UNIVERSITÀ DI PAVIA
Department of Brain and Behavioral Sciences

2nd International Summer School

"Introduction to Bayesian Data Analysis with Stan"

Leonardo Egidi
University of Trieste

Gioia Di Credico
University of Trieste

Pavia, 30 September - 4 October 2019

Leonardo Egidi is a postdoctoral researcher at the Department of Business, Economics, Mathematics and Statistics (DEAMS) of the University of Trieste, professor of the course *Bayesian Statistics,* and teaching assistant of the course *Statistical Methods for Data Science* in the same university. He received his PhD in Statistics at the Department of Statistical Sciences of the University of Padova. His research mainly focuses on both theoretical and applied Bayesian statistics, with a particular attention to mixture models, robust priors, relabelling algorithms and hierarchical models for sports data, such as football and volleyball. He is an R packages developer and he also provides statistical consultancy to small firms, hospitals and medical departments. He has been elected in the board of the young section of the Italian Statistical Society (ySIS).

Gioia Di Credico is a postdoctoral researcher at the Department of Business, Economics, Mathematics and Statistics (DEAMS) of the University of Trieste, and teaching assistant of the course *Bayesian Statistics* in the same university. She received her PhD in Statistics at the Department of Statistical Science of the University of Padova. Her work mainly concentrates on the development and application of Bayesian statistical methods in epidemiology. It focuses on generalised linear models with splines, variable selection techniques and Bayesian hierarchical models.

Cascina Cravino

Aula Informatizzata.

University of Pavia

Via Bassi 21

27100 Pavia (Italy)

Registration Fees

Academic	€ 400,00
Student	€ 300,00
Non academic	€ 500,00

Deadline for sending application

13 September 2019

Secretary

Dr. Gianfranca Corbellini

dbbs.master@unipv.it

Dept. of Brain and Behavioral Sciences

Program

DAY 1: Foundations of Bayesian inference in theory and practice

• What is Bayesian inference?

• Generative models, prior, likelihood, posterior

• Advantages and disadvantages of Bayesian methods (comparisons with other approaches to inference)

• Bayesian data analysis workflow

• Introduction to computation with Markov Chain Monte Carlo (MCMC)

• Challenges of implementing MCMC in practice (i.e., why do we need Stan?)

• Introduction to Stan with simple examples

DAY 2: Bayesian applied regression models

• Bayesian perspective on linear and generalized linear models (GLMs)

• How to think about priors for GLMs

• Programming and fitting GLMs in Stan (using RStan, the R interface to Stan)

• Approaches to inference/prediction using GLMs

• Communicating results from regression models

DAY 3: Model checking, model comparison, and model selection/averaging

• Graphical and numerical model checking (posterior predictive checks)

• Comparing models based on different criteria

• Prediction vs explanation

• Model selection vs model averaging

DAY 4-5: Hierarchical/Multilevel modeling

• Theory of Bayesian hierarchical modeling, partial pooling

• Programming and fitting hierarchical models in Stan

• Understanding and diagnosing MCMC problems when fitting hierarchical models

• Using reparameterizations to solve computational problems when fitting hierarchical models

• If we have time we can cover more advanced topics like covariance with temporal and/or spatial structure

We will be using the **RStan interface** to Stan, which can be installed by following the instructions at https://github.com/stan-dev/rstan/wiki/RStan-Getting-Started