Bayesian Data Analysis Session 1

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Overview

Session 1: Edwin

What is Bayesian statistics? Theory and simple examples.

Session 2: Rick

Building hierarchical models with Stan.

Introduction

Intuition of Bayesian Statistics

Statistics describes the world in probality distributions.

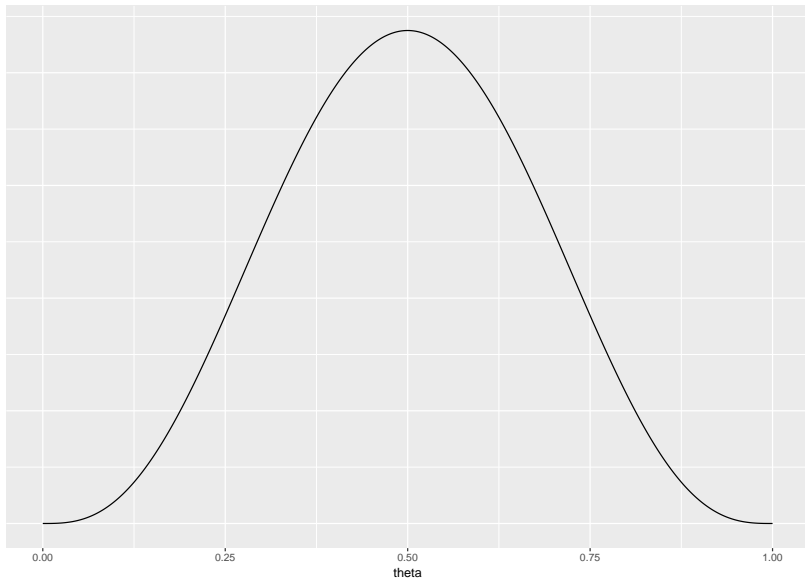Collect data to learn about the distributions: $\hat{\theta}$

Reverse engineering of parameters producing the data.
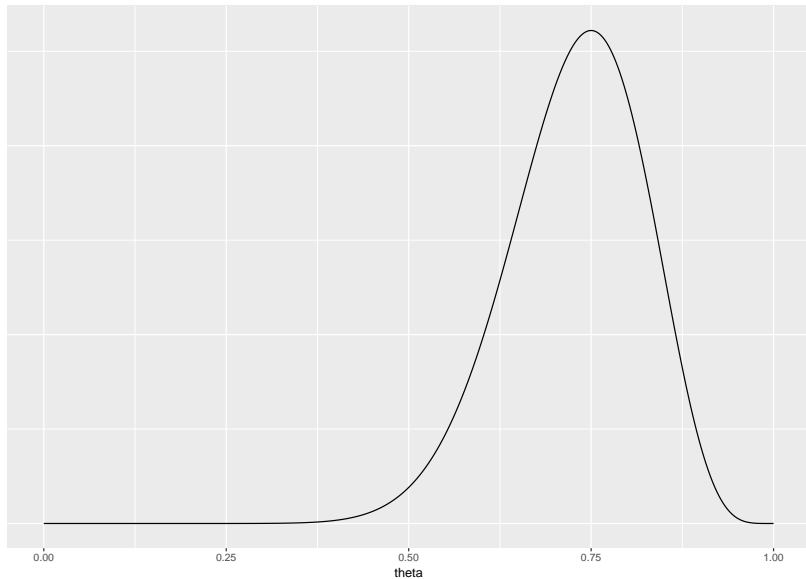
How do we deal with uncertainty?

A Bayesian:

- Sets a probabilty distribution on all θ.
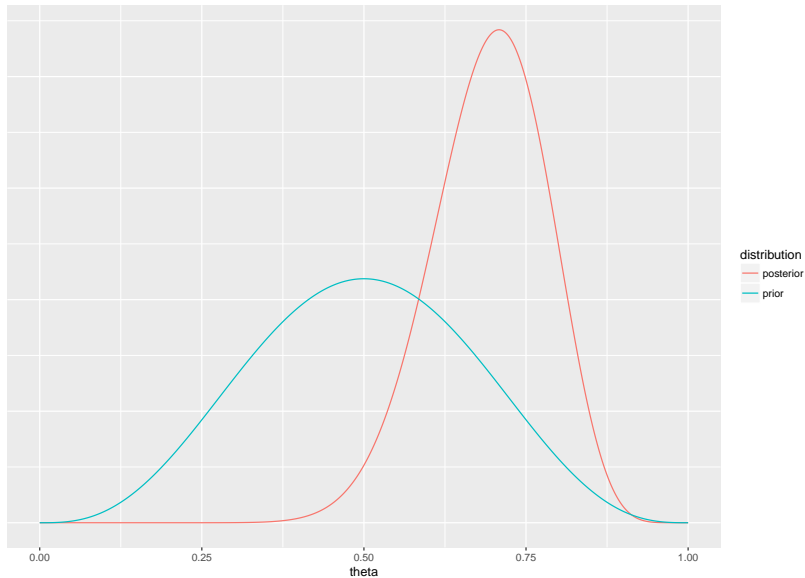- Updates his beliefs with data.

Set a prior: $P(\theta)$

Get the likelihood function: $P(D|\theta)$

Update prior to posterior with likelihood: $P(\theta|D)$

Likelihood not in this plot, on different scale (why?).

Bayesian data analysis

The essence of BDA is **credibility (re)allocation**.

We have an a priori idea about θ:

- expert opinion
- previous research
- educated guess

Data provides evidence of the parameter value.

The posterior is a compromise between prior and likelihood. It reflects the current knowledge.

Bayesian vs frequentist

- Frequentist only consider the likelihood.
- Frequentits have an objective view of probability. For Bayesians it is a subjective best guess.
- Frequentists: data random, parameters fixed. Bayesians: data fixed, parameters random.

Why do we want BDA in the first place?

- ► Elegant and intuitive paradigm.
- ► Incorparation of previous knowledge and allowing for updating.
- ► Describe complex relationships without huge amounts of data.