**Introduction to Bayesian inference and Modelling**

**Organisers**

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**Description**

UCL Social Data Institute (SODA) will be hosting a 5-day workshop. The aim is to introduce academics and professional data analysts to the basics of Stan for Bayesian inference in RStudio. The atmosphere of the workshop will be friendly and supportive, with the goal to teach the absolute basics of Bayesian inference in Stan for academics and professionals alike from diverse backgrounds ranging from industry to research fields such as population health, social sciences, disaster risk reduction, and many more.

**What is Stan?**

Stan is an interface for several statistical software packages (e.g., RStudio, Python, Julia, Stata, and MATLAB) which allows the user to perform state-of-the-art statistical modelling within a Bayesian framework. The focus of this workshop will be solely on Stan and RStudio. We will show you how one can develop and compile Stan scripts for Bayesian inference through RStudio to perform basic parameter estimation, as well as a wide range of regression-based techniques starting with the simplest univariable linear models and its different families to the more advanced multivariable spatial risk models.

**What will you learn?**

The workshop will cover the following topics:

* Introduction to Probability Distributions
* Introduction to Bayesian Inference
* Bayesian Generalised Linear Models
* Bayesian Hierarchical Regression Models
* Spatial Intrinsic Conditional Autoregression Models

By the end of the workshop, the participants should:

* Acquire the foundational and advanced knowledge on key principles of statistical modelling within a Bayesian framework;
* Be able to perform inferential statistics on spatial and non-spatial data to carryout hypothesis testing for evidence-based research using the diverse types of regression-based models from a Bayesian framework;
* Be able to perform spatial risk prediction for areal data as well as quantify levels of uncertainty using exceedance probabilities;
* Acquire new programming language skills such as Stan (interfaced with RStudio).

**Course structure**

The course will consist of 5 lectures and 5 computer seminar sessions supported with a live walkthrough demonstration. Here is the information on timetable and programme structure:

**Timetable:**

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| **Date** | **Topics** |
| 08/07/2024 | Introduction to Probability Distributions |
| 09/07/2024 | Introduction to Bayesian Inference |
| 10/07/2024 | Bayesian Generalised Linear Models |
| 11/07/2024 | Bayesian Hierarchical Regression Models |
| 11/07/2024 | Spatial Conditional Autoregression Models |

**Programme:**

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| **Times** | **Format** |
| 10:30am – 12:00pm (1.5h) | Lecture |
| 12:00pm – 01:00pm (1h) | Lunch Break |
| 01:00pm – 02:00pm (1h) | Live Demonstration Walkthrough |
| 02:00pm – 02:15pm (0h15mins) | Short Break |
| 02:15pm – 04:15pm (2h) | Computer Practical Seminar |
| 03:45pm – 04:00pm (0h15mins) | Summary |
| 04:00pm | Close |

**Prerequisite:** This course assumes participants have some basic working knowledge of RStudio, as well as a background in introductory-level statistics.