PHYS 798N: Interdisciplinary Communication for Data-Driven Science

3 credits

MW 11:00am – 12:15pm, AJC 2134

INSTRUCTORS

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Please include "PHYS798N" in the subject heading of your email so that your message receives high priority.

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Girvan's Office Hours: Wed 2-3pm, A.V. Williams 3341, or by appointment

Serrano's Office Hours: Tues 11am-12pm, A.V. Williams 3317, or by appointment

WEBSITE

Accessible via www.elms.umd.edu

DESCRIPTION

Students will work on a semester-long individual research project under the direction of a faculty mentor, and they will concurrently use this project to develop and refine their communication skills of scientific concepts. Class sessions will address interdisciplinary communication with some discussion of data exploration, analysis, and visualization. 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 communicating 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 either (i) a peer-reviewed journal or proceedings, or (ii) a grant call for research proposals. The student's current research advisor(s) may serve as his/her mentor(s) for this research project.

GOALS

This course is designed to help students do the following:

- Develop scientific communication skills for diverse audiences
- Hone research skills in a supervised setting
- Learn effective approaches for exploring, analyzing, and visualizing data
- 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 occasionally 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 groups.

ASSIGNMENTS

Course assignments will be categorized and identified as Formal or Informal assignments. Formal assignments are expected to be delivered with a professional level of polish, as if they were to be submitted to research colleagues. Grading for these assignments will focus on both content and form. Informal assignments will not be graded, and their focus is mainly on content, not form. They are intended to allow for communication practice as well as focused discussion of the student's research progress. Below are general descriptions of the assignments. Each assignment will receive its own "Instructions and Rubric" document on ELMS.

FORMAL ASSIGNMENTS

- 1- to 2-page written Statement of Intent (due on 2/22). Your Statement of Intent should:
    - Describe the data
    - Discuss your main research question(s)
    - Describe how the project is interdisciplinary. Describe how it involves network biology (for COMBINE fellows)
    - Briefly discuss the methods you will use
    - Detail what part of the research (if any) you have completed prior to 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 (week 4).
- Oral research presentation for a multi-disciplinary scientific audience (weeks 12 & 14). This ~10 minute oral presentation should cover motivation, background, key questions, methods, preliminary results, and future directions. Oral research presentations will be delivered twice by every student for an opportunity to revise based on instructor and peer critique.
- Research poster (due on 4/24 and a revised version due 5/8), aimed at the audience of your choice.
- Short research paper or formal proposal (~4000-5000 words), broken down into:

- Draft abstracts for two different fields (10%, due on 3/13). 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 3/25).
- Paper outline, including one summary figure that encompasses the paper visually and mockups of the remaining figures (10%, due on 4/3).
- Final paper (70%, due on 5/15), aimed at the audience of your choice.

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

- Introducing your data and motivating questions (week 2). You will give a short presentation introducing your research project.
- Critical review of seminal, data-driven, interdisciplinary research papers (week 5). You will small groups to review and discuss seminal research papers of your choosing. Groups will briefly discuss common features of their seminal papers, drawing from the papers for examples. What worked well? Was the data clearly presented? What could have been improved? Groups will then present their critiques to the rest of the class.
- Research project updates (weeks 6 & 7). These will focus on methodology and results.
- Visualizing complex concepts and data (week 9). Each student will submit a complex visualization and be ready to discuss the content and execution critically.

PEER REVIEW

Through elms.umd.edu, you will provide peer review to one another's written submissions, including statements of intent, 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. You will also provide live peer review of oral presentations via ELMS forums and Google Docs.

GRADING

- Participation: 20% (including informal presentations and peer reviews)
- Statement of Intent: 7%
- Elevator speech: 5%
- Oral research presentations 9%
- Poster: 9% (split into 4.5% for version 1 and 4.5% for version 2)
- Final paper/proposal: 50%

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

Week #	Dates	Topics/Activities	**Assignments due**
1	M 1/28 and W 1/30	- Introduction to the course and logistics - How to get the most out of peer reviews - Introduction to the 'Intro to Your Dataset' and the 'Statement of Intent' assignments	

		- Basics of proposals	
2	M 2/4 and W 2/6	- *Students introduce their data sets and motivating question(s)*	
3	M 2/11 and W 2/13	- How to give an elevator speech about your research - What's in an abstract? - *Each student will bring an abstract for discussion*	
4	M 2/18 and W 2/20	- *Elevator speeches* - Crafting the Introduction and Background section of a journal article	**1-page project Statement of Intent (Friday 2/22)**
5	M 2/25 and W 2/27	- *Critical review of seminal, data-driven, interdisciplinary research papers (each student will bring a suggestion of a seminal paper for critical review that might also be of interest to others)*	
6	M 3/4 and W 3/6	- Features of high-impact research papers - *Research updates*	
7	M 3/11 and W 3/13	- *Research updates*	**Abstracts (3/13)**
8	M 3/18 and W 3/20	Spring Break	
9	M 3/25 and W 3/27	- How to make best use of an outline for journal articles - *Scientific visualizations: Conveying complex information*	**Draft of Intro/ Background (3/25)**
10	M 4/1 and W 4/3	- Vector Graphics, Schematics, and Summary Figures	**Outline of final paper (4/3)**
11	M 4/8 and W 4/10	- How to give a scientific presentation - How to prepare a scientific poster	
12	M 4/15 and W 4/17	- *Individual research presentations for interdisciplinary audiences*	
13	M 4/22 and W 4/24	- How to refine and edit your work	**Poster V1 (4/24)**
14	M 4/29 and W 5/1	- *Revised individual research presentations for interdisciplinary audiences*	
15	M 5/6 and W 5/8	- Publishing your research	**Poster V2 (5/8)**
16	M 5/13	Finals week - No meeting	**Final paper (5/17)**