

DS-GA 3001.009: Special Topics in Data Science: Responsible Data Science

Lecture: Mondays 11am-12:40pm **Lab:** Thursdays 5:20-6:10pm

Location: 60 5th Avenue, room 110

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office hours Mondays 1:30-3pm or by appointment, at 60 5th Avenue, room 605

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office hours Thursdays 4-5pm or by appointment, at 60 5th Avenue, room 606

Prerequisites: Successful completion of these courses, or approval of the instructor.

- DS-GA 1001: Introduction to Data Science
- DS-GA 1002: Probability and Statistics for Data Science

Course description and impact

The first wave of data science focused on accuracy and efficiency: on what we *can* do with data. The second wave is about responsibility: what we *should* and *should not* do. Accordingly, this technical course tackles the issues of ethics and responsibility in data science, including legal compliance, data quality, algorithmic fairness and diversity, transparency of data and algorithms, privacy, and data protection.

Data science promises to improve people's lives, accelerate scientific discovery and innovation, and bring about positive societal change. Yet, if not used responsibly -- in accordance with ethical and moral norms, and legal and policy considerations -- this same technology can cause harm on an unprecedented scale. Algorithmic changes in search engines can sway elections and incite violence; irreproducible results can influence global economic policy; models based on biased data can legitimize and amplify racist policies in the criminal justice system; algorithmic hiring practices can silently and scalably violate equal opportunity laws, exposing companies to lawsuits and reinforcing the feedback loops that lead to lack of diversity, which is both socially undesirable and can negatively impact performance of organizations. These strategic issues become more important as the economy globalizes. Therefore, as we develop and deploy data science methods, we are compelled to think about the effects these methods have on individuals, population groups, and on society at large.

The European Union recently enacted the General Data Protection Regulation (GDPR) that mandates legal protections of data subjects on the part of government entities and companies that employ algorithms and data to make decisions. The US is following suite with a plethora of

local efforts, including a recently passed algorithmic transparency law in New York City that applies to City agencies. These legal framework, and many others that will soon follow, compel us develop skills and acquire methodologies for operationalizing responsibility.

An important feature of this course is its holistic treatment of the data science lifecycle, beginning with data discovery and acquisition, through data cleaning, integration, querying, analysis, and result interpretation. For example, when considering fairness and diversity in hiring and college admissions, we will be looking at how the data was collected, cleaned and otherwise pre-processed, before analyzing the fairness of a particular classification or ranking method.

Learning objectives

After successfully completing the course, students are able to

- Construct an end-to-end case study that illustrates the role of data science in society.
- Explain the ethical and/or legal constraints in the collection and sharing of data according to a framework of the student's choice.
- Implement a computer program that applies anonymization and privacy techniques to a dataset, and explain the trade-offs with utility.
- Articulate the differences between various interpretations of algorithmic fairness, and relate these interpretations to the points of view of different stakeholders.
- Implement a computer program that audits a black-box classifier.

Topics covered

The course is structured into a sequence of lectures and accompanying assignments.

The assignment consists of labs, homeworks, and a course project.

- Labs are short exercises done in class and submitted in class.
- Homeworks are longer exercises designed to take one to two weeks to complete.
- The course project is designed to take 3 weeks to complete.

This course uses the python programming language. All labs and homework assignments are expected to be formulated as Jupyter notebooks.

While none of the homeworks are stand-alone writing assignments, writing is embedded in the homeworks. During the homeworks, students write computer programs and provide short essays on the interpretation of the data and the implications for the data around some decision or problem that the data inform. The writing length would typically be one to two to pages for these essays.

This course does not have a required textbook. Each topic will be accompanied by required reading, as listed in the weekly schedule. In some cases, expert-level technical research papers are listed as assigned reading.

Background Reading (required)

- Barocas & Selbst (2016) “Big Data’s Disparate Impact” [link](#)
- White House Report on Big Data (2014) “Big Data: Seizing Opportunities, Preserving Values” [link](#)
- Brauneis & Goodman (2017) “Algorithmic Transparency for the Smart City” [link](#)
- Kroll et al. (2017) “Accountable Algorithms” [link](#)

Background Reading (optional)

- Matthew Salganik “Bit by Bit: Social Research in the Digital Age” (book, [read online](#))
- Cathy O’Neil “Weapons of Math Destruction” (book)
- Frank Pasquale “The Black Box Society” (book)
- Virginia Eubanks “Automating Inequality” (book)

Weekly topics and reading

- Posted on the [course website](#)

Course assessment

All assignments (labs and homeworks) must be entirely be the student’s own submissions. Any sharing or copying of assignments is considered cheating and will result in an F in the course. A second cheating incident will result in a one-semester suspension from the program.

Students accumulate up to 100 points during the course.

- **Labs: 10 labs x 2 points per lab = 20 points.** Attend 10 labs for full credit.
- **Homeworks: 4 homeworks x 10 points per homework = 40 points.** Homeworks are assigned on Monday in class, and are due before class, at 10am on a Monday. Homeworks must be submitted on time. If a homework is submitted late, the student will receive no credit. Each student can make use of 2 additional days for late homework submission. If a late day is used, it is used in full. That is, if a student submits a homework 2 hours late, this counts as a full day.
- **Project: 20 points.**
- **Final exam: 20 points.** The exam will be conducted in class.

Grades will be determined using this scale:

Grade in Course	Points Earned
A	94 - 100

A-	90 - 93
B+	87 - 89
B	84 - 86
B-	80 - 83
C+	76 - 79
C	72 - 75
C-	70 - 71
D+	66 - 69
D	62 - 65
D-	60 - 61
F	Less than 60

Moses statement

Disability Disclosure Statement: Academic accommodations are available for students with disabilities. The Moses Center website is www.nyu.edu.csd. Please contact the Moses Center for Students with Disabilities (212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.