

Introduction to Bayesian Statistics and WinBUGS



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Tentative Outline:

Days 1 & 2 : Powerpoint presentation

1. Introduction to the Bayesian paradigm:
 - Philosophical arguments for the Bayesian approach, exemplified using statistical brain-teasers.
 - Practical arguments for the Bayesian approach.
 - Comparison with frequentist paradigm.
2. Obtaining the posterior distribution using Bayes theorem.
 - Simple example and quick demonstration in WinBUGS.
 - Bayesian inference including point and interval estimation, hypothesis “testing”.
 - Prediction.
 - An examination of examples from the fisheries literature, especially hierarchical models.
3. Prior distributions.
 - Reference/non-informative priors, vague priors.
 - Informative priors.
 - Sensitivity to the prior.
4. Implementation.
 - Markov chain Monte Carlo for sampling from the posterior. Metropolis-Hastings algorithm, Gibbs sampler.
 - The dangers of MCMC, and checking MCMC convergence.
5. Model diagnostics.
 - Model complexity (p_D), and model selection using DIC.
 - Model checking using posterior-predictive checks.

Day 3: Introduction to WinBUGS/OpenBUGs

Morning: Introduction to WinBUGS: Model syntax, compiling the model, initial values, updating, thinning, burn-in, monitoring. Evaluating model complexity and fit.

Afternoon: Practice with real data.

Day 4: Running WinBUGS from R

Morning: Using the BRugs package to run WinBUGS from R. Checking MCMC convergence and implementing posterior-predictive checks.

Afternoon: Practice with real data.

Day 5: Advanced topics and tricks

Morning: Truncated densities. The “ones trick” for implementation of non-standard priors or likelihoods. Time permitting, a brief introduction to Automatic Differentiation Model Builder (ADMB) for those models where WinBUGS won't work.

Afternoon: Practice/demonstrations with real data.