COM-421

Statistical neurosciences

Cursus	Sem.	Type
Computational Neurosciences minor	E	Opt.
Computer science	MA2	Opt.
Data Science	MA2	Opt.
Neuroscience		Opt.
SC master EPFL	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Remark

Pas donné en 2017-18

Summary

In neuroscience, new measurement techniques have permitted to acquire a wealth of experimental data, both scientific and commercial. This class introduces the student to a variety of statistical tools, tailored to the special case of neural data. Students will work with various real data sets.

Content

Examples of the latter include neuromarketing and the control of computer machinery via brain signals. This opens the door for large-scale statistical approaches. The class introduces the student to a variety of statistical tools , tailored to the special case of neural data. An integral part of the class is for the student to work with real data, choosing from a number of data sets and applying the techniques studied in class.

1. Tuning Curves and Receptive Fields (spatio-temporal and spectro-temporal) (5 weeks)
2. Statistical Models, Gaussian Process Factor Analysis (2 weeks)
3. Information-theoretic Techniques (3 weeks)
4. Network Science (2 weeks)

Keywords

Neuroscience, Statistics, Regression, Entropy, Information Theory, Information Measures, Graphical Models

Learning Prerequisites

Required courses

• The class assumes a basic understanding of probability: coin tossing and the standard Gaussian (normal) distribution.

• The class also assumes a basic understanding of linear algebra: vectors, matrices, eigenvalues, eigenvectors.

Learning Outcomes

By the end of the course, the student must be able to:

• Analyze neuroscience data

• Argue in a precise statistical way about neuroscience data

- Interpret neuroscience data
- Justify conclusions about neuroscience data

Teaching methods

Ex cathedra + exercises

Assessment methods

4 homework sets 20%, midterm exam 30% and Matlab project 50%

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

Here are two books that are related to the class. We do *not* require that you buy these books - but they are recommended reading. (There will be lecture notes for the class.)
1. P. Dayan and L. F. Abbott. *Theoretical Neuroscience*, MIT Press, Cambridge, MA, 2001.In this class, we cover Part I of the book; we will not touch upon Parts II and III.
2. D. Freedman, R. Pisani, and R. Purves. *Statistics*, W. W. Norton & Company, 2007 (4th edition).This is a general-purpose statistics book for all those who do not like excessive mathematical notation,with very good intuitive explanations of many statistical phenomena.

Ressources en bibliothèque

- Statistics / Freedman
- Theoretical Neuroscience / Dayan

Notes/Handbook

Lecture notes will be handed out in class and/or made available on Moodle.

Websites

- http://linx.epfl.ch
- http://linx.epfl.ch/page-70285-en.html

Moodle Link

- http://moodle.epfl.ch