

THEORETICAL SESSIONS

PACKAGE 1: Basics of statistics (Oct 24th to 26th & Oct 31st to Nov 3rd – 18 hrs)

Session 1-1: Statistical inference I – Oct 24th - 9:30 to 12:30 – *ISC amphitheater*

- Motivations: population vs. sample, description vs. inference
- Basic things to know: statistical model, probabilities, distributions, parameters
- Maximum Likelihood Estimation (MLE)

Session 1-2: Statistical inference II – Oct 25th - 9:30 to 12:30 – *ISC amphitheater*

- Confidence intervals: computation & interpretation
- Significance testing: Fisher's procedure, interpretation of p-values
- The significant problems of p-values

Session 1-3: Good practices in statistics I – Oct 26th 14:00 to 17:00 - *ISC amphitheater*

- The replication crisis
- Improving reproducibility: version control, encapsulation, code sharing
- Statistical power: computation, consequences of low power

Session 1-4: Good practices in statistics II – Oct 31st - 9:30 to 12:30 - *ISC amphitheater*

- False positives: multiple comparison problem, questionable research practices
- Positive predictive value (PPV), base rate of true hypotheses
- Changing one's mindset: para-statistical thinking, exploratory research, pre-registration

Session 1-5: Linear models I – Nov 2nd - 14:00 to 17:00 – *ISC amphitheater*

- Causality vs. correlation
- Regressions & ANOVAs
- Model fitting: Ordinary Least Squares (OLS), assumptions, diagnostics

Session 1-6: Linear models II – Nov 3rd - 9:30 to 12:30 – *ISC amphitheater*

- Categorical predictors, interactions
- Contrast coding, significance testing, post-hoc tests
- Parametric & non-parametric tests

PACKAGE 2: Advanced statistics (Dec 5th to 7th and 12th to 14th – 18 hrs)

Session 2-1: Mixed linear models I – Dec 5th - 9:30 to 12:30 – *ISC amphitheater*

- Motivation & concepts: non-independence, fixed & random effects, variance-covariance matrices
- Model specification: syntax with lme4, practical exercise
- Analysis: diagnostics, hypothesis testing, reporting

Session 2-2: Mixed linear models II – Dec 6th - 9:30 to 12:30 – *ISC amphitheater*

- Generalized mixed models
- Debugging: interpreting and fixing warnings and errors in lme4
- Model selection, power analysis

Session 2-3: Predictive statistics – Dec 7th - 14:00 to 17:00 – *ISC amphitheater*

- Motivation & concepts: inference vs. prediction, generalizability vs. interpretability
- Criteria for model selection: goodness-of-fit, variance-bias tradeoff
- Prediction: loss functions, performance metrics, cross-validation

Session 2-4: Bayesian statistics I – Dec 12th - 9:30 to 12:30 – *NeuroCampus amphitheater*

- Motivations: frequentist vs. Bayesian paradigms
- Fundamentals: Bayes theorem, prior & posterior probabilities
- Bayesian statistical inference: point & interval estimates, conjugate distributions, MCMC sampling

Session 2-5: Bayesian statistics II – Dec. 13th - 9:30 to 12:30 – *NeuroCampus amphit.*

- Specifying the priors: Bayesian subjectivity, (non-)informative priors
- Hypothesis testing; posterior-based approach, Bayes factors
- R implementations: the ecosystem of Bayesian packages + a few simple code examples

Session 2-6: Bayesian statistics III – Dec. 14th - 14:00 to 17:00 – *NeuroCampus amphit.*

- Practical Bayesian modelling with rstanarm: specification, diagnostics, estimation, hypothesis testing
- Other common software: brms (R), JASP
- Going further: prior & posterior predictive checks, model sensitivity

PRACTICAL SESSIONS

"Learning R" workshop (Oct 25th 14:00 to 17:00 + Nov 7th 9:30 to 12:30 – 2x3 hours – *NeuroCampus room F28*)

- *This workshop will be divided in 2 sessions. It is a practical introduction to R, intended for those who have never or almost never programmed in R.*
- *In order to be efficient and make the most out of the few hours we have together, you will be given exercises to do at home and we will do the corrections together. So you also need to have a few hours free for that homework.*
- *Limited to 12 participants.*

"Data analysis" workshop (week of Dec 18th, exact date to be set with participants – 6h – *online*)

- *This workshop is aimed at students who are already familiar with R and actively using it to analyse a dataset.*
- *During the workshop will work on their own dataset under the guidance and assistance of the instructor.*
- *Limited to 6 participants.*