

# Bayes Stats and Naive Bayes Classifier

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What is the difference between Bayes and Frequentist reasoning?

I have misplaced my phone somewhere in the home. I can use the phone locator on the base of the instrument to locate the phone and when I press the phone locator the phone starts beeping.

Problem: Which area of my home should I search?

**Frequentist approach:**

I can hear the phone beeping. I also have a mental model which helps me identify the area from which the sound is coming. Therefore, upon hearing the beep, I infer the area of my home I must search to locate the phone.

**Bayesian approach:**

I can hear the phone beeping. Now, apart from a mental model which helps me identify the area from which the sound is coming from, I also know the locations where I have misplaced the phone in the past. So, I combine my inferences using the beeps and my prior information about the locations I have misplaced the phone in the past to identify an area I must search to locate the phone.

## Frequentist vs. Bayesian

**Frequentists** believe the "true" distribution is fixed (and not known). We can infer more more about this "true" distribution by engaging in sampling, testing for effects, and studying relevant parameters of the population.

**Bayesians** believe that data informs us about the distribution, and as we receive more data our view of the distribution can be updated, further confirming or denying our previous beliefs (but never in certainty).

Bayes Theorem  $\Rightarrow$  Bayes Rule

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

# Bayes Rule broken down...

## Likelihood

How probable is the evidence  
given that our hypothesis is true?

## Prior

How probable was our hypothesis  
before observing the evidence?

$$P(H | e) = \frac{P(e | H) P(H)}{P(e)}$$

## Posterior

How probable is our hypothesis  
given the observed evidence?  
(Not directly computable)

## Marginal

How probable is the new evidence  
under all possible hypotheses?  
 $P(e) = \sum P(e | H_i) P(H_i)$

What is the Naive Bayes Classifier?

# Quick video to introduce Naive Bayes Classifier

<https://www.youtube.com/watch?v=IIVINQDk4o8>



# Takeaways from the video...

Soon to be updated...

# Naive Bayes in ML...

**GREAT SOURCE** that sums up Naive Bayes in ML and uses a python code example:

<https://www.analyticsvidhya.com/blog/2015/09/naive-bayes-explained/>

- Supervised learning
- Classification Model
- Based on Bayes Theorem
- Good as a first-cut, quick and simple model
- Based on a naive assumption