Sociotechnical Design for Robotics Courses

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Sociotechnical Thinking

What:

- Sociotechnical lessons integrate technical skills with ethical and social responsibility. They equip students with useful frameworks and strategies to draw conclusions about the ethics of engineering designs and practices.

How:

- We designed sociotechnical lessons for the Human-Robot Interaction course. Both lessons will also be taught during this current semester for CPE 4160 (Autonomous Mobile Robotics).

Engineers should graduate from higher education institutions...

- Aware of the social and political impact of their creations.
- Recognizing their duty to avoid perpetuating discrimination and injustice.
- Able to identify values associated with engineering designs.
- Able to draw conclusions about the ethics of using and designing technologies.

Lesson Plan 1: Algorithmic bias in Computer Vision

Some training sets are not very diverse, so computer vision algorithms struggle to recognize people with certain skin tones. Computer vision uses machine learning to analyze images and identify visual information through training sets. However, it is not as simple as uploading your face to training sets. While more diversity will improve the robots performance, the biometric data of your face getting stored can be an invasion of privacy.

Importance:
We need to understand the responsibility of everything we create and that it ensures no discrimination happens from it.

Assessment:
Students compare how algorithms with different training sets observe different objects and relate it to identifying humans.



Image: Saraswat (2019)

Lesson Plan 2: Representation of Gender and Race in Robots

How gender and race representation impact HRI and society.

Importance:
The lesson challenges motivations for gendering, as well as prompts designers to practice awareness of personal biases and perspectives.



Image: AILA, DFKI Robotics

Assessment Questions:

- What social ideals/images is the design drawing from?
- How does the perceived identity of the robot relate to its functionality and intended purpose?
- Does the design reinforce or subvert existing stereotypes and norms? If so, how (e.g. with its name, voice, shape, etc.)?
- Who benefits from this representation? Who is harmed or excluded by it?

Research Questions

- How do students' assignments demonstrate socially conscious design in a course on robotics?
- What are upper-division CPE students' beliefs about their responsibility as engineers? Do these beliefs change after experiencing sociotechnical lessons?
- How do sociotechnical lessons impact students' engagement with global social justice issues outside of the robotics course?

Data Collection Plan

- Students will complete a pre- and post-survey to evaluate their understanding of sociotechnical thinking. Topics include:
  - Exposure to societal dimensions of computing
  - Effects of sociotechnical learning on engineering students' empowerment and agency
  - Lesson feedback and reflections

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REFERENCES