WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER

The Bayesian Approach to Inverse Problems: Overview

Invited Talks at the University of Cambridge, UK

Preamble

- This is no commercial for the Bayesian approach to inverse problems.

- The term "*Bayesian*" is en vogue and used all too frequently.

- Especially it is often used to reformulate well established methods.

- This provokes (justified) resistance and reservation.

- Motivation of this talk: Counteract some common objections and highlight some interesting features of the Bayesian approach.

wissen.leben
WWU Münster

Overview

Three talks on the Bayesian approach to inverse problems.

Talk 1: "*Theoretical Aspects*".

Talk 2: "*Computational Aspects*".

Talk 3: "*Hierarchical Bayesian Approaches to EEG/MEG Source Reconstruction*".

wissen.leben
WWU Münster

Overview

Three talks on the Bayesian approach to inverse problems.

Talk 1: "*Theoretical Aspects*".

► Deterministic, statistical and Bayesian perspective on inverse problems.
► Basic principles and concepts of Bayesian inference and modeling applied to inverse problems;
► Connections to variational regularization and ridge regression;
► Point estimates: Common myths and recent results;
► Advanced topics and some recent trends;
► What might be *real* benefits of Bayesian inference over other approaches?

Talk 2: "*Computational Aspects*".

Talk 3: "*Hierarchical Bayesian Approaches to EEG/MEG Source Reconstruction*".

wissen.leben
WWU Münster

Overview

Three talks on the Bayesian approach to inverse problems.

Talk 1: "*Theoretical Aspects*".

Talk 2: "*Computational Aspects*".
- ▶ Exemplary application: High-dimensional inverse problems using sparsity constraints;
- ▶ Basic principles and algorithms of Markov chain Monte Carlo (MCMC) based posterior inference;
- ▶ Iterative optimization and sampling;
- ▶ More advanced topics and some recent trends;

Talk 3: "*Hierarchical Bayesian Approaches to EEG/MEG Source Reconstruction*".

wissen.leben
WWU Münster

Felix Lucka (*felix.lucka@wwu.de*)

Overview

Three talks on the Bayesian approach to inverse problems.

Talk 1: "*Theoretical Aspects*".

Talk 2: "*Computational Aspects*".

Talk 3: "*Hierarchical Bayesian Approaches to EEG/MEG Source Reconstruction*".
- ▶ Indispensable tools for neuroimaging;
- ▶ Challenging, severely ill-posed inverse problem;
- ▶ Various demans from the application;
- ▶ Hierarchical Bayesian modeling (HBM) to address various uncertainties;
- ▶ Own results on fully-Bayesian inference for HBM;

wissen.leben
WWU Münster

Overview

Three talks on the Bayesian approach to inverse problems.

Talk 1: "*Theoretical Aspects*".

Talk 2: "*Computational Aspects*".

Talk 3: "*Hierarchical Bayesian Approaches to EEG/MEG Source Reconstruction*".

wissen.leben
WWU Münster