

PHYS 798N: Data Practicum at the Intersection of the Physical, Computer, and Life Sciences

MW 11:00am – 12:15pm, EGR 3114

INSTRUCTORS

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WEBSITE

Accessible via www.elms.umd.edu

DESCRIPTION

Students will work on a semester-long individual project under the direction of a faculty mentor, and they will concurrently work to develop and refine their research projects in a course setting. Class discussions will address data exploration, analysis, and visualization as well as interdisciplinary science communication. The motivating idea behind this course is to fill a major gap in graduate science education by helping students develop and hone the skills necessary for conducting data-driven, interdisciplinary research. The course has a significant focus on developing skills for communication to diverse audiences. Students will learn to communicate with individuals in the same field, with individuals in another specified field to which their research is applicable, and with a general science audience.

FINDING A MENTOR AND IDENTIFYING A PROJECT

At the beginning of the course (or preferably beforehand), students identify their mentor(s) and work with them to develop a *well-defined, short-term* research project. The project should explore an interesting data set and should be interdisciplinary in nature, involving at least two of the following: physical, computer, and life sciences. For students taking this course to fulfill the COMBINE (Computation and Mathematics for Biological Networks) program requirements, the project should involve biological networks. Note that this project may be part of your dissertation work, but the final paper is meant to present a self-contained story and be suitable for submission to a peer-reviewed journal or proceedings. Your current research advisor(s) may serve as your mentor(s) for your project.

GOALS

This course is designed to help students do the following:

- Develop research skills in a supervised setting
- Learn methods for exploring, analyzing, and visualizing data
- Develop scientific communication skills for diverse audiences
- Publish research results well before the dissertation defense

CLASS MEETINGS AND PRESENTATION GROUPS

We are scheduled to meet on Mondays and Wednesdays, 11am-12:15pm. Because the course involves a significant research component outside of the classroom with your research mentor, we will sometimes have only one course meeting per week. The meeting schedule will be announced in class and posted on the website. Students will give formal and informal presentations approximately every other week (see schedule below). To facilitate this logistically, students will be divided into two presentation groups at the start of the semester.

FORMAL ASSIGNMENTS

- 1- to 2-page written proposal (due on 2/8). Your proposal should:
 - Describe the data
 - Discuss your main research question(s)
 - Describe how the project is interdisciplinary
 - Briefly discuss the methods you will use
 - Detail what part of the research (if any) you have completed prior to the start of this course
 - Outline your plan for addressing the research questions during this course
 - Identify and briefly describe the journal or proceedings to which you intend to submit your results. (This can be changed later.)
- Elevator speech for a general audience (weeks 4 and 5).
- Oral research presentation for a multi-disciplinary science audience (weeks 11 and 12). This ~10 minute oral presentation should cover motivation, background, key questions, methods, preliminary results, and future directions.
- Research poster (due on 4/26), aimed at the audience of your choice.
- Short research paper (~4000-5000 words), broken down into the following:
 - Draft abstracts for two different fields (10%, due on 3/1). You will submit two abstracts for your research, aimed at two different audiences of your choosing (e.g. field 1: physics and field 2: biology).
 - Draft of introduction and background (10%, due on 3/15).
 - Paper outline, including one summary figure that encompasses the paper visually (like a graphical abstract) and mockups of the remaining figures (10%, due on 4/3).
 - Final paper (70%, due on 5/10), aimed at the audience of your choice.

INFORMAL ASSIGNMENTS (not separately graded but part of your participation grade)

- Introducing your data and motivating questions (weeks 2 and 3). You will give a short presentation introducing your research project.
- Research project updates (weeks 6 & 7 and weeks 13 & 14).
- Critical review of seminal, data-driven, interdisciplinary research papers (weeks 9 and 10). You will self-organize into small groups of about 3 students to review a seminal research paper of your choosing. Groups will then present their critiques to the rest of

the class. Prior to these presentations, some class time will be allocated for students to propose potential papers and organize into groups (~week 7). Groups will briefly explain the main results of the paper and then provide a critical review. What worked well? Was the data clearly presented? What could have been improved?

PEER REVIEW

Through elms.umd.edu, you will provide peer review to one another's written submissions, including proposals, outlines, drafts, and final papers. For each peer reviewed assignment, you will be asked to review the submissions of 2-3 of your fellow students.

GRADING

- Participation: 20% (including informal presentations and peer review of written assignments)
- Proposal: 7%
- Elevator speech: 5%
- Oral research presentation 9%
- Poster: 9%
- Final paper: 50%

TENTATIVE SCHEDULE (with due dates). *Student led topics listed in italics.* Instructor led topics underlined. **Due dates for written assignments in bold.**

Week #	Dates	Topics/Activities	Assignments due
1	W 1/25	- <u>Introduction to the course</u> - <u>Developing your proposal</u>	
2	M 1/30 and W 2/1	- <u>Making the most of the peer review process</u> - <i>Group A introduces their data sets and motivating question(s)</i>	
3	M 2/6 and W 2/8	- <i>Group B introduces their data sets and motivating question(s)</i> - <u>What's in an abstract?</u>	1-page project proposal (2/8)
4	M 2/13 and W 2/15	- <u>How to give an elevator speech about your research</u>	
5	M 2/20 and W 2/22	- <i>Elevator speeches from Groups A and B</i> - <u>Data visualizations part 1: Schematics and simple plots</u>	
6	M 2/27 and W 3/1	- <u>How to give a scientific presentation</u> - <i>Group A research updates</i>	Abstracts (3/1)
7	M 3/6 and W 3/8	- <i>Group B research updates</i> - <i>Each student should bring a suggestion of a seminal paper for critical review that might also be of interest to</i>	

		<i>others</i>	
8	M 3/13 and W 3/15	- <u>Features of high-impact research papers</u>	Draft of intro & background (3/15)
		Spring Break	
9	M 3/27 and W 3/29	- <u>Data visualizations part 2: Conveying complex information</u> - <i>Critical review of seminal, data-driven, interdisciplinary research papers</i>	
10	M 4/3 and W 4/5	- <i>Critical review of seminal, data-driven, interdisciplinary research papers (continued)</i>	Outline of final paper (4/3)
11	M 4/10 and W 4/12	- <u>How to prepare a scientific poster</u> - <i>Individual research presentations for interdisciplinary audiences (Group B)</i>	
12	M 4/17 and W 4/19	- <i>Individual research presentations for interdisciplinary audiences (Group A)</i>	
13	M 4/24 and W 4/26	- <u>How to refine and edit your work</u> - <i>Group B research updates</i>	Poster (4/26)
14	M 5/1 and W 5/3	- <i>Group A research updates</i>	
15	M 5/8 and W 5/10	- <u>Publishing your research</u>	Final paper (5/10)