

02-680 Module 19

Essentials of Mathematics and Statistics

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Maximum a Posteriori Estimation

Frequentist vs. Bayesian Schools

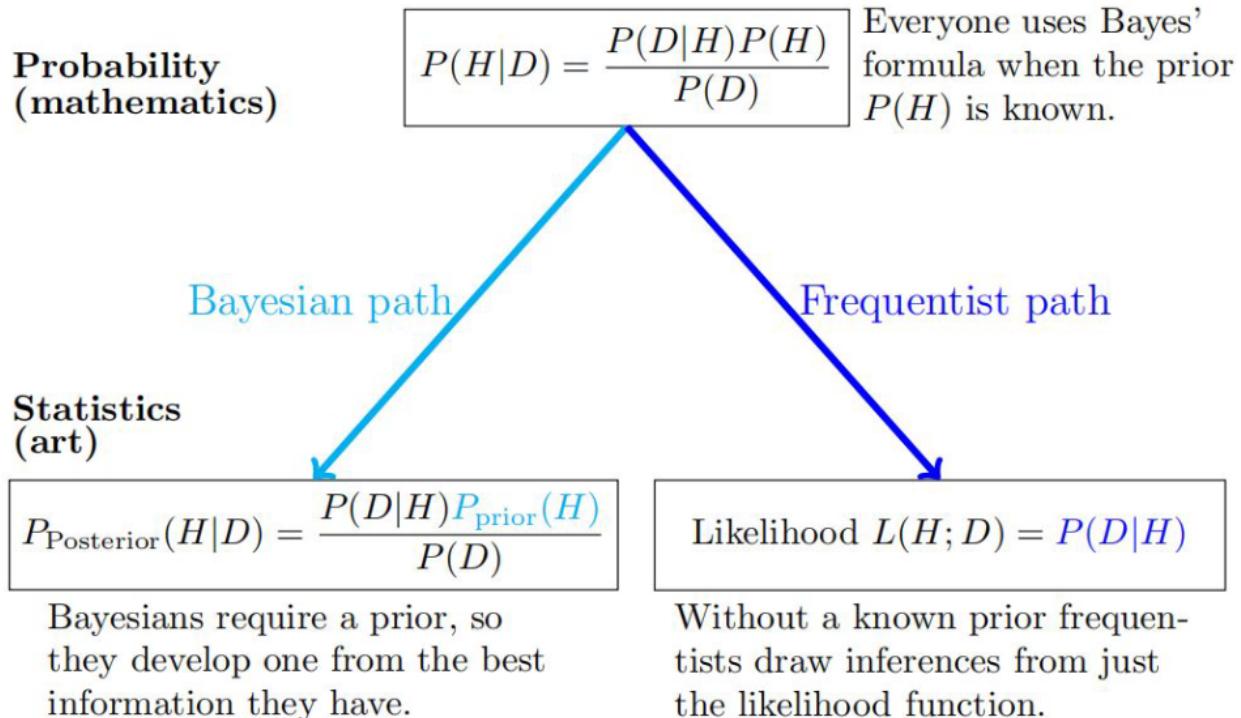
The **Frequentist School** assumes that H is fixed and not random. It uses likelihood only:

$$L(H|D) = p(D|H)$$

Probabilities reflect long-run frequencies. Relies only on observed data.

The **Bayesian School** takes H to be a hypothesis (parameter) and D some data. Different people will have different a priori beliefs, but we would still like to make useful inferences from the data.

When $p(H)$ is known, there is no disagreement, we will all just follow Bayes' Rule as written.



In practice, there is no universally-accepted prior. The main philosophical difference concerns the **meaning of probability**.

- The Frequentist school represents the idea that *probabilities represent long-term frequencies of repeatable random experiments*

- **Objective interpretation**
- Example: ‘A coin has 0.5 probability of tails’ means that the relative frequency of tails goes to 0.5 as the number of flips goes to infinity.
- The Bayesian school represents the idea that *probability is an abstract concept that measures a state of knowledge or a degree of belief in a given population*
 - **Subjective interpretation**
 - Example: ‘A coin has 0.5 probability of tails’ means you "believe" that you will get tails 50% of the time.
 - That is, they consider a range of values each with its own probability of being true.