BAYESIAN STATISTICS FOR ECOLOGISTS

INTRODUCTION

IGB 18. TO 26. NOVEMBER 2019

INTRODUCTIONS ALL AROUND…

- Name
- What you do at IGB
- Why you're here

COURSE OBJECTIVES

- Understand fundamentals of Bayesian statistics
- Connect a question to a statistical model (i.e., likelihood and prior formulations) in math and in code
- Use and diagnose MCMC samplers for inference
- Code a variety of models (e.g., descriptive statistics, regressions, hierarchical models) in the language of your choice — we will use Stan and R
- Interpret and analyse results

PROJECTS

- Form small groups (1–4 people + a dataset)
- Over the course of the week, formulate a question and translate that question into a model
- Choose appropriate likelihood and priors
- Code and run model, interpret results
- ~10 minute presentations, to be given **Tuesday 26.11**

PROJECT PRESENTATIONS

- **Introduction:** main questions, background
- **Why Bayes**: What do we gain from using Bayesian statistics here?
- **Data**: introduce your dataset
- **Model**: present your model & priors
- **Issues**: did you have any trouble fitting the model?
- **Results**: present results with (if desired) diagnostics

TYPICAL DAY

9:00-10:30	Theory lecture
10:30-10:45	Coffee break
10:45-12:30	Practice
12:30–13:30	Lunch
13:30-15:00	Practical lecture
15:00-15:15	Break
15:15–17:30	Practice, project work

ROUGH SCHEDULE

Day	Lecture topics	Coding practice	Presentation work
Monday 18.	Intro Probability theory Bayes' Theorem Likelihood & optimisation	Probability exercises Single parameter estimation	Choose groups, decide on projects
Tuesday 19.	Maximum Likelihood Applied Bayesian methods MCMC	Write a likelihood function	Outline project Choose model structure Discuss likelihoods/priors
Wednesday 20.	Metropolis-Hastings Intro to Stan Multivariate models How to choose priors Metropolis within Gibbs GLMs	Univariate Metropolis sampler Metropolis within Gibbs Simple Stan models	Develop/code likelihood and priors for your model
Thursday 21.			Coding your model and working on presentation (on your own)
Friday 22.	Hierarchical Models	Advanced models in Stan	Working on projects
Monday 25.	Model evaluation, diagnostics Model comparison	Visualisation with bayesplot wAIC in Stan	Work on presentations
Tuesday 26	Additional topics (on demand)		Presentations