Course Overview

Workshops/Conferences

Practical Inference for Researchers in the Physical Sciences

by Francesca Capel (ODSL) , Johannes Buchner (PUC)

Monday 6 Sep 2021, 10:00 → Wednesday 15 Sep 2021, 16:00 Europe/Berlin

Description

Overview

The ORIGINS Data Science Laboratory is organising the next set of block courses from September 6th - 15th 2021 on the theme of **Practical Inference for Researchers in the Physical Sciences.**

The idea with the block course format is to have two weeks of more intense lectures and tutorial sessions. With this course, we want to focus on bridging the gap between learning about Bayesian probability theory and the actual application of these methods to realistic research problems. In this way, the course will be a mix of standard lectures as well as interactive coding exercises.

The courses and tutorials are organised by Johannes Buchner and Francesca Capel. All sessions will be held online via Zoom. Please register for the course using the link below and feel free to get in touch if you have any questions.

Course content

This session consists of two one-week courses.

Block I: Monte Carlo inference methods

September 6th - 8th 2021

In this block, we will refresh some of the basic concepts of Bayesian inference and introduce the algorithms and tools that can be used to implement analyses. The main lecturer is Johannes Buchner.

Topics covered:

- Refresher on Bayesian inference for parameter estimation and model comparison
- Parameter uncertainties, degeneracies and knowledge updates
- Modern Monte Carlo algorithms for Bayesian inference in practice:
  - Importance Sampling
  - Markov Chain Monte Carlo
  - Nested Sampling
- Modern probabilistic computation packages

Block II: Bayesian workflow

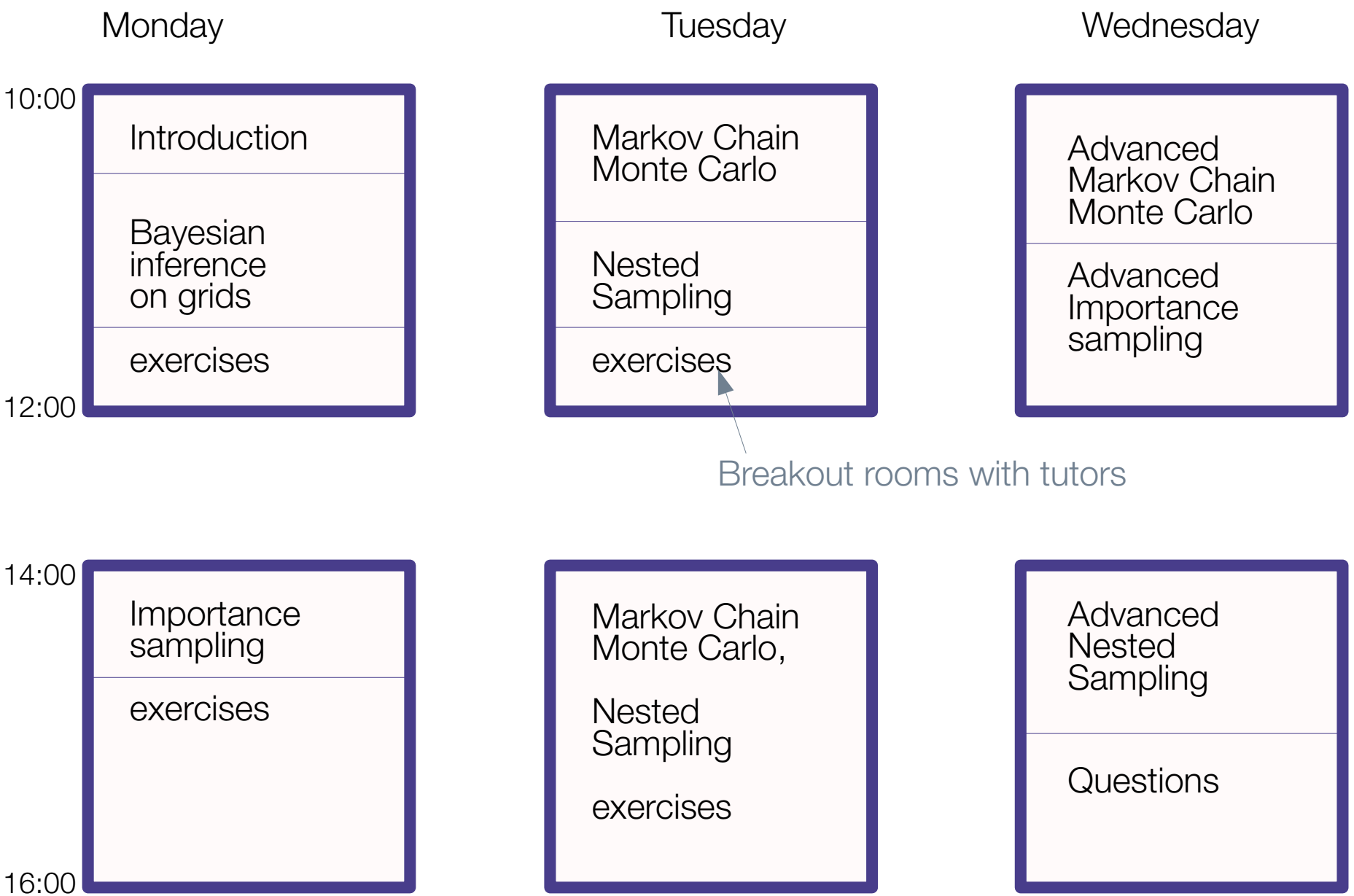
September 13th - 15th 2021

In this block, we will demonstrate how to apply the above methods to realistic problems and deal with common issues that may arise. The main lecturer is Francesca Capel.

Topics covered:

- Going from a science question to a statistical model
- Defining sensible priors for your problem
- Diagnosing problems in models and computation
- Verification of a statistical model through simulations
- Experiment design
- Model comparison

Structure


Monday
Tuesday
Wednesday
10:00
Introduction
Bayesian inference on grids
exercises
12:00
Markov Chain Monte Carlo
Nested Sampling
exercises
Advanced Markov Chain Monte Carlo
Advanced Importance sampling
Breakout rooms with tutors
14:00
Importance sampling
exercises
16:00
Markov Chain Monte Carlo,
Nested Sampling
exercises
Advanced Nested Sampling
Questions

Achievements

- Certificate 100+ points
- 3 ECTS (LMU) 300+ points
- 5 ECTS (TUM) 500+ points

need to be reached in each part

and course feedback form filled out

Points for this week

+200 – Big Homework

+300 – Homework (~5 homework)

+150 – Exercises (~10 exercises)

} to be submitted as a PDF report by Sep. 30th

+5 x 10 – active in discussions or tutorial (~10 such sessions)

+5 – find a mistake (send email)

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Grading

Based primarily on effort:

- Exercises:
  - explain your approach
  - visualisations
  - interpret results
  - Show what you have tried, what you researched/used on your own and what you have learned works/doesn't work
- Contributing to peer discussion
- Asking questions