

Computational Science and Engineering Capstone Project Course - AC297r

Course ID:156202
2017 Spring
Tuesday 04:00pm - 06:00pm
Location: Pierce 301

Instructor: Pavlos Protopapas

Canvas site: <https://canvas.harvard.edu/courses/20897>

Project Display Site: <http://iacs.seas.harvard.edu/capstone>

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Syllabus

The CSE Capstone Project course will give you the opportunity to work as a team to integrate knowledge acquired in other courses and to apply skills and ideas in computational and data science such as data management, machine learning, statistics, and visualization. You will have the opportunity to solve complex real-world problems working across knowledge domains and applying cutting-edge tools and methods incorporating critical thinking.

While working on a substantial and challenging project with your partner organization, company, or research lab, you will practice **professional skills**. Upon completion of the Capstone Project Course you will be prepared to conduct research at a professional level. The projects will be selected so that current statistical,

machine learning, computational, and engineering methods can be used. In addition, most projects have been designed to address important contemporary business and societal issues.

A significant component of the course will be the **substantial feedback** and guidance from the professor and the teaching fellows (TFs)s, including explicit measures of evaluation, feedback on all aspects of the project and its implementation, as well as self-assessment and peer evaluation. This feedback process will begin with the data acquisition and data exploration phase and extend through the design and implementation phase of the project.

You will also most likely meet with your **project partner organizations** a few times but these meetings are for consultation and feedback only. Goals and guidelines are set during meetings with the professor and the TFs and you will be graded by the professor and the TFs. Some partners are more hands-on than others and you will have the opportunity to determine the level of partner involvement jointly during the course.

We expect you to work with your team members to develop your **collaborative skills** such as group management and conflict resolution, and to sustain good interpersonal relations. You will be asked to evaluate each team member's contribution as well as your own contribution to the project. Many employers consider the ability to engage in productive teamwork a requirement for success.

Learning Outcomes for this course

- collaborate with others in conducting research or applied science
- acquire, organize and process data
- create and outline solutions using statistics, machine learning and mathematical modeling
- implement those solutions
- communicate and defend your work
- practice professional skills by communicating with partners from outside the University in a courteous and punctual manner.

Online Discussion

Students are encouraged to talk about their projects, difficulties and all, and to engage with students doing other projects. This will make your experience more fun, and your knowledge base larger.

Each project group will have a private space in Canvas to share documents and private communications.

Notifications and class news will be posted on Canvas and sent via Canvas notifications. Please make sure you have Notifications turned on otherwise you might miss important announcements.

Course Structure

Town Hall Meetings (a.k.a class time)

The nature of Capstone projects is such that you will be mostly working with your group and instructors. There will be a weekly **Town Hall Meeting** of the whole class on Tuesdays 4:00pm to 6:00pm in Pierce 301 starting **January 24th 2017** and ending April 25th. During the meeting:

- we will have the typical class announcements
- we will have short tutorials or guest lectures on both technical and non-technical subjects such as communicating in the professional world (being on time, being courteous, wearing the right clothes, etc), all about Intellectual Property, all about Start-ups.

Attendance is mandatory.

Weekly meetings with your group's Teaching Fellow

Each project group will be assigned a specific TF, with whom they will work for the whole semester. The group will meet with the TF on a weekly basis. These meetings will be freely structured and will allow for collaborative work while the TF is present to answer any questions. Every other week these meetings will coincide with the meetings with Prof. Protopapas (see below.)

Bi-Weekly meetings with the professor (Pavlos)

Before each meeting you will share a diary/workbook of your work with the professor and the TFs so they can familiarize themselves with your progress. This communication will make the meetings run more efficiently.

Bi-weekly: each group will have update meetings with Pavlos. Regular meetings will be 53 min long.

Midterms

After the end of each phase, there will be a midterm (see schedule) during which you are expected to present the progress of your work. There are two such midterms. The first one you will present your work to the class, the second

Meetings with the partners

You will write a report to the partner, have the TF approve it and then send it to the partner. We have high expectations for your meetings with the partners. You need to be courteous, punctual, and well prepared.

Final Presentations and Showcase

On May 8th there will be a poster session for all the projects (mark your calendars) and on May 10-11 we will have the final presentations.

Project Phases, Milestones and Midterms

Phase 1: team formation - project selection - connect with partners - project re-definition (weeks 1-4)

In this phase, the TFs will introduce the projects, you will choose your project, meet the project partner, understand the problem, set up your group including the roles, refine the project goals, and produce a preliminary project plan.

Phase 2: Learning and Data exploration or contractual statement (weeks 5-8)

In this phase you will review, understand, and if needed, learn the existing state-of-the-art methods in the literature relevant to the project problem. You might need to learn statistical and machine learning methodologies, if you are not already familiar with them (e.g. deep neural networks, variational methods, etc). You will also explore the data (for projects with data), and redefine the project definition and goals.

Phase 3: Formulation of solution, implementation (weeks 9-13)

In this phase, the heart of the project, you will get to implement and try ideas using the methods you learned in the previous phase. You will also address computational and performance issues.

Final Phase : Presentations

This is a continuation of the previous phase where you narrow down your methodology, finish the implementation and produce results. This is the final product and result-driven phase.

Course Policies

Grades:

Midterm 1 (including report to partner): 20%

Midterm 2 (including report to partner): 20%

Poster session: 10%

Final Presentation: 30%

Final Report: 10%

Peer Assessment: 10%

Assessment

You will be assessed individually for your contribution to the group's work. Five (5) pts. will be given for your efforts to create a successful team experience. Your grade will be determined by the points earned during the phases of this course.

Pavlos' grade rubric is Top, Middle, Low and Inadequate for the following criteria :

1. Substantial Effort
2. Depth of Investigation
3. Explanation of Method
4. Choices made and Why
5. Thoroughness
6. Presentation

You will submit reports in Canvas. No work will be accepted after the deadline. Do not leave submission for the last minute as we all know that this is when the web breaks.

Peer Assessment

10% of the grade for each milestone will be self and peer evaluation. Peer evaluations are an important skill to learn so we expect you to give thorough and constructive feedback.

- Self and Intra-group evaluation : you will be evaluating your teammates' and your own contribution during midterm and finals.
- Inter-group evaluation : your group will be asked to evaluate another group. At least one member of your group is expected to be present at the presentation of the other team and to write the evaluation.

Collaboration Policy

You are expected to motivate and help each other in your group. You will ask you to sign a "contract" with your teammates.

Questionnaires

We might ask you to complete a couple of online questionnaires during the semester. The answers will be used to assess the progress of the course so far and will not affect your grade.

Missed classes and Assignment Deadlines

It is very important that you attend all presentations. You are allowed only one absence from a presentation for whatever reason provided that the rest of your group is there. If more than one member is absent the presentation must be rescheduled for the week after. You are allowed only one such extension.

Originality and Plagiarism

You must do your own work; we have zero tolerance for plagiarization.

You must acknowledge any source code that was not written by you by mentioning the original author(s) directly in your source code (comment or header). You can also acknowledge sources in a README.txt file if you used whole classes or libraries. Do not remove any original copyright notices and headers. However, you are encouraged to use libraries, unless explicitly stated otherwise!

You may use examples you find on the web as a starting point, provided their licenses allow you to reuse the example. You must quote the source using proper

citations (author, year, title, time accessed, URL) both in the source code and in any publicly visible material.

If you have any doubts about whether a library is available to use in your work, please direct your question to one of the TFs.

Accommodations with students with disabilities

Students needing academic adjustments or accommodations because of a documented disability must present their Faculty Letter from the Accessible Education Office (AEO) and speak with me by the end of the second week of the term to identify, discuss, and document any feasible instructional modifications or accommodations. Students from the extension school should contact the extension school disability office at disabilities@dcemail.harvard.edu or (617) 495-0977. Failure to do so may result in inability to respond in a timely manner. All discussions will remain confidential, although I may contact AEO to discuss appropriate implementation.

