DCDS 500: Computational Data Sciences Research Exploration

Washington University in St. Louis

Spring 2019

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Class times: Thu 1:00-4:00 in Jolley 517 (except Week 1, when we'll be in Jolley 431)
Office hours: By appointment.

1 Course Description

1.1 Overview

This is a *graduate seminar*, designed to lay the foundation for future study and success in transdisciplinary research involving the computational and data sciences. The course provides opportunities to engage with the emerging conceptual and technical challenges emerging from the increasingly ubiquitous availability of extensive datasets capturing many aspects of human life, social behavior, and scientific discovery. The class meets weekly to discuss seminal and recent scholarship on technological applications to substantial problems. We will emphasize issues of knowledge development as well as causal inference and justice in the context of complex data. Additionally, students will work in diverse teams to apply methods to case studies. Students are expected to reflect on assigned readings, participate actively in-class discussion and team projects, produce oral and written reports on teamwork.

Students will:

- Identify and investigate substantive research questions appropriate to be addressed using data-driven methods. Collaborate effectively in teams to integrate different perspectives on framing and solving substantive problems to be addressed with computational approaches.

- Develop and use causal theory to understand how data are generated, what measurement exists and is missing, and mechanisms that drive complex patterns across observations.

- Recognize the social and ethical implications of data-driven applications to substantive domains and design solutions that mitigate unintended consequences.

- Apply conceptual and technical skills to substantive issues, and communicate the methods and implications clearly through strong oral and written arguments

1.2 Prerequisites

Enrollment as a Ph.D. student in the Division of Computational and Data Sciences, or permission of instructors.

1.3 Format

The class will meet once a week for three hours. Class formats will vary, from presentation and discussion of readings to collaborative work on problems. Participation is crucial and will count heavily towards final grades. Students will complete reading reflections to help prepare for in-class work. In addition, teams will complete two larger projects over the course of the semester, and one will be developed further as a final paper.

1.4 Texts and Readings

The reading list is evolving and may change based on the interests of the class. We will post a list of papers to the course website / Piazza and also use significant portions of the following two texts:

1. *Local Justice*, Jon Elster. Russell Sage Foundation.

2. *The Book of Why*, J. Pearl and D. Mackenzie. Basic Books.

Effective Reading Readings will include text chapters and empirical reports to provide an overview of current thinking, conceptual issues, and methods used to garner empirical support. It is encouraged that you approach readings actively and systematically. Read to understand and not to memorize – it may be worthwhile to skip paragraphs. Effective reading includes summarizing the main theses upon completion of an article, and evaluating the research evidence used to support theses.

Summarizing includes asking:

1. What issue is of most concern to the author?

2. Why does the author think this issues is important?

3. What theoretical assumptions guide the interpretation and integration of findings?

4. What are the main findings and/or main points of the chapter or article, and what is the most critical evidence presented by the author in support of these points?

Evaluating research evidence entails inquiring:

1. What are the strengths of the work?

   - Theoretical or empirical contribution?
   - Credibility/tenability of the assumptions?
   - Appropriateness of the research design, measures, and sample selection for the question under investigation?
   - Soundness of the interpretation of the data?

2. How would you improve on the work?

3. What questions provoked by the work merit further investigation?

4. What research designs or methods would be fruitful to addressing these questions in future investigations?

1.5 Preliminary Syllabus

This preliminary list of topics may change based on time constraints, the interests of the class, or other factors. The topics will be interwoven with practice in doing team projects on novel datasets, writing, and presenting.

1. Foundations: Ethics, morality, doing transdisciplinary and team science. What kinds of questions can and should we ask with novel data and computational power?

2. Causality: intervention, causal inference, the Rubin framework, models (including DAGs).

3. Justice: global framework (including utilitarianism, Rawls' notion of justice, Nozick's notion), local justice, social justice in today's world.

2 Course Policies

2.1 Announcements and Course Website

The main course website is at:
http://www.cse.wustl.edu/~sanmay/teaching/dcds500-spring2020.
We will use Piazza for all questions and discussions related to the class. Please post questions on Piazza – they will reach both instructors and are likely to be answered sooner. Individual emails about class issues will typically be met with a response saying "Please post your question to Piazza (anonymously if you so desire)." A link to the Piazza site will be on the main course website.

All announcements related to the class will be made either in class or on the website or Piazza. **We will assume that any announcement made on the website or on Piazza is known to everyone in class within one business day of it being posted.** It is important to check the website regularly! You are responsible for all announcements made in lecture or on the website.

2.2 Assessment and Course Grade

Your overall course score will be determined using the following weights. There is no absolute correspondence of scores to grades.

1. Class participation: 20%

2. Short assignments: 10%

3. Presentations: 10%

4. Group project 1: 30%

5. Group project 2: 30%

2.3 Collaboration and Academic Integrity

This class is inherently collaborative. However, we ask that you prepare your short response papers independently, although you may discuss them orally with each other. It is critical that in all your written and oral work you attribute credit appropriately, whether that is to others you have discussed the work with, or scholarly or online sources. We will discuss and follow standard citation practices in this regard.

Submitting an assignment that is in violation of this policy will lead to an initiation of the school's formal academic integrity review and sanction process. If you have any questions about this policy, please speak with us!

2.4 Other accommodations and resources

Accommodations based upon sexual assault The University is committed to offering reasonable academic accommodations (for example, no contact order, course changes) to students who are victims of relationship or sexual violence, regardless of whether they seek criminal or disciplinary action. If you need to request such accommodations, please contact the Relationship and Sexual Violence Prevention Center (`rsvpcenter@wustl.edu` or 314-935-3445) to schedule an appointment with an RSVP confidential, licensed counselor. Information shared with counselors is confidential. However, requests for accommodations will be coordinated with the appropriate University administrators and faculty. See `http://rsvpcenter.wustl.edu`.

If a student comes to us to discuss or disclose an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if we otherwise observe or become aware of such an allegation, we will keep the information as private as we can, but as faculty members of Washington University, we are required to immediately report it to a Department Chair or Dean or directly to Ms. Jessica Kennedy, the University's Title IX Coordinator. If you would like to speak with the Title IX Coordinator directly, Ms. Kennedy can be reached at (314) 935-3118, `jwkennedy@wustl.edu`, or by visiting the Title IX office in Umrath Hall. Additionally, you can report incidents or complaints to the Office of Student Conduct and Community Standards, or by contacting WUPD at (314) 935-5555 or your local law enforcement agency. See `https://titleix.wustl.edu/`.

Bias Reporting The University has a process through which students, faculty, staff and community members who have experienced or witnessed incidents of bias, prejudice or discrimination against a student can report their experiences to the University's Bias Report and Support System (BRSS) team. See: `http://brss.wustl.edu`

Mental Health Mental Health Services' professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See: `http://shs.wustl.edu/MentalHealth`

Preferred Name and Gender Inclusive Pronouns In order to affirm each person's gender identity and lived experiences, it is important that we check in with others about pronouns. This simple effort can make a profound difference in a person's experience of safety, respect, and support. See: `https://students.wustl.edu/gender-pronouns-information/` and `https://registrar.wustl.edu/student-records/ssn-name-changes/preferred-name/`

Military Service Leave Washington University recognizes that students serving in the US Armed Forces and their family members may encounter situations where military service forces them to withdraw from a course of study, sometimes with little notice. Students may contact the Office of Military and Veteran Services at (314) 935-2609 or `veterans@wustl.edu` and their academic dean for guidance and assistance. See: `https://veterans.wustl.edu/policies/policy-for-military-students/`.

Center for Diversity and Inclusion (CDI) : The Center of Diversity and Inclusion (CDI) supports and advocates for undergraduate, graduate, and professional school students from underrepresented and/or marginalized populations, creates collaborative partnerships with campus and community partners, and promotes dialogue and social change. One of the CDI's strategic priorities is to cultivate and foster a supportive campus climate for students of all backgrounds, cultures and identities. See: `diversityinclusion.wustl.edu/`