Excellent health statistics - smokers are less likely to die of age related illnesses.'

statistics (def.):

(1) a branch of mathematics dealing with the collection, analysis, interpretation, and presentation of masses of numerical data,

(2) the only science in which two recognized experts, using exactly the same set of data, may come to completely opposite conclusions.

Course introduction

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Why Bayesian?

- Computationally intensive but conceptually simple.
- More flexible modelling.
- Straightforward decision-making, less prone to misinterpretation.
- Very important in machine learning, growing presence in other fields.

Course objectives

Main: To apply Bayesian statistics in practice.

- Learn about the Bayesian view on probability and inference.
- Start using tools for Bayesian statistics.
- Understand the principles of Markov Chain Monte Carlo and their implications for Bayesian computation.

Illustrative examples

Course information

Prerequisites: Basic probability theory, basic statistics, R programming.

Organization: 8 lectures + 2 hands-on sessions.

Requirements:

- Take-home exercise (after first 4 lectures),
- Final project (deadline: before end of the school year).

Materials:

- All slides will be made available,
- including all code and data to reproduce what you see on the slides.
- Further reading references will be included at end of each lecture.

The tools that you will see me use

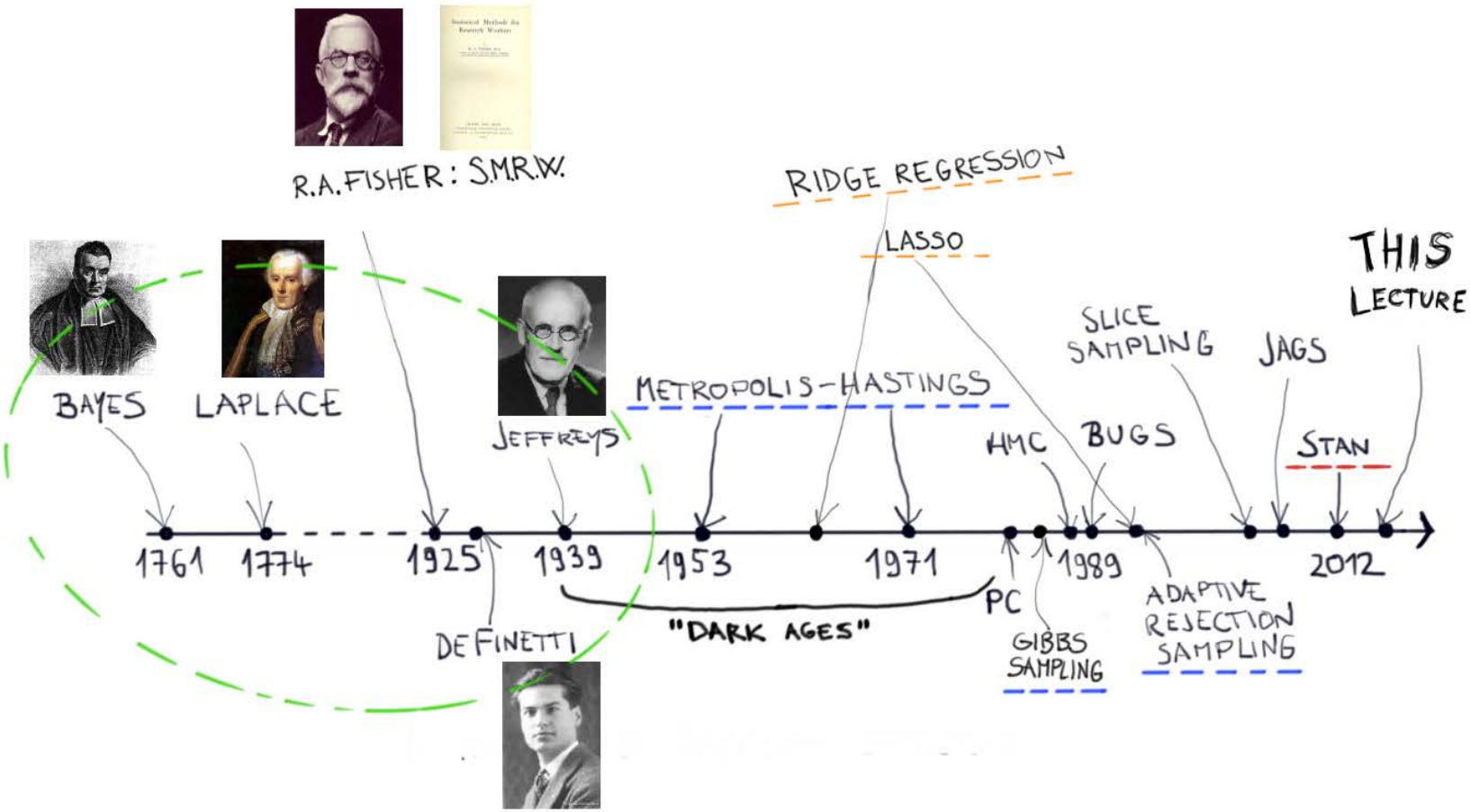
Software:

- **R** + **RStudio**,
- **ggplot2** package for visualization,
- **Stan** for Bayesian inference.

Reporting:

- **LaTeX** + **Texmaker**,
- **RStudio** + dynamic reports (**sweave**, **R markdown**, **R notebooks**).

The Bayesian statistics timeline



Lectures outline

1. **Probabilistic thinking**
2. Principles of Bayesian inference
3. Probabilistic programming with Stan
4. Estimation, group comparison and linear regression

——————— break ———————

5. A gentle introduction to Markov Chain Monte Carlo
6. Hands-on session 1
7. Hierarchical modelling
8. Hands-on session 2 & Where to go from here