CSE 40437/60437 - Social Sensing and Cyber-Physical Systems - Spring 2015

Instructor

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Course Overview

Online social media (e.g., Twitter, Facebook), smartphones, and ubiquitous internet connectivity have greatly facilitated data sharing at scale, allowing for a firehose of human and sensor observations to pour in about the physical world in real-time. This opens up unprecedented challenges and opportunities in the field of *social sensing and cyber-physical systems (CPS)* where an important goal is to efficiently organize the real-time data feeds and accurately reconstruct the "states of the world", both physical and social. This course offers students the opportunity to learn the theoretical foundations, state-of-the-art techniques, and hands-on experience in this exciting area. The topic of this class is timely due to the increasing interest in online social networks, big data, and human-in-the-loop systems, as well as the proliferation of computing artifacts that interact with or monitor the physical world.

The class contains four main components: (i) the introduction to social sensing and cyber-physical systems; (ii) key technical challenges (e.g., big data analytics, system reliability, user mobility, energy, privacy, etc.); (iii) state-of-the-art techniques and systems (e.g., MapReduce/Hadoop, fact-finding, etc); (iv) emerging applications (smartphone-based crowdsensing, online social media sensing, participatory/opportunistic sensing, intelligent transportation, smart buildings, body area networks etc). The students will have the opportunities to work with real world social sensing and cyber-physical system problems.

Attendance

Students are expected to attend all class and project meetings, and turn in all assignments before the due date and time. Exceptions will only be made for the grave circumstances outlined in the duLac student life handbook. Students who must be absent due to participation in a University activity must confer with the instructor at the earliest possible date.

Lectures and Readings

The course will primarily be open discussions on the emerging topics in social sensing and cyber-physical systems area. I have not yet found an excellent, broad, textbook about this area, and so the lectures will be supplemented with a variety of articles from top venues in this field (e.g., ACM and IEEE proceedings), project websites, and so forth. Note that the readings for each week will help you to be ready for the lecture and the discussion. You are expected to read at least the abstract (and preferably the introduction) of the papers (the papers are posted on the course website). The readings are not a substitute for the lectures. The lecture notes are posted under the "Resource" of Piazza system.

Grading

- 10% of the grade will be assigned on individuals' class participation and proactive discussion of lecture topics and project presentations (Individual based).
- 10% of the grade will be assigned on an in-class paper presentation on the selected topic by each group. (Group based)
- 30% of the grade will be assigned on individuals' homework assignment (Individual based).
- 50% of the grade will be determined by a group course project. This grade includes project proposal, mid-term report, mid-term project presentation, a final project presentation, a final project paper, and project updates and demonstrations (to the instructor). The project will implement some innovative social sensing model, service, system, or computing environment. Students will be allowed to work in groups of up to 3 on the project. (Group based)
    - 5%: Project discussion and updates

- 5%: Project proposal
- 5%: Mid-term project presentation
- 10%: Mid-term project report
- 10%: Final project presentation
- 15%: Final project paper

Note: For individual based work, each student will receive the credit based on her/his own work. For the group based work, every student in the group will receive the same credit based on the group's work.

Assignments

Assignments are normally due at the **beginning** of class on the date due. This might change due to the break (e.g., Spring Break). Please double check with the assignment description and the course website for the actual due date. Late assignments will receive no credit. This includes assignments submitted after class has begun.

Programming assignments will be turned in electronically by copying all required files to a "dropbox" directory. You are free to turn in assignments multiple times before the deadline expires. It would be a good habit to turn in an incomplete but working assignment on a daily basis. Thus, there is no excuse for failing to turn in an assignment: everyone should turn in something long before the deadline. Exceptions will be made only in grave circumstances.

Course Project

Please refer to the course and project webpage for more details:

http://www3.nd.edu/~dwang5/courses/spring15/

http://www3.nd.edu/~dwang5/courses/spring15/project/project.html

Computing Resources

For the course projects, we can provide access to several large computing systems here at Notre Dame which are no cost to you: our 10K-core Condor pool, and a 180-TB Hadoop cluster. For the commercial cloud

providers (e.g., Amazon Web Service), it will require that you create an account coupled with a credit card on those systems. A reasonable credit (usually $100) is available for academic use of those systems, so that you will be able to experiment at reasonable scale at no additional cost. However, if you go over the limit, you might be responsible for the additional costs. Please schedule a meeting with the instructor if you believe your project will need such computing resources.

Paper Presentations

Each group will do an in-class paper presentation to present a selected technical paper in the weeks of April 6 and 13.

The in-class paper presentation will provide good opportunities for you to exercise your scientific presentation ability, practice critical thinking, understand how to judge and challenge other's work in a professional way, and learn how to organize and lead an active scientific/technical discussion session.

Prerequisites

Senior or Graduate standing.

Proficiency in the Python programming language

Collaboration

The assignments are to be completed individually.

The in-class presentation and course project will be completed in a group of up to 3 students.

You are encouraged to seek out and exploit external manuals, books, websites, and other documentation that will help you to complete the assignment and project, provided that you indicate what sources you have used. However, all software development, experimental work, and writing of results must be done solely by you and your partner(s).

This class follows the binding Code of Honor at Notre Dame. The graded work you do in this class must be your own. In the case where you collaborate with other students make sure to fairly attribute their contribution to your project.

You must read and abide by the Academic Code of Honor. http://honorcode.nd.edu

A Note About the Assignments

The lectures will explain the general principles and direct you towards reference materials. However, you will need to figure out some of the details on your own by reading manuals and experimenting on your own. **Do not expect to succeed on the first try.** You may need to consult with the instructor and TA during class, office hours, or via email to solve problems. Thus, start working on each assignment right away, and do not leave it until the last minute.