

**Introduction to Neural data analysis (NEURL-UA 302-005)
Spring 2017**

This syllabus is subject to change. Changes will be announced in class and by email.

Description

This course will provide a probability-based introduction to statistics as relevant for neuroscience. We will pay special attention to the assumptions behind and relations between different techniques. We will emphasize the ability to look critically at data and plots of data. This course will be a good preparation for doing research in neuroscience. *Prerequisites:* Introduction to Neural Science (or permission from the lecturer), Calculus 1 or equivalent

Instructors

Lecturer: Prof. Wei Ji Ma, wm44@nyu.edu, Meyer 754, 212 992 6530
Teaching assistant: Gerick Lee, gml325@nyu.edu

Weekly schedule

Tue 10 AM - noon Lecture, Meyer 808
Wed by appointment Gerick's office hours, Meyer 1139
Thu 10 AM Homework due through NYU Classes. No extensions.
Thu 10 AM - noon Recitation, Meyer 808
Meet with Weiji by appointment

Questions

Weiji and Gerick will not answer content-related questions by email. Please ask your questions at an office hour or by appointment.

Materials

- There will be no textbook. Lecture notes will be provided.
- Please install Matlab on your laptop before the first recitation. To get it:
 - If you work in a lab that uses Matlab, you could ask them for a license.
 - Or follow the instructions on <http://localweb.cns.nyu.edu/unixadmin/#august10-2015>

Grading

The total grade will be calculated as follows:

Best 9 of 12 homework sets	50%
Midterm	20%
Final	20%

Participation	10%
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Letter grade

Your numerical grade will be turned into a letter grade according to the following scale: 90-100 A; 87-89 A-; 84-86 B+; 80-83 B; 77-79 B-; 74-76 C+; 70-73 C; 67-69 C-; 64-66 D+; 60-63 D; 57-59 D-; 0-56 F.

Homework

- There will be **twelve** homework sets. The lowest **three** homework grades will not be counted. You can drop homeworks for any reason, but no more than three will be allowed.
- Homework is due at **10 AM on the Thursday of recitation**, through NYU Classes → Assignments. Late homework will not be accepted by the system and will count as 0. **No extensions.**
- Each homework will be posted at least a full week before it is due.
- How to submit:
 - All text answers should be **typed (no handwriting)**.
 - For typesetting (especially equations), **LaTeX** is probably easiest (user-friendly interface: www.overleaf.com), but you can also use Microsoft Word with Equation Editor or Mathtype.
 - Insert plots into your homework instead of submitting them as separate files. **Convert to PDF before submitting. Name the PDF with the homework number and your last name, e.g. “HW1_Ma.pdf”.**
 - If a problem involves Matlab coding, submit your Matlab code as separate files. **Make sure that the code runs without errors!**
- If you think your homework has been graded incorrectly, please first talk to your TA and if no resolution is reached, to Wei Ji.
- We will not provide answer keys. However, we will discuss any homework problem in recitation upon request.

Policies on collaboration and cheating

- You are expected to work on these homework assignments independently. If you are stuck on a problem: Try your best first – this could mean struggling for hours, but that is often the best way to learn. If you are still stuck, the preferred method is to contact your TA or Wei Ji for help.
- If you ask a classmate for help **after trying hard yourself**, then you must indicate on your homework whom you worked with on what. You will not be penalized for learning with your peers. We ask that you say who you worked with for two reasons: 1) Honesty. 2) We want to know what material is difficult so we can spend more time helping you

learn. If you relied on a peer for a challenging question then we want to make sure that you understand the material before test time.

- Under no circumstances should you copy a classmate's answer, even if you modify it slightly. **Copying someone else's work is cheating, is easy to detect, and will yield a grade of 0.**
- If someone asks you for help on the homework: do not give them your answer – this is cheating and will yield a grade of 0. First, make sure that the person you are helping has tried their best on the homework. You will only hurt them come exam time if you just handed them the answers all semester. Second, explain how you got started and how you thought about the problem. If you can help someone learn that way, that is impressive.

Participation

- Attendance is mandatory. Your participation grade will be based on attendance, as well as on participation during lecture and recitation.
- To request an excused absence, please email Gerick and Wei Ji in advance.

Midterm and final

- Both exams will be take-home. You may use any written and electronic materials, but of course not consult or communicate with anyone on the exam.
- No early or late exams.

Schedule

Day	What	What is due	Topic
Tue Jan 24	Lecture 1		Types of data in neuroscience. Summarizing data (including binning and smoothing). Plotting practices.
Thu Jan 26	Recitation 1		Matlab Tutorial Part 1
Tue Jan 31	Lecture 2		Probability and probability distributions
Thu Feb 2	Recitation 2	Homework 1	Matlab Tutorial Part 2
Tue Feb 7	Lecture 3		Normal distribution, mean, variance
Thu Feb 9	Recitation 3	Homework 2	
Tue Feb 14	Lecture 4		Estimating a parameter: MLE and credible interval
Thu Feb 16	Recitation 4	Homework 3	
Tue Feb 21	Lecture 5		Estimating the population mean: SEM, bootstrap, and confidence interval
Thu Feb 23	Recitation 5	Homework 4	
Tue Feb 28	Lecture 6		Linear regression and correlation
Wed Mar 2	Recitation 6	Homework 5	
Tue Mar 7	Lecture 7		Hypothesis testing. Significance. One-sample t-test.
Thu Mar 9	Recitation 7	Homework 6	
Tue Mar 14	Spring break!		
Thu Mar 16	Spring break!		
Tue Mar 21	Lecture 8		More t-test. Two-sample t-test. Permutation test.
Thu Mar 23	Recitation 8	Midterm	
Tue Mar 28	Lecture 9		Rank-based tests
Thu Mar 30	Recitation 9	Homework 7	
Tue Apr 4	Lecture 10		ANOVA
Thu Apr 6	Recitation 10	Homework 8	
Tue Apr 11	Lecture 11		Power, effect size, and false discovery rate. Bayes' rule
Thu Apr 13	Recitation 11	Homework 9	
Tue Apr 18	Lecture 12		Categorical data: logistic regression, classification
Thu Apr 20	Recitation 12	Homework 10	
Tue Apr 25	Lecture 13		Model fitting. Psychometric curve.
Thu Apr 27	Recitation 13	Homework 11	
Tue May 2	Lecture 14		Model comparison
Thu May 4	Recitation 14	Homework 12	Final review