

Physics Teams: Bayesian – Frequentist

Kind of Physics Problems

- Bayesian-Frequentist: Two approaches to Parameter Determination and Hypothesis Tests

What did people contribute

- Search for papers, lecture notes -> present found papers, discussion about collection and selection; reading, discussing and summarizing selected material
- Discussion of simple examples: Parameter Determination (measure lifetime) and hypothesis test

References

Feldman, Cousins: A Unified Approach to the Classical Statistical Analysis of Small Signals

Louis Lyons: BAYES AND FREQUENTISM: A PARTICLE PHYSICIST'S PERSPECTIVE

Lecture Stephanie Hansmann-Menzemer: Modern Methods of Data Analysis

A.L. Read, Modified frequentist analysis of search results

Properties and differences Bayesian – Frequentist

- definition of probability and Bayes theorem
- prior, posterior probability and likelihood function

Example: Parameter Determination (measure lifetime)

- Probability density: $p(t|\tau) = 1/\tau e^{-t/\tau}$
- Bayesian
 - choose several priors in order to investigate sensitivity
 - determine posterior
- Frequentist
 - Neyman construction

Example: Hypothesis Tests: Background vs Signal + Background

- Bayesian:
 - compare posterior probabilities
 - Bayes factor
- Frequentist:
 - p-value
 - likelihood ratio

How did you benefit? What did you like?

- better understanding of CLs, profile likelihood
- theory behind fitting procedures
- interpretation of results

Possible follow-up topics for other students?

- correct treatment of systematics for more difficult problems
- coverage (with simulation)
- confidence levels more intensively
- analyse typical fit method, e.g. maximum likelihood. What is exactly done?
- toys with different priors; differences in results for the two methods