I. Data Science is interdisciplinary overlap that includes Applied Ethics via DSEJ

II. Major challenges students encounter in learning and enacting DSEJ

1. Ethics is viewed as a repetition of, “No, you are not allowed to do that!” Ethics as the study of NO! Ethics as the work of going backward. Ethics as the practice of defining boundaries on creativity. These are some of the most detrimental frameworks for teaching ethics, especially in the sciences. Framing ethics this way places it in opposition to the vision and hope for future goods that are often the impetus for innovation in DS (e.g., healthcare data mining for personalized diagnosis and treatment).

2. Most students, like most people, have not had time or opportunity to learn ethical theory and do not know that there are ethical systems that they can learn and apply and practice to become better at identifying positive ethical ways forward.
3. Many students experience marginalization, disempowerment, or outright exclusion when raising ethical concerns in technical teams. These experiences can occur due to cultural, institutional, or personal bias against them because of their identities or because of their willingness to act courageously to speak up, or both.

4. Students often experience ethics as tightly linked to guilt and shame. So discussions of and even raising ethical issues become a way of shaming or being shamed.

5. Students often only hear a single view of ethics in relation to the bottom line: ethics is in opposition to the financial goals of privatized DS and to the financial constraints on public funding of DS. This framing can result in students’ lack of willingness to raise ethical concerns, for fear of being labeled as not a team player, not looking out for the welfare of the people and company whose financial wellbeing supposedly hinges on going forward without too many questions asked.

III. Instruction in DSEJ can teach students ethical reasoning in DS. DSEJ can give students helpful ways to counter and negate each of the above challenges.

1. DSEJ, like all ethics, is fundamentally about vision for the future, and about maximizing happiness and flourishing. Ethics is mostly about finding ways forward, not about going backward. DSEJ sharpens perception and increases creative problem-solving to facilitate equitable DS. DSEJ is like a GPS system for DS, helping to clarify the intended destination and to provide guidance for how to get there.

2. It is recommended that instructors wanting to engage in DSEJ not put students on the spot and not force students to rely only or primarily on the ethical intuitions that they currently have. Those intuitions may be excellent, but teaching DSEJ by putting students on the spot, making them defend their intuitions absent instruction in ethical reasoning and analysis, can be counterproductive. Ethical reasoning is DSEJ is best when it introduces or presents more in depth an overview of at least 2 ethical theories from which students can analyze decision and action trajectories in DS, and can compare and contrast approaches. There are ways of doing this both in standalone courses via integration of case examples into technically demanding courses in DS. What is not recommended is assigning students popularized or contemporary accounts of ethical challenges in DS and asking students to reflect on those accounts drawing only from their existing ethical intuitions. Introducing students to ethical theories and pathways of ethical reasoning can help them raise awareness about actions that companies or groups take that are justified by the bottom line or by company culture (e.g., “We only hire people like us!”).
3. DSEJ includes a strong witness to the courage and creativity of a diversity of scientists, ethicists, advocates, historians, and whistleblowers. There are a number of available books and examples that both highlight the terrible injustices in the unexamined practice of DS, based on biases due to race, gender, sexual orientation, and ethical concern. There are also a number of available examples of mindful practitioners of DS engaging in DSEJ and changing their corporate cultures from within.

4. a. Teaching students ethical theories and teaching students ethical reasoning gives them both the ability to ethically reason about challenges in DS and standpoints from which to reason that are not their own. They can defend or critique ethical positions from within the standpoints of the theories they are engaging, rather than defending or critiquing personal ethical intuitions in themselves or other students. As students develop expertise in ethical reasoning and are better able to engage from a range of ethical theories, they can experience some freedom from shame or guilt about their own ethical choices or intuitions, even as they may choose to examine those more closely.

b. Since ethics is primarily about increasing happiness and flourishing, any lapses in ethical reasoning are best framed for students as opportunities to become more mindful, to raise awareness, to increase understanding, and not as instances of moral failure. Students can engage DSEJ in their own projects and internships as ways of increasing awareness and knowledge among the entire DS team they are a part of.

5. DSEJ can include an introduction to theories and practices of Corporate Social Responsibility (CSR). CSR is widely spoken about in many areas of business leadership and business ethics and there are several approaches, with increasing influence.
IV. Developing EDGE Perception in DSEJ: Ethically Defensible Goals and Expectations (EDGEs)

EDGEs is a framework that I have developed for teaching ethical reasoning in DSEJ. EDGE perception in ethical reasoning is analogous to edge perception in visuospatial and tactile object recognition. Without the ability to perceive edges, we have a difficult time navigating the world. Without the ability to perceive EDGEs, we have a difficult time being visionary and seeing justice in DS.

Ethically Defensible Goals are those major principles and goods of a given ethical theory, along with the argument supporting those principles and goods.

Ethically Defensible Expectations result from reasoning from these Goals to the ethically optimal implementation of DS in a given context of interest.

Only after the EDGEs have been well-defined can the Ethical Challenges be perceived. Ethical Challenges are those resulting from EDGE perception within the current, suboptimal implementation of DS in a given context of interest.

Once the Ethical Challenges are clear via EDGE perception, students can propose responses via technical, policy, or other interventions.
V. Student Learning Outcomes in Data Science Ethics and Justice (DSEJ)

1. Answering the question: What are influential perspectives in ethics that relate to advancing DSEJ? **Students will be able to describe and explain the basis for the core values and/or goods of at least 2 prominent ethical theories (e.g., Act Utilitarianism; Rule Utilitarianism; Contractualism; Moral Law Theory; Virtue Theory in Mencius, Aristotle, or Aquinas; Ethics of Care).**

2. Answering the question: Why are the ethical motivations for implementing a data science technology of interest? **Students will be able to reason from the goals of an ethical theory to clearly argue for ethically defensible expectations of data science technologies in relation to individuals, communities, society, and institutions, assuming the optimal implementation of these technologies.**

3. Answering the question: What are the core ethical challenges of current implementations of data science technologies? **Students will use historical and recent scholarship on data science implementations and their effects on persons and communities marginalized due to gender, race, sexuality, and/or socioeconomic status, to identify core ethical challenges posed by technologies such as data collection, data management, data manipulation, algorithms, machine learning, robotics, semi-autonomous and autonomous systems, and artificial intelligence.**

4. Answering the question: What are the primary Principlist approaches in DSEJ and how do they relate to the primary ethical challenges in data science? **Students will define ethical principles such as autonomy, justice, beneficence, transparency, and reliability, and connect them both to their underlying ethical theories and to applications in mitigating ethical challenges in data science.**

5. Answering the question: What do we know about technical solutions to at least some of the ethical challenges posed by current, suboptimal implementations of data science technologies? **Students will describe conceptual remedies and pseudocode for mitigating or averting data bias and algorithmic bias, especially with regard to persons and communities marginalized due to gender, race, sexuality, and/or socioeconomic status.**

6. Answering the question: How might DSEJ be implemented in practice in a welfare state capitalist system? **Students will draw on theory and applications in Corporate Social Responsibility to recommend ways of implementing DSEJ in the field.**
VI. Topics to Engage

1. Proxies in data that impose bias due to race, economic status, gender, sexual orientation.
2. Enforced poverty via tech-generated unemployment of vast sectors of the economy.
3. Climate Crisis monitoring and data privacy (e.g., privately owned solar arrays).
4. Health information, privacy, and discovery.
5. Biobanking and direct-to-consumer online genetic testing.
6. Data Fiduciaries.
7. Automated cars.
8. Automated weapons.
10. Preference modeling using social media preferences, violations of privacy and consent.
11. Preference modeling using purchases, violations of privacy and consent.
12. Job seeking and algorithm bias (e.g., Indeed.com).
13. Insurance, monetizing risk, and algorithm bias.
15. School funding and algorithm bias.
17. Financial algorithms and investing, effects on markets.
18. Real estate development, purchases, and algorithm bias.
20. False identifications via algorithms.
21. AI and augmented reality: violations of privacy, new social display rules and social display arms race.
22. Robotics/AI and sex devices, reflecting and influencing public images of women and men.
23. Transhuman/Posthuman futures and the nature of human nature.
24. Enhancing usable and transparent algorithms for correcting data and algorithmic biases.
VII. Suggested Texts

Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy, by Cathy O’Neil
Responsible Conduct of Research, by Adil E. Shamoo and David B. Resnik
The Black Box Society, by Frank Pasquale
Algorithms of Oppression: How Search Engines Reinforce Racism, by Safiya Umoja Noble
Fairness and Machine Learning: Limitations and Opportunities, Solon Barocas, Moritz Hardt, Arvind Narayanan (freely available online)
Ethics and Data Science, by Mike Loukides, Hilary Mason, DJ Patil (freely available online)
Gifts of Virtue, Alice Walker, and Womanist Ethics, by M. Harris
Black Womanist Ethics, by Katie Cannon
Buddhist Ethics, by Damien Keown
Buddhist Ethics: A Very Short Introduction, by Damien Keown
Rawls Explained: From Fairness to Utopia, by Paul Voice
Utilitarianism: A Very Short Introduction, by Katarzyna de Lazari-Radek and Peter Singer
Moral Thinking, by Richard Hare
The Morality of Happiness, by Julia Annas
Intelligent Virtue, by Julia Annas
Feminist Interpretations of John Rawls, Ruth Abbey (Ed.)
The Sources of Normativity, by Christine Korsgaard