

Naive Bayes

Naive Bayes is a classifier that uses the Bayes Theorem

Bayes Theorem

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Algorithm

Consider you have a bunch of features $X = \{x_1, x_2, \dots, x_n\}$ and label y , the Bayes Theorem states

$$P(y|X) = \frac{P(X|y)P(y)}{P(X)}$$

This can be made into something nice if only all the features were independent, that is the assumption of Naive Bayes, it is also the reason why nobody really uses naive bayes. In general you would have features that have some correlation with other features. Anyways, following the assumption we get

$$P(y|(x_1, x_2, \dots, x_n)) = \frac{P(x_1|y)P(x_2|y)\dots P(x_n|y)P(y)}{P(x_1)P(x_2)\dots P(x_n)}$$

Given some training data, you can calculate all the things on the right.

Gaussian Naive Bayes

This is naive bayes with just some features being continuous instead of categorical or ordinal. You assume that the feature has a latent gaussian distribution and calculate variance and mean from the data.

Questions

1. Give some examples where naive bayes could be useful
2. define posterior probability
3. Define prior probability
4. is Naive bayes discriminative or generative?

Answers

1. It can be used for text classification, but it would be an inferior model anywhere.
2. $P(A|B)$ (the thing we are trying to model)
3. $P(A)$ (the thing we already know)
4. Generative, it doesn't make boundaries