Paper ID #37316

Assessing Engineering Student's Representation and Identification of Ethical Dilemmas through Concept Maps and Role-Plays

Ashish Hingle

Ashish Hingle (he/his/him) is a Ph.D. student in the College of Engineering & Computing at George Mason University.

His research interests include technology ethics, information systems, and student efficacy challenges in higher education.

Aditya Johri (Professor)

Assessing Engineering Student's Representation and Identification of Ethical Dilemmas through Concept Maps and Role-Plays

Abstract

This Research-to-Practice paper presents a study of the use of concept maps for assessing engineering students' representation and identification of ethical dilemmas. The concept maps were implemented in the context of role-play case studies in a class on technology ethics. Due to the ubiquitous nature of technological applications in the field of engineering, it is important to teach students how to identify and address ethical dilemmas that might emerge through algorithms embedded in different systems. To understand how technology operates, students must explore the context around their implementation and understand the perspective of all stakeholders involved. Role-play scenarios (RPSs) are one pedagogical technique for students to explore nuanced topics and gain a situated perspective. For this study, we implemented RPSs, and data were collected from 56 undergraduate students during the Fall 2020 semester. Students were introduced to the case through a set of resources, including videos, publications, and news articles, and they created a pre-role-play scenario concept map. After participating in the roleplay scenario discussions, students completed a post-discussion concept map as a group activity.

Analysis of the pre-and-post concept maps shows students were able to identify a greater number of concepts and ethical dilemmas after participating in the role-play scenario. This research reduces some of the barriers to role-play activities being incorporated in the classroom from an assessment perspective.

1. Introduction

Algorithm-supported technologies have become increasingly common in the "technologized everyday" [1], all while affecting people's personal and professional lives worldwide. In their personal lives, these technologies attempt to modernize friendships and intimacy in a more open, public manner [2]. In the professional world, efficiency, expanding production capabilities, and solving mundane tasks are some of the ways these technologies have been applied across domains [3]. However, there is increasingly less choice associated with interacting with these systems. Users can opt into using some algorithmically-supported systems, but others are ubiquitous and unavoidable. For example, recommendation systems based on your shopping cart [4], facial recognition in public spaces [5], voice-assistants constantly surveying spaces for keywords [6], and human resources management [7], [8] are all examples of how commonplace the use of these technologies has become.

The prevalence of algorithmic-supported technology has encouraged the development of improved security and authentication processes. Biometric technology, which uses unique human characteristics to establish these identification processes, has emerged as a standard technology to facilitate more secure interaction with systems [9]. Facial recognition technology (FRT) is one such biometric technology that has been rapidly growing for its use as a component with other technology (i.e., smart mobile assistants) and as a product itself (i.e., facial recognition and identification software). The merits of FRT have been largely debated due to the ethical concerns regarding the "assetization" [10] of one's privacy to enable the technology to identify, verify, search, or sort based on human features [11]. FRT and the data generated through it can be likely abused even with strong regulation.

There is no doubt that the field of biometrics is steadily growing, primarily due to the increase in technology use due to the COVID-19 pandemic [12]. With the field's growth, companies are steadily hiring more machine learning engineers, data scientists, and people who can work with these exceedingly complex systems. However, how prepared are these employees to make decisions working with systems that can change how people interact with the world? There is some impetus for businesses to be held accountable for this preparation as it largely affects the perception of their products/services and the potential blowback from the services they provide [13]. Therefore, developing an ethical mindset should not be considered an annual training topic but rather something that employees will be engaging with every day.

Educational institutions play a significant role in preparing employees for the workforce as well, as students trained to work with these technologies will be required to address ethics in their products, services, and work from their first day. The need for meaningful ethics instruction has only continued to grow with the increase in new systems that rely on algorithms, artificial intelligence, machine learning, and other adjacent fields. We believe that higher education systems are critical to providing students with the tools to recognize, interact with, and make decisions related to these technologies, all while focusing on ethics and fairness as core principles. The ability to nurture students' ethical mindset should be integrated into the domain coursework to encourage a view of the interconnectedness of these concepts.

This paper will assess engineering students' identification of concepts and ethical dilemmas related to algorithmic systems in general, but more specifically to FRT. Concept maps are used to identify student understanding before and after participating in the role-play scenarios (RPSs), which serve as a synthesized learning activity for students.

2. Related Work

2.A. Algorithmic harm in Technology

Today, algorithms, artificial intelligence, and data-supported systems have become synonymous with enabling technology. However, the harms and consequences associated with these technologies cannot be ignored simply for their benefits. Some researchers have questioned the impact of these technologies on the future of work, especially how human capital will be affected by machines performing more tasks and what form this may take in public, private, and gig work [14]–[16].

Other researchers raise concerns about how the inputs, outputs, and black-box nature of these technologies can be detrimental to society at large. In a whitepaper published in the Yale

Journal of Law & Technology, Slaughter et al. [17] present a taxonomy of algorithmic harms associated with algorithmic dependent technologies, such as FRT. The authors outline six harms: 1) faulty inputs, 2) faulty conclusions, 3) failure to adequately test, 4) discrimination by proxy, 5) surveillance capitalism, and 6) inhibiting competition. The first three harms are directly related to flaws in the design of algorithms, and the next three outline how "even sophisticated algorithms still systemically undermine civil and economic justice (page 7)".

The call for algorithmic ethics has come from researchers across domains to address issues of privacy, bias, and data misuse by organizations charged with the stewardship of people's personal information.

2.B. Teaching technology ethics to engineering students

Engineering education researchers have acknowledged ethics coursework as a critical requirement for engineering students to learn during their early-career training and development of their engineering identity [18]–[20]. Although there is some variation in how engineering higher-education organizations institutionalize ethics instruction, the values promoting responsibility, fairness, loyalty, and avoiding conflicts of interest, discrimination, and unfair competition are often shared [21]. These values are expressed across other domains in the institution, but they are especially emphasized in the field due to the mission of care and standard of work professional engineers must demonstrate.

Ethics instruction can take different forms depending on who the students are, what their level of experience may be, and the goals of the instruction. The type of interventions can also be actively shaped by institutional-level goals [22]. For undergraduate students, mapping the landscape of a specific topic and recognizing potential ethical dilemmas is an important first step. Due to the variety of student backgrounds, it is not uncommon to have both students who have never engaged with the topic before and those that have been exposed to it through work, training, or other activities. To navigate the complexities of both developing and using technology that has a spectrum of potential benefits and consequences, it is essential to explore the topic starting with a fundamental view.

2.C. Role-Plays and Concept Maps

Role-play activities (sometimes also called role-play scenarios or simulations) put participants in a defined scenario and facts with defined roles to interact and create a simulated interaction [23]. Participants engage with the materials provided and negotiate the facts presented with their own experiences and understanding to continue the conversation in a genuine but open way. In the educational setting, role-plays successfully allow students to engage with multiple perspectives and opinions about a topic they are learning [24]. As the experience relies on participants taking on other perspectives, the role-play case should be well defined but leave room for the participant to make decisions based on their judgment on how the interaction would go.

Role-play activities have been used to instruct topics within engineering education in the past, specifically when instructing on ethics. Loui [24] used role-plays to explore how students' professional engineering identity matures and expands from engaging with other engineers. Brummel & Daily [25] used role-play scenarios to provide students with expert witness reporting guidance for test traffic crashes. [26] integrated role-plays as a component activity for each of the modules in an entrepreneurship class focused on bringing together business and engineering innovations.

Although role-play activities are effective in allowing students to take on differing perspectives, assessment for these activities can be troublesome, especially for classes of larger size, due to the individualized nature of the activity. Some activities to grade these activities include concept maps, reflection assignments, and papers conducted in a pre-and-post format to measure what students understood before and after participating in the activity. In this study, we focus on the use of concept maps to serve as an assessment tool for student learning through the guided RPS activity.

Concept maps can be used to address this issue of assessment. According to Novak and Gowin [27], "concept maps are intended to represent meaningful relationships between concepts in the form of propositions." Due to their design, concept maps can be created in a programmatic way that allows for ease of grading. This tool allows assessment designers to create both wide or narrow, shallow or deep evaluations of understanding based on the evaluator's needs. Coupled with the pre-and-post nature of the assessment, participants can explore the effect of the intervention through more detailed responses.

3. Research Study

The following section describes the research questions, structure of the course, and roleplay case scenario used for this study.

3.A. Research Questions

The following research questions were addressed in this study:

RQ1. Was there any extension in the number and depth of concepts related to FRT evident through comparing pre-and-post role-play concept maps after participation in the RPS activity?

RQ2. What concepts and ethical dilemmas related to FRT did students identify in their preand-post RPS concept maps?

3.B. Data Collection

For this study, data were collected from an undergraduate course on Information Technology (I.T.) within the College of Engineering at a public university in the United States. The course covers topics required of all students in the I.T. program. 56 students, juniors and seniors, participated across 12 groups of 4-6 participants. Due to the COVID-19 pandemic, classes were taught through an online format with synchronous instruction.

The course outcomes include understanding how the growing reliance on I.T. affects the global environment, gaining an appreciation of the impact on societies around the world, and gaining knowledge of professional codes of ethics, ethical decision-making models, and processes. The course is split into four modules addressing topics that help expose students to a gamut of uses and influences of technology: 1) Societal Impacts of Technology, 2) Privacy and Surveillance, 3) Data & Algorithms, and 4) Ethics. The data for this study comes from the second module of the class and focuses on machine learning, artificial intelligence, and algorithms being used to conduct biometric facial recognition.

Each week, students were assigned resources and materials to engage with, which included published journal papers, news articles, forums, and videos. After engaging with the resources, students were given a tutorial on creating a concept map before participating in the role-play discussion. This was an individual activity. The specific instruction asked students to "Draw a concept map to depict the terrain of "facial recognition." It should include different aspects of technology, applications, stakeholders, and/or other aspects you consider relevant." Students were encouraged to use any means to generate the concept map (specialized software, wordprocessing tools, or even hand-drawn) to encourage students to address the topics in whatever way they were comfortable. Most students used flowchart software to create the concept map. A few students hand drew and labeled their concept map, before submitting a scanned version for grading.

Students then participated in the RPS activity, which is roughly a 45-minute-long session where 4-6 participants engaged in a semi-structured discussion on the topic. Students were randomly assigned roles from within the case. This group activity served as a central activity to connect all the resources and the case to the overall topic of the module. Students were encouraged to use and synthesize all the material they covered in the module while navigating the intricacies of the role assigned. For the final part of the assignment, students were tasked with creating an updated concept map on FRT. As this concept map was supposed to take into consideration the perspectives of all the stakeholders taking part in the RPS activity, the final concept map was submitted as a collaborative group concept map.

Figure 1: An example of a study participant's completed concept map on the terrain of biometric facial recognition technology.

3.C. Role-Play Case Study

The RPS used for this study explored biometric facial recognition technology being used to reduce and prevent the transmission of COVID-19 at a university campus. Role-play participants served as members of a task force at Andrew Hamilton University (AHU), an imaginary university set in the United States, tasked with making informed decisions on adopting FRT on campus. The campus has already established a mobile application reporting system that is supposed to be used by all community members on campus. There is no verification process to confirm that those on campus have completed their report for the day. The FRT system is supposed to fix the shortcomings of the mobile application. Members of the task force are asked to provide justification based on the specifics of their role for whether FRT should be used on campus and how it could be implemented

The role-play case scenario provided to participants can be found in Appendix A. The roles assigned to participants can be found in Appendix B. Further details of the case, examples of similar cases, and the application of role-playing for ethics are available in the following related papers [28]–[30].

4. Methods

In this section, we discuss the methods used to assess the concept maps and the categories used to classify ethical dilemmas identified by students

4.A. Concept Map Scoring

There are two commonly used methods to address scoring concept maps. More commonly known as the traditional method [31], the first method focuses on giving weights to different elements within the concept map. Novak and Gowin [27] outline this technique by focusing on the number of concepts based on a relationship (scored 1 point), levels of hierarchy within the map (scored 5 points), number of cross-links that are presented scored 2 points), and valid examples that are used (scored 1 point). This traditional assessment technique has been explored more over time, with additional studies providing new context and learning for places where they are best used.

The second method, termed a 'holistic scoring method' by Besterfield-Sacre et al. [32] scores the concept maps based on three categories: comprehensiveness, organization, and correctness. This approach takes into account the content of the concept map in a complete way, although it may take more time for reviewers to rank the quality of concept maps initially.

We scored the pre-and-post concept maps together to reach consistency in the assigned scores for each map. After scoring them once, all the maps were reread to make sure the scores were fair. We initially attempted to use the traditional method but ultimately elected to use the holistic scoring technique. We noticed that using the traditional method for scoring the concept maps resulted in scores that seemed overinflated as it emphasized quantity over quality. For most of the participants, this was the first time they were using concept maps, and they did not understand how to emphasize the structure of the maps without just adding more branches. Students seemed aware of techniques to score more based on the sheer number of concepts they identified, including fracturing a concept into smaller chunks to show more concepts. They focused more on putting as many concepts down as possible, which added much noise to the analysis.

The holistic method provided a more accurate representation of the scores in our data set.

In addition, it allowed the participants to contextualize what they learned through the provided resources and allowed them to bring together the discussions from the RPS activity. Using this approach, the concept maps were graded as follows:

Holistic Method Scoring Criteria

Score

0 1 2 3

Comprehensiveness

The map does not describe the breadth of topics related to FRT.

The map lacks detail. It includes less than four concepts related to applications, stakeholders, pros, cons, limitations, or other details of interest.

The map has general details. It includes less than eight concepts related to applications,

stakeholders, pros,
cons, limitations,
or other details of
interest.
The map has
specific details and
examples. It
includes eight
concepts related to
applications,
stakeholders, pros,
cons, limitations, or
other details of
interest.
Organization
The map does
not include
any
hierarchies or
cross-links
between
concepts.
The map is
arranged with
hierarchies or
cross-links, but
either may be
missing or not be
developed

completely.
The map is
arranged with both
hierarchies and
cross-links. May be
missing a few of
each.
The map is arranged
with both
hierarchies and
cross-links. It is well
developed and
connects concepts
across the map well.
Correctness
The map does
not correctly
describe the
FRT.
The map describes
FRT in a naïve
way and may
contain
inaccuracies in
both concepts and
links.
The map describes
FRT in a largely
accurate way.

There may be some inaccuracies in both concepts and links.

The map describes FRT correctly and provides a contextual understanding of the subject matter using logic and examples.

Table 1: Modified concept map scoring criteria based on Besterfield-Sacre et al. (2004).

4.B. Participants Identified Ethical Dilemmas

For RQ2, we were interested in understanding what specific ethical dilemmas (and their potential harm) students were able to identify within the case study. Slaughter et al. (2021) outlined some of the implications of algorithmic harm today by creating a baseline taxonomy that can be explored within the purposes for which algorithms are ultimately used. The taxonomy of harms related to algorithms, including those that are used in Facial Recognition technologies, are:

Harm Category	Description of Harm
Faulty Inputs	Skewed, misrepresentative, or biased data or inputs
Faulty Conclusions	Conclusions that are inaccurate or misleading
Failure to Test	Biased or harmful outcomes due to inadequate testing
Proxy Discrimination	Neutral characteristics used to emulate protected groups
Surveillance Capitalism	Commercialization of privacy
Threats to Competition	Algorithm supported collusion between organizations

Table 2: Algorithmic harms as described by [17].

Using this white paper, we matched the concepts that students identified through their concept map with those outlined as algorithmic harms in the paper. Each of the items outlined within the report was discussed in detail as part of the resources provided to students through the class readings, videos, and discussion and were also woven into the guiding questions introduced in the RPS activity. We scored each concept map based on the algorithmic harms that were identified or implied by concepts outlined on the map. The authors discussed and agreed on the presence or absence of each category within each concept map. Some participants explicitly referenced a harm.

5. Results

This section outlines the results of the concept map pre- and post-scoring, along with the results of students' identification of ethical dilemmas.

5.A. Concept Maps Scored Results

We used the Wilcoxon signed-rank test to compare the results of the pre-and-post discussion concept maps. Table 1 shows the descriptive statistics and the results of the Wilcoxon signed-rank t-test for pre-and-post concept maps. According to all three criteria (comprehensiveness, organization, and correctness), the test revealed that the student scores were significantly higher after participating in the role-play discussion. According to Cohen [33], student's comprehensiveness scores increased with a moderate effect size based on the r-value (r = 0.39), organization scores increased with a small effect size (r = 0.26), and the correctness scores increased with a moderate effect size (r = 0.47).

Descriptive Statistics

Comprehensiveness

(n = 57)

Organization

(n = 57)

Correctness

(n = 57)

Pre Post Pre Post Pre Post

Min 1 1.5 0 1 1 1.5

1st Quartile 1.5 2 1 1 1.5 2

Median 2 2 1 1.5 2 2.5

3rd Quartile 2 2.5 2 2 2 2.5

Max 3 3 3 3 3 3

Average 1.87 2.27 1.42 1.76 1.81 2.27

Wilcoxon Matched Pair Statistics

Comprehensiveness

(n = 57)

Organization

(n = 57)

Correctness

(n = 57)

P value 0.0000128* 0.00487* 0.000000240*

Cohen’s Effect Size Moderate Small Moderate

*$p < 0.05$.

Table 3. Results of descriptive tests and Wilcoxon Matched Pair statistics.

Based on these results, we can say that there was an extension in the number and depth of concepts related to FRT through analysis of the pre-and-post role-play concept maps.

5.B. Identified Ethical Dilemmas

Through the concept maps created in the pre-and-post activities, students identified more concepts that could be mapped to the taxonomy of harms. Table 4 below outlines the percentage of concept maps that identified each item in the taxonomy.

Pre-Discussion

Concept Map

Post-Discussion

Concept Map

Faulty Inputs 55% 86%

Faulty Conclusions 30% 86%

Failure to Test 15% 52%

Proxy Discrimination 48% 55%

Surveillance Capitalism 11% 29%

Inhibit Competition 0% 0%

Table 4. Students' recognition of concepts matching the Taxonomy of Harms [17]

Overall, students were able to identify a breadth of harms of algorithmic-supported technology. In five of the six categories, students identified more potential harms of using FRT from before they participated in the RPS activity.

6. Discussion

By exploring the use of concept maps and role-play activities, we understand how these tools can be used together to explore topics of ethics applied to algorithmic-supported technologies. Overall, concept maps function well when paired with role-play activities to assess and evaluate students' participation. These findings help lower some of the assessment barriers to adopting role-play activities.

The RPS activity helped affirm students' understanding of the specific concepts by letting them talk about what they recognized, but it also encouraged others to bring their role's perspectives to the conversation. We expected that the group concept maps would score better than the individual concept maps as students were supposed to work together and create a map representing their group's consensus. Participating in the role-play discussion and collaborative effort of creating the concept maps supports an environment of collaborative learning and shared knowledge. In our results, the group concept maps did score higher across all our metrics, but specifically, they raised the minimum and average scores across the criteria (Table 3). Students who were unable to recognize many ethical concepts at play alone were able to recognize more by participating in the activity. Additionally, students across the board identified more concepts related to the Taxonomy of Harms [17].

It is essential to highlight the specific learning experiences in implementing these tools.

For concept maps, we found it important to encourage the evolution of the drawn map as more resources are provided, and discussion takes place. Students often missed rudimentary but important terms and concepts in the first concept map drawn. They also did not elaborate on the cross-links between different topics as often. However, on the second concept map, students were able to tease out the concepts or terms that they had missed on the first.

Additionally, by design, the RPS activity is expected to make students negotiate between the way they personally feel about the case and how their assigned role would behave. This constant brokering of perspectives is important to keep in mind across the breadth of the class. Some students' perspectives aligned with those of their role, but this was not true for everyone. Some students came into the class without feeling particularly strongly for or against the topic, but on completing the activities did have a preference and opinion. The roles are written to leave room for the intersection of participants' personal experiences, and every participant who played a specific role may bring their experiences to influence the case differently. This is fundamentally important because people behave in different ways, even when given the same information. If we are truly aiming to instruct students on how to develop an ethical mindset, we should give them the tools to understand, take perspectives, and answer questions.

7. Conclusion

The goal of the study was to explore how engineering ethics can be explored through the use of concept maps and role-play activities in helping students take on different perspectives on an issue. The timeliness of the topic is paramount as students will be put in ethically grey situations sooner rather than later as they enter the workforce. Our results show that students were able to identify significantly more concepts within the terrain of FRT. They were also able to identify more ethical dilemmas before and after their participation in the RPS activity. Students were better able to identify the problems in the creation of algorithms and the larger social issues at play. Our study provides a way for role-play activities to be adopted into the classroom with fewer barriers to assessment.

Acknowledgments

This work is partly supported by U.S. National Science Foundation Awards#1937950, 1939105; USDA/NIFA Award#2021-67021-35329. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funding agencies. The research study has been approved by the Institutional Review Board at George Mason University.

Appendix A: Role-Play Scenario – Case Study

Trisha Brown is the Chief of Safety and Emergency Management (SEM) office at a large suburban university, the Andrew Hamilton University (AHU). She is responsible for the safety and security of all students, faculty, and staff on campus. In recent months, her responsibilities have suddenly shifted from the regular aspects of the work – the police force, traffic safety, fire drills – towards responding to the needs of keeping the university functional and safe during a pandemic. She and members of her office have been working round the clock to ensure that the campus is ready to open for the new semester.

While they work towards this goal, she is also engaged in planning for the future of the campus and as part of this effort, she is looking at technology solutions for the problem at hand. She has to be prepared, she has realized, for the eventuality that a vaccine will take some time to develop, and even if it does it might not be as effective as it needs to be and not everyone might agree to be vaccinated. She has assembled a task force with members from across the university and has worked hard to ensure that all constituents are well represented. On the recommendation of this task force, to keep the decision-makers informed and to be able to track the health of anyone who is on campus, she has championed an app where users can upload their health information daily.

One member of this task force, a staff member of the Information Technology Software and Services (ITSS) group has recently approached her with another innovative technology that can address one of the shortcomings of the app, which is that users have to proactively submit their information and there is no way to capture their health automatically. Even though the university is thinking of taking people's temperature as they enter buildings, this approach will require manpower and it might be too late if someone has been on campus for a while already and interacted with others. The new technology uses facial recognition to identify if someone is on campus and then quickly looks them up in the app database to map if they have entered their information. If not, they get a notification on their phone, and security is alerted to their presence and where they are on campus.

Although Trisha is appreciative of the power and possible usefulness of this technology, she is a little circumspect of the privacy, bias, and discrimination issues that she has read about. For instance, she is unsure how to balance the pros and cons of this solution especially since facial recognition technology and solutions for analysis are changing fast. She knows that a lot of parameters must be looked at and examined in-depth if a good solution must be reached regarding the usefulness of this potential solution. Consequently, she has asked her task force members to learn more about the use of facial recognition and then report back to her with their personnel recommendations about this solution and she has further instructed the task force to reach a consensus on their recommendation so that she can forwards with making this decision.

Each of you has been assigned one of these roles as members of Trisha's task force and today you are meeting to present your personal recommendation and why you suggest that and then discuss as a team to come towards some kind of consensus on your recommendation to Trisha.

Appendix B: Role-Play Scenario – Participant Roles

Role 1: Vice President in the Information Technology Software and Services (ITSS)

Role 1 recently moved to AHU after a successful career in the industry. In their last job as Chief Technology Officer (CTO) of a small company, they successfully led the migration of their legacy software to a cloud-based solution. They are an unabashed technology optimist who believes that information technology can solve almost any organizational problem. They believe once a solution has been implemented any problems associated with it can be addressed. They point out that no new technology comes without some downsides that must be overcome.

Role 2: Organization psychology undergraduate and VP of AHU student organization

As part of their position, and because of their interest in the wellness and wellbeing of fellow students, Role 2 represents the student body on this task force. They are a frequent user of social media and have used it well to drum up support for causes that they believe in on campus. They have been vocal about the safety of women on and around the campus. They had recently launched a major campaign against bullying on social media and had also campaigned for the COVID app when it launched.

Role 3: Professor in the Department of History and a member of the faculty senate.

Role 3 represents faculty on this task force and serves on many other committees as well. As a historian, they often take a long-term perspective on issues and is often circumspect of technologybased solutions especially when they think there are other, simpler ways of solving a problem. When the app for COVID was being rolled out, they pushed for self-reported data entry by the user rather than some form of automatic collection of information. They are often preoccupied with issues of surveillance and new limits on privacy due to technology.

Role 4: Associate vice-president in the Provost office at AHU

Role 4 serves on the team that looks at student admissions and retention. They are worried that a perception that the university is not doing enough for student safety might impact admissions. They made sure that the admissions office publicized the COVID app and reassured students and their parents that AHU was taking all the necessary steps. They think facial recognition software would make a huge impact in terms of publicity and will put AHU on the map when it comes to using technology to ensure safety during COVID. However, they are worried about where the funds for the technology and the cameras will come from and whether they will have to spend time trying to get permission from students to use this data.

Role 5: Senior Director in the Office of Equity and Inclusiveness (OEI) at AHU

Role 5 works towards a range of efforts such as transfer agreements with community colleges, outreach in K12 schools, summer camps for kids that can assist with advancing AHU's mission to admit and support a broad range of students. They are naturally inclined to be skeptical of any effort that might undermine inclusiveness on campus and this includes technology-driven projects. They had raised the question about access to smartphones and data plans when it came to the use of the COVID app. They are worried that a facial recognition-based solution to COVID detection and prevention might introduce other unintended problems with grave consequences for students and faculty.

Role 6: Director of a non-profit consulting firm that works with both private and public sectors

Role 6 works in the field of facial recognition with both the government and the industry. They are providing consulting for the task force pro bono. They are a renowned expert on the topic of facial recognition and were responsible for creating one of the first deployable applications of facial recognition, based on an algorithm she wrote, that they later sold to a large company. They have been a proponent of facial recognition and have seen the technology grow by leaps and bounds over the past decade. They are cognizant of problems with FR technology, especially security risks and algorithmic bias, but believe it is not the technology itself but how it is applied that matters.

References

[1] M. Willson, “Algorithms (and the) everyday,” Information, Communication & Society, vol. 20, no. 1, pp. 137–150, Jan. 2017, doi: 10.1080/1369118X.2016.1200645.

[2] D. Chambers, “Networked intimacy: Algorithmic friendship and scalable sociality,” European journal of communication (London), vol. 32, no. 1, pp. 26–36, 2017, doi: 10.1177/0267323116682792.

[3] K. Kyung-Hoon, “Government oversight in managing risks of AI in health care,” Reuters,

Jan. 12, 2022. https://www.reuters.com/legal/litigation/government-oversight-managingrisks-ai-health-care-2022-01-12/ (accessed Jan. 19, 2022).
[4] M. Kantor, “When Data Meets AI, Retailers Predict Shopping Trends,” Forbes, Apr. 12, 2019. https://www.forbes.com/sites/esri/2019/04/12/halo-forecasting-predicting-customershopping-patterns/ (accessed Jan. 19, 2022).
[5] T. Klosowski, “Facial Recognition Is Everywhere. Here’s What We Can Do About It.,” Wirecutter: Reviews for the Real World, Jul. 15, 2020. https://www.nytimes.com/wirecutter/blog/how-facial-recognition-works/ (accessed Jan. 19, 2022).
[6] R. Molla, “Your smart devices are listening to you, explained,” Vox, Sep. 20, 2019. https://www.vox.com/recode/2019/9/20/20875755/smart-devices-listening-humanreviewers-portal-alexa-siri-assistant (accessed Jan. 19, 2022).
[7] R. Metz, “There’s a new obstacle to landing a job after college: Getting approved by AI,” CNN, Jan. 15, 2020. https://www.cnn.com/2020/01/15/tech/ai-job-interview/index.html (accessed Jan. 19, 2022).
[8] S. Soper, “Fired by Bot at Amazon: ‘It’s You Against the Machine,’” Bloomberg.com, Jun. 28, 2021. Accessed: Jan. 19, 2022. [Online]. Available: https://www.bloomberg.com/news/features/2021-06-28/fired-by-bot-amazon-turns-tomachine-managers-and-workers-are-losing-out
[9] O. Arab, “What The Rapid Adoption Of Biometrics Means For Your Business,” Forbes, Jan. 21, 2022. Accessed: Feb. 03, 2022. [Online]. Available: https://www.forbes.com/sites/forbesbusinessdevelopmentcouncil/2022/01/21/what-therapid-adoption-of-biometrics-means-for-your-business/
[10] K. Birch and F. Muniesa, Assetization: Turning Things into Assets in Technoscientific Capitalism. MIT Press, 2020.
[11] M. Smith and S. Miller, “The ethical application of biometric facial recognition technology,” AI & Soc, Apr. 2021, doi: 10.1007/s00146-021-01199-9.
[12] “COVID-19 and the future of disruptive technologies,” KPMG US - Technology Disruptors, Aug. 31, 2020.

[13] C. Gurnani, “The AI revolution is here. It’s up to businesses to prepare workers for it | CNN Business,” CNN, May 30, 2019. https://www.cnn.com/2019/05/30/perspectives/ai-businessjobs/index.html (accessed Jan. 19, 2022).
[14] N. J. Fast and A. S. Jago, “Privacy matters… or does It? Algorithms, rationalization, and the erosion of concern for privacy,” Current Opinion in Psychology, vol. 31, pp. 44–48, Feb. 2020, doi: 10.1016/j.copsyc.2019.07.011.
[15] A. Jaiswal, C. J. Arun, and A. Varma, “Rebooting employees: upskilling for artificial intelligence in multinational corporations,” International journal of human resource management, vol. ahead-of-print, no. ahead-of-print, pp. 1–30, Mar. 2021, doi: 10.1080/09585192.2021.1891114.
[16] C. Østerlund, M. H. Jarrahi, M. Willis, K. Boyd, and C. Wolf, “Artificial intelligence and the world of work, a co-constitutive relationship,” Journal of the Association for Information Science and Technology, vol. 72, no. 1, pp. 128–135, 2021, doi: 10.1002/asi.24388.
[17] R. K. Slaughter, J. Kopec, and M. Batal, “Algorithms and Economic Justice: A Taxonomy of Harms and a Path Forward for the Federal Trade Commission,” Yale Journal of Law & Technology, vol. 23, 2020, Accessed: Jan. 19, 2022. [Online]. Available: https://yjolt.org/algorithms-and-economic-justice-taxonomy-harms-and-path-forwardfederal-trade-commission
[18] J. Buckeridge, “Do Engineers Still Move Mountains? A ‘New World’ Appraisal in Light of Ethics, Engineering, Economics & the Environment,” p. 6, 2011.
[19] J. R. Herkert, “Engineering ethics education in the USA: Content, pedagogy and curriculum,” European journal of engineering education, vol. 25, no. 4, pp. 303–313, 2000, doi: 10.1080/03043790050200340.
[20] M. Jose Casan, M. Alier, and A. Llorens, “Teaching Ethics and Sustainability to Informatics Engineering Students, An Almost 30 Years’ Experience,” Sustainability (Basel, Switzerland), vol. 12, no. 14, pp. 5499-, 2020, doi: 10.3390/su12145499.
[21] A. Colby and W. M. Sullivan, “Ethics Teaching in Undergraduate Engineering Education,” Journal of Engineering Education, vol. 97, no. 3, pp. 327–338, Jul. 2008, doi:

10.1002/j.2168-9830.2008.tb00982.x.

[22] J. L. Hess and G. Fore, “A Systematic Literature Review of US Engineering Ethics Interventions,” Science and engineering ethics, vol. 24, no. 2, pp. 551–583, 2017, doi: 10.1007/s11948-017-9910-6.

[23] B. J. Brummel, C. K. Gunsalus, K. L. Anderson, and M. C. Loui, “Development of Role-Play Scenarios for Teaching Responsible Conduct of Research,” Science and engineering ethics, vol. 16, no. 3, pp. 573–589, 2010, doi: 10.1007/s11948-010-9221-7.

[24] M. C. Loui, “Ethics and the Development of Professional Identities of Engineering Students,” Journal of Engineering Education, vol. 94, no. 4, pp. 383–390, Oct. 2005, doi: 10.1002/j.2168-9830.2005.tb00866.x.

[25] B. J. Brummel and J. S. Daily, “Developing Engineering Ethics through Expert Witness Role Plays,” Jun. 2014, p. 24.400.1-24.400.13.

[26] J. Ferrill and L. Getzler-Linn, “Teaching Ethics Specific To Entrepreneurship,” Jun. 2006, p. 11.1209.1-11.1209.22.

[27] J. D. Novak and D. B. Gowin, Learning how to learn. Cambridge [Cambridgeshire] ; Cambridge University Press, 1984.

[28] D. A. Martin, G. Bombaerts, and A. Johri, “Ethics is a disempowered subject in the engineering curriculum,” 49th SEFI Annual Conference: Blended Learning in Engineering Education: Challenging, Enlightening - and Lasting? European Society for Engineering Education (SEFI), 2021.

[29] A. Hingle, A. Johri, H. Rangwala, and A. Monea, “Using the Boeing Max Air Disaster as A Role-play Scenario for Teaching Ethical Thinking,” presented at the 2021 ASEE Virtual Annual Conference Content Access, Jul. 2021.

[30] A. Hingle, H. Rangwala, A. Johri, and A. Monea, “Using Role-Plays to Improve Ethical Understanding of Algorithms Among Computing Students,” presented at the 2021 IEEE Frontiers in Education Conference (FIE), Oct. 2021. doi: 10.1109/FIE49875.2021.9637418.

[31] M. Besterfield-Sacre, J. Gerchak, M. R. Lyons, L. J. Shuman, and H. Wolfe, “Scoring Concept Maps: An Integrated Rubric for Assessing Engineering Education,” Journal of Engineering Education, vol. 93, no. 2, pp. 105–115, 2004, doi:

https://doi.org/10.1002/j.2168-9830.2004.tb00795.x.

[32] M. Besterfield-Sacre, J. Gerchak, M. R. Lyons, L. J. Shuman, and H. Wolfe, “Scoring Concept Maps: An Integrated Rubric for Assessing Engineering Education,” Journal of Engineering Education, vol. 93, no. 2, pp. 105–115, 2004, doi: https://doi.org/10.1002/j.2168-9830.2004.tb00795.x.

[33] J. Cohen, Statistical Power Analysis for the Behavioral Sciences, 2nd ed. New York: Routledge, 1988. doi: 10.4324/9780203771587.