

COMP64101: Reasoning and Learning under Uncertainty

Department of Computer Science,
The University of Manchester

Instructors



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Learning outcomes

- Describe the fundamental concepts of uncertainty quantification.
- Analyse the differences among statistical inference approaches.
- Explain the models and algorithms commonly used in probabilistic graphical models, state space models, Bayesian neural networks and Gaussian processes.
- Apply an advanced uncertainty quantification model to a data-driven application using tools such as Scikit-learn and PyTorch, and probabilistic programs such as NumPyro and Stan.

Content of the module

Week	Starting	Subject	Lecturer
1	Sept 23	Probability and Statistics (L)	Michele
2	Sept 30	Probability and Statistics (L/T, T, Lab)	Michele
3	Oct 7	Statistical inference (L)	Michele
4	Oct 14	Statistical inference (L/T, T, Lab)	Michele/Mauricio
5	Oct 21	Probabilistic graphical models (L)	Omar
7	Nov 4	Probabilistic graphical models (L/T, T, Lab)	Omar
8	Nov 11	Bayesian neural networks (L)	Omar
9	Nov 18	Bayesian neural networks (L/T, T, Lab)	Omar
10	Nov 25	Gaussian processes (L)	Mauricio
11	Dec 2	Gaussian processes (L/T, T, Lab)	Mauricio/Michele

L: Lecture; T: Tutorial

Materials available to you

- ❑ **Slides** accompanying the lectures, posted in Blackboard (BB).
- ❑ **Jupyter Notebook.** Each session will be accompanied by a Jupyter Notebook to illustrate practical aspects of the Lecture. Lab sessions will be based on these Notebooks.
- ❑ **Github repo for the module:** TBC
- ❑ **Exercise sheets.** Exercise sheets will be available every two weeks with solutions released a week after.
- ❑ **Podcasts.** The Lectures will be automatically recorded through the University podcast system and you will be able to access soon after the Lecture has ended.

How are the weeks organised?

□ **Week 1, 3, 5, 8, 10**

- **2-h Lecture** Tuesdays 13:00-15:00, Crawford House SEM RM E.

□ **Weeks 2, 4, 7, 9, 11**

- **1-h Lecture/Tutorial** Tuesdays 13:00-14:00, Nancy Rothwell 1A.027 MT.
- **1-h Tutorial** Fridays 13:00-14:00, Simon 4.05.
- **2-h Labs** Fridays 15:00-17:00, Kilburn 1.10.

- **Discussion board.** You can use the Discussion Board on BB to ask questions (managed by the instructors).

Assessment

- ❑ A coding assignment (50%)
 - To be released on Friday, Nov 22, 17:00.
 - Handle in Friday, Dec 13, 17:00.
- ❑ A written exam (50%), at some point between Jan and Feb, 2025. (TBA).
 - The exercise sheets contain typical exam questions. We strongly encourage you to work on the exercise sheets on a weekly basis rather than waiting until the Exam to look at the solutions for those exercises.