_1, A_2, \dots A_n) = \frac{P(A_1, A_2, \dots A_n|C)P(C)}{P(A_1, A_2, \dots A_n)} \quad (1)$$

It is naive because we assume independence of features  $A_i$  when class is given. This gives likelihood  $P(A_1, A_2, \dots A_n|C) = P(A_1|C)P(A_2|C) \dots P(A_n|C)$ .

## Algorithm

From the above theorem, we know that we should choose a class which maximises posterior probability i.e  $P(C|A_1, A_2, \dots A_n)$ .

Since  $P(A_1, A_2, \dots A_n)$  is same for all values of  $C$ , we can omit the marginal probability.

$$\hat{C} = \arg \max_C (P(A_1|C)P(A_2|C) \dots P(A_n|C))P(C) \quad (2)$$

This is called Maximum A Posteriori estimation.