FGV EMAp
ESCOLA DE MATEMÁTICA APLICADA

**PROGRAMA DE VERÃO 2023 - 709**
**ESCOLA DE MATEMÁTICA APLICADA FGV EMAp**
**DISCIPLINA:** Computing for Bayesian Applied Modelling
**PROFESSOR:** Luiz Max Fagundes de Carvalho
**CARGA HORÁRIA:** 12h
**PRÉ-REQUISITO:**
**PERÍODO:** 23/01/23 a 17/02/23 (Quartas e quintas-feiras)
**HORÁRIO:** 14h20min às 16 h

# PLANO DE ENSINO

## 1. Ementa

The goal of this course to familiarise the student with key topics in improving computational performance and stability when fitting and interrogating Bayesian models.
Modern applications are quite complicated, with hundreds to thousands of parameters and sometimes millions of data points. The Bayesian approach has become quite popular amongst applied researchers, in part due to the ease of incorporating external information and expert domain knowledge into the analysis seamlessly. In all but the simplest situations, however, the problem of actually obtaining estimates is mathematically intractable and we thus need to resort to computational tools to approximate the integrals of interest.

In this course we will explore the interaction between model structure and computational issues. We will discuss some approaches for making models easier to compute and interpret.

Syllabus:
Modelling fundamentals: generative modelling, prior and posterior predictive checks; reparametrisation and the funnel of Hell; simulation-based calibration; parametrisation for regression models; Marginalisation and Rao-Blackwellisation. Iterative model building and checking. Computational aspects: numerical stability, vectorisation and exploiting multicore architectures.

Familiarity with Bayesian Statistics and Stan (https://mc-stan.org/) are a plus, but not required.

## 2. Procedimentos de avaliação

Não será aplicado avaliação durante o curso.

## 3. Bibliografia Obrigatória

Gelman, Andrew, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, and Donald B. Rubin. "Bayesian Data Analysis." (2013).
- Kruschke, John. "Doing Bayesian data analysis: A tutorial with R, JAGS, and Stan." (2014).
- Gelman, Andrew, Aki Vehtari, Daniel Simpson, Charles C. Margossian, Bob Carpenter, Yuling Yao, Lauren Kennedy, Jonah Gabry, Paul-Christian Bürkner, and Martin Modrák. "Bayesian workflow." arXiv preprint arXiv:2011.01808 (2020).
- McElreath, Richard. Statistical rethinking: A Bayesian course with examples in R and Stan. Chapman and Hall/CRC, 2020."

## 4. Mini Currículo

Graduado em Microbiologia e Imunologia pela Universidade Federal do Rio de Janeiro (2012) e PhD em Biologia Evolutiva pela University of Edinburgh, Reino Unido (2018). Atualmente é professor adjunto na Escola de Matemática Aplicada (EMAp) da Fundação Getúlio Vargas (FGV). Desenvolve pesquisa básica em métodos quantitativos em biociências, especialmente em Bioestatística. Tem interesse em Redes Complexas, Cadeias de Markov Monte Carlo, Filogenética Estatística e Análise espacial.