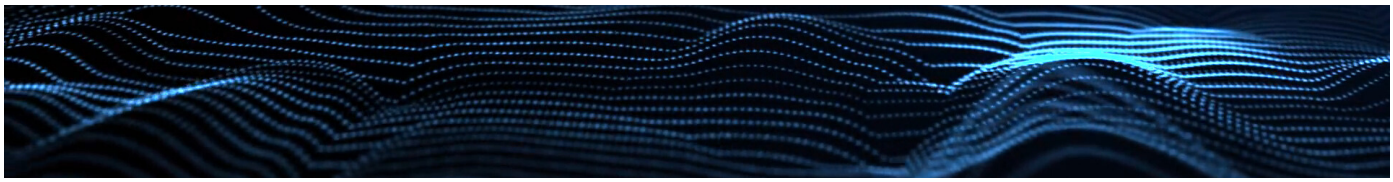
MLG MACHINE LEARNING GROUP

SEMINAR



HIERARCHICAL BAYESIAN MODELS FOR LONGITUDINAL DATA ANALYSIS

Hierarchical models (sometimes denoted as multilevel or random-effects models) can be thought of as regression models where a subset of parameters needs some kind of regularization. In these models, we try to avoid overfitting by incorporating prior structural knowledge.One common example where hierarchical models are very useful is when we need to estimate subject-specific or unit-level parameters.
The introduction of a population variance parameter produce shrinkage or partial pooling, which reduce the effective number of parameters.
In addition, the inference is robust to the presence of different amount of information per unit. The shape of the population distribution is learnt from the units with more data while the ones with less data will "borrow information or statistical strength" from the others.
Another example is found in data with temporal or spatial structure, where we have a strong prior of continuity, smoothness, or vicinity correlation. For example, penalized splines are commonly used for non-linear regression, the coefficients of spline basis functions can be mathematically modeled as random effects, which produce an automatic smoothing, i.e. the level of smoothing is lower with growing data.

In this talk I'll show a longitudinal (time series) analysis of blood pressure from elderly people to illustrate the benefits of hierarchical models. I'll argue that, when it's not computationally prohibitive, full posterior inference has many advantages over point estimates, Laplace approximations or variational inference. I'll briefly describe the main idea behind Hamiltonian Monte Carlo (HMC), a powerful Markov chain Monte Carlo sampling method, and why it revolutionized the field of Bayesian inference. Finally, I'll introduce the probabilistic programming language Stan, a very popular and highly efficient software that was used in this analysis and whose core inference engine is based on a particular implementation of HMC.

Scan me, I am a map !

WHEN

March 6th, 14.30

WHERE

Rotule Room, NO8.08
NO Building
Campus de la Plaine
Université Libre de Bruxelles

Dr Matías Bossa is a former researcher at the University of Zaragoza (Spain) and the Aragón Institute of Engineering Research. He obtained a M.Sc. in Physics from the Instituto Balseiro, Argentina, in 2002, modeling neutron propagation in the Galaxy. In 2011 he obtained his PhD in Biomedical Engineering by the University of Zaragoza working on brain morphometry using statistics on Lie groups. From 2003 to 2019, he belonged to the Medical Image Analysis Lab at the I3A, where he worked on computer vision, statistical machine learning, applied statistics and Bayesian analysis of biomedical data. He coauthored 10 papers in top journals and presented at many conferences in the areas of Computer Vision, Medical Imaging, Neuroscience, Computational Anatomy, Pattern Recognition and Particle Physics. He also has been assistant professor with the Electronics Engineering and Communications Department of the University of Zaragoza.