

BCN Professional Development

PSY6930: Topics in Psychology

Spring 2023, Class # 17345, Section 3481

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| Meeting room: | Psychology 130 |
| Meeting times: | Monday, 10:40AM-1:40PM |
| Instructor: | Dr. Peter Kvam |
| Office: | Psychology 216 |
| Office hours: | Wednesday, 10:40-12:40 or by appointment |
| Email: | pkvam@ufl.edu |

Course Description

This semester of the Behavioral & Cognitive Neuroscience Professional Development Seminar will focus on the tools of data science, with an emphasis on machine learning (ML) and artificial intelligence (AI). This will include both how they have been inspired by neural systems and how they can be used to analyze neural and behavioral data. We will cover some foundational topics related to the mathematics and statistics of data science, traditional applications like logistic regression, modern data analysis methods using AI/ML, and the future of these approaches within psychology and neuroscience. The 3-credit version of the class will also focus on developing and carrying out projects using machine learning approaches, specific to the interests of students enrolled in the class.

Readings will consist of primary source articles and online content, including tutorials on different methods as well as papers implementing these methods. Assignments and projects can be completed in the programming language of your choice, but it will be very helpful to have some basic background in a language like R, MATLAB, or Python. Contact the instructor if you need any resources for developing your understanding of one of these programming languages in advance of or during the course.

In-person / Online Attendance

We will try to offer the course in a HyFlex format, allowing students to attend online as needed. Due to the collaborative nature of the projects and discussions, in-person attendance is strongly encouraged where possible. This will be incentivized by the grading scheme for attendance credit, outlined below. However, if you are sick or feel ill, please let your instructor know and attend online for full credit instead.

In general, acceptable reasons for absence (or online attendance) include career-relevant activities like academic conferences or interviews, as well as other reasons like illness, serious family emergencies, military obligation, severe weather conditions, religious holidays, participation in official university activities, or court-imposed legal obligations (e.g., jury duty or subpoena). All of these will be excused when it comes to discussion grades – just let the instructor know as soon as possible before class.

Readings. This course does not have reading material that we will require you to purchase – anything that is necessary will be provided on eLearning / Canvas.

Objectives

The goal of this class is to provide students the skills needed to implement and use a variety of machine learning methods for data analysis. Students will develop a deeper understanding of how and why machine learning methods have been developed and learn how these models can be applied in their own research. By the end of the course, you should be familiar enough with these methods to use one or more of them on a data set and be prepared to present the results in a course symposium at the end of the semester.

Structure

The course will focus primarily on in-person discussions and informal / ad-hoc presentations. The first hour (10:40-11:40) will involve all students and be devoted to covering background knowledge or discussing a specific topic in data science, and the remaining part of class (11:40-1:40) will focus on developing and carrying out research projects related to ML or AI, individual or in small groups. The instructor will be closely engaged with students during this time to help develop and carry out these projects.

For in-person discussions, we will sometimes assign roles to facilitate class discussions. These roles could include things like “coder” (responsible for implementing a simple / toy example), “visualizer” (responsible for presenting a graphic showing the results or methods), “impact assessor” (responsible for projecting what the impact of a method might be on their field), or other similar roles that you might play as academics. The tasks corresponding to assigned roles should be completed before the corresponding class in order to facilitate presentations and discussion during the class period.

Grading

Grades will be determined based on discussion and participation in class, including any roles you are assigned, as well as presentation during our final class symposium at the end of the semester. This is the breakdown of the contributions:

Discussion & Participation: 80%

Regular attendance of class and involvement in discussions: **60 points (60%)**

Receive **5 points** for attending in person (including symposia days)

Receive **3 points** for attending online (without excuse; with excuse, 5 pts)

Completing all assigned roles during class: **20 points (20%)**

End-of-semester symposium presentation: 20%

Final project presentation (4/18 & 4/25): **20 points (20%)**

For students involved in the 1-credit option, expectations for projects will be much more relaxed and can involve “third-author” types of roles on projects with other students.

The grades assigned to different levels of performance are shown below. For assignment of grade points based on these grades, we will follow the standard UF scale.

<https://catalog.ufl.edu/graduate/regulations/>

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| 90-100% | A | 73-76.9% | C |
| 87-89.9% | B+ | 70-72.9% | C- |
| 83-86.9% | B | 67-69.9% | D+ |
| 80-82.9% | B- | 63-66.9% | D |
| 77-79.9% | C+ | 60-63.9% | D- |
| | | 0-59.9% | E |

Respect and non-discrimination

Respect for fellow students and instructors is expected of all class attendees. Intentionally disruptive or disrespectful conduct affecting other students may result in removal from the class session or from the course altogether.

Sexual Harassment. Sexual Harassment is not tolerated in this class, in the Department of Psychology, or at the University of Florida. Sexual harassment includes: the inappropriate introduction of sexual activities or comments in a situation where sex would otherwise be irrelevant. Sexual harassment is a form of sex discrimination and a violation of state and federal laws as well as of the policies and regulations of the university. All UF employees and students must adhere to UF's sexual harassment policy which can be found here: <https://hr.ufl.edu/forms-policies/policies-managers/sexual-harassment/>. Please review this policy and contact a university official if you have any questions about the policy. As mandatory reporters, university employees (e.g., administrators, managers, supervisors, faculty, teaching assistants, staff) are required to report knowledge of sexual harassment to UF's Title IX coordinator. You can also complete a Sexual Harassment Complaint Form (Title IX) here: <https://titleix.ufl.edu/title-ix-complaint-form/>.

Accommodation for Disabilities. Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu/>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course schedule

| WEEK | DATE | TOPIC | HELPFUL LINKS |
|----------|-------------|---|---------------------------------------|
| 1 | 1/9 | (Introductions and planning | |
| 2 | 1/16 | NO CLASS – MLK Day | |
| 3 | 1/23 | Background – probabilities, matrix algebra | Intro to matrices |
| 4 | 1/30 | When and where to use machine learning | First rule of ML |
| 5 | 2/6 | Supervised learning – regression & classification | Linear classification |
| 6 | 2/13 | Neural networks – real & artificial | AI & Neuroscience |

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| 7 | 2/20 | Training and fitting your models | Loss functions |
| 8 | 2/27 | Deep learning | A Neural Network Playground |
| 9 | 3/6 | Activation functions & types of layers | Types of activation functions |
| 3/13 NO CLASS – SPRING BREAK | | | |
| 10 | 3/20 | Unsupervised learning | IBM's guide to unsupervised learning |
| 11 | 3/27 | Reinforcement learning | What is reinforcement learning? |
| 12 | 4/3 | New trends: Computational evolution | Agent-based methods for game theory |
| 13 | 4/10 | New trends: Automated parameter estimation | Likelihood-free inference with CNNs |
| 14 | 4/17 | Final project symposium – Day 1 | |
| 15 | 4/25 | Final project symposium – Day 2 | |

THIS SYLLABUS IS SUBJECT TO CHANGE. PLEASE CHECK THE COURSE WEBSITE FOR UPDATED INFORMATION AND CURRENT VERSION.

Other notes

There will be substantial math and programming involved in the course. It is probably necessary to have some mathematical and statistical training (through undergraduate / introductory graduate-level statistics, and around Trigonometry / Pre-Calculus for math), but this should be covered in your graduate courses. It is advisable to have some basic background in programming in R, Python, MATLAB, or another modeling language, or partner with someone who does on your projects. Mastery of these languages is not necessary, but familiarity will help with assignments and projects. Examples in class provided by the instructor will be in MATLAB but should be readily translatable to other languages (relevant packages are usually available in R or Python). The instructor will be available during office hours and by appointment to answer questions, assist in understanding the material, and provide guidance on final projects.

Studying and working together on projects, especially the final symposium, is strongly encouraged. The University and instructors reserve the right to penalize any student who is guilty of academic misconduct, including but not limited to plagiarism, collusion, cheating, or discrimination or harassment in study groups. Students are welcome to use any resources at their disposal (notes, papers, internet) for their projects, but they should acknowledge all intellectual contributions to the project with authorship, as appropriate (including if your advisor helped you!).

Honor Pledge

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University

of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Course feedback

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.