

**Scientific Method
The Logic of Science**

Logics

Probability theory
Information theory

Scientific handling of data

predicting data

estimating parameters
fitting data
precision of parameters

comparing models

Sampling distribution
 $\text{prob}(\text{Data}|\text{Parameters,Model})$

odds ratios
information measures

Bayes Theorem

$$\text{prob}(\text{Parameters} | \text{Data, Model}) = \frac{\text{prob}(\text{Parameters} | \text{Model})\text{prob}(\text{Data} | \text{Parameters, Model})}{\text{prob}(\text{Data} | \text{Model})}$$

Principle of indifference

Prior knowledge about parameters?
 $\text{prob}(\text{Parameters}|\text{Model})$

Bayesian updating

Gaussian likelihood

Which likelihood?
 $\text{prob}(\text{Data}|\text{Parameters,Model})$

Non-gaussian likelihood

Gaussian error analysis

Maximum likelihood method

Maximum posterior method

linear data fitting

non-linear data fitting

error propagation

errors known?

Minimization of χ^2

method of least mean squares

Linear regression

Nonlinear regression

mean values
variance
standard error

