Robotics & Automation

SOCIAL IMPACT CASE STUDIES

These group activities were developed for the geekStarter Robotics & Automation workshops held in April and November 2019 and are intended for educational use.

December 2019
Calgary, Alberta, Canada

How to use

Students will work in groups, with each group focused on a specific case study. Each case study consists of an Overview and several Roles that invite the students to look at the case study from different perspectives.

In the first part of the activity, students read through their case study and answer the questions individually. The second part of the activity is completed in groups, following the instructions provided.

List of Case Studies

- A.I. Personal Assistant
- Facial Recognition
- HoloLens
- Interview with A.I.
- Self-Driving Cars
- CubeSats
- Exoskeletons
- Robots for Public Spaces
- Smart Prosthetics
- Water Drones

Social Impact Activity: Perspectives

GROUP INSTRUCTIONS: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.

- As a group, create a **brief summary** of the case study and the technology involved, along with main benefits and concerns.

- With your group, discuss and agree on a set of (minimum 3) **rules and recommendations** for future uses and applications of the technology in a socially responsible way.

- Choose a representative of the group who will **share** your group's summary and recommendations with the rest of the audience. Write down any feedback received from the audience.

Case Study: Google's A.I. (Duplex) and customer service
Source: Canada's National Observer article: Google's A.I. personal assistant sparks concerns about future of communication

There is no denying it, people today are busy. So busy, that performing a task such as booking appointments over the phone can feel like wasted time. Google is trying to help with this by creating an artificial intelligence (A.I.) service called Duplex, which allows users to outsource booking appointments by phone to a virtual personal assistant. In two separate cases, the employees of the business who answered the phone had no clue they were interacting with a robot.

In calling about a restaurant reservation, the A.I. was able to handle a series of questions for almost a minute, and wasn't puzzled when told the booking wasn't needed because the restaurant wouldn't be busy. The A.I. computerized voice occasionally drops some "ummms" and "mm-hmms" in the script to appear more life-like. Google mentioned that this A.I. cannot carry out general conversations, will identify itself at the start of the call and let the receiver of the call know that it is recording the call.

Morrison, an associate professor at the University of Waterloo who studies technology's impact on culture, said "I live in fear of a Google Duplex world where I have to make a hair appointment and the person on the other end treats me like a robot, and is awful to me, and how am I going to prove that I'm a human?.....Is it going to make all of our conversations with each other deeply suspicious and mistrustful?"

Google states that this technology is not only convenient, but will also help with accessibility and language barriers. The company says that it will benefit traditional businesses which don't have online booking services, such as OpenTable or Urbanspoon.

University of Toronto Professor Gerald Penn calls the A.I. "brilliant", also noting that someone who knew they could be talking to Google's software would likely be able to outsmart it. Penn said the technology could eventually have a significant impact on the customer service industry: "What's going to happen to small retailers when a significant part of the phone calls they're receiving are not from people? That could turn into a kind of negative spiral where they're disincentivized to provide any kind of decent phone support, because they're just talking to robots anyway."

Roles/Profiles

- Restaurant employee who takes phone reservations
- Apple engineer working on rival technology
- CEO's assistant who uses Google Duplex to make frequent lunch reservations
- Regular customer who phones in to the restaurant make reservations
- Lead engineer of Google Duplex

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are the benefits of Google AI assistant, in your opinion?
2. What concerns do you have and how would you address them?
3. Are you in favour of this technology, or not? Explain.
4. What regulations will be needed if AI assistants become more widespread?

WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

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geekStarter Robotics and Automation Workshop - Edmonton 13 April 2019
Social impact activity: Perspectives

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YOUR ROLE

Engineer at Apple - working on rival technology

Answer the following questions **from the perspective of your assigned role**

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YOUR ROLE

Assistant to CEO - makes frequent restaurant bookings

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YOUR ROLE

Lead engineer at Google - developing AI Duplex technology

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YOUR ROLE

Regular restaurant customer - phones in to make reservations

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YOUR ROLE

Restaurant employee - takes phone reservations

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Source South China Morning Post: Drones, facial recognition and a social credit system: 10 ways China watches its citizens (Aug 2018)

Facial recognition technology uses algorithms to match someone's facial characteristics across photos and video. The technology is already commonplace in many aspects of contemporary life. It is used to tag people on Facebook, to unlock iPhones and PlayStations and to focus cellphone photographs, and soon will be used to admit fans to Major League Baseball games. As the technology advances, "real-time" facial recognition — which involves the constant scanning of live video feeds to match moving faces with a database of still images — is starting to spread.

China plans to create a facial recognition system that can identify people within three seconds – with a 90% accuracy rate. The system will be used for security and government purposes, such as public administration and tracking wanted criminal suspects. The technology is expected to help police catch fugitives and shorten the immigration process.
Various cities have already started using facial recognition to name and shame minor offenders, spot a criminal among thousands-strong crowds and verify the identities of passengers at airports. Facial recognition technology has also been put to use in other areas of Chinese society. A KFC outlet in Hangzhou, China, has rolled out a "Smile to Pay" system; retailers are using it to identify customers and their buying preferences and some toilets in Beijing use facial recognition science to limit the amount of toilet paper dispensed to each individual.

But this new type of facial recognition technology has deepened concerns about mass surveillance, mistaken identifications and the unfair targeting of minorities.
That is because facial recognition has never been perfect, and probably never will be. It cannot say with 100 percent certainty that the faces in two images are the same; most current systems provide a score indicating how likely the match is. A system's accuracy depends on several factors, starting with data used to "train" the algorithms. The broader the database of faces and conditions — people with varied skin tones, captured at various angles and distances and under different lighting conditions — the more accurate the algorithm will be.

Technological advances have improved the accuracy of facial recognition systems, which have evolved from old-style machine learning, based on comparisons of certain facial characteristics, to "neural networks" that take a more holistic view of faces. But the systems still are susceptible to misidentifying people of certain races. A recent MIT study found that facial recognition algorithms developed by Microsoft, IBM and China-based Face++ failed to correctly identify black women far more frequently than white men. One of the MIT researchers, Joy Buolamwini, has also showed that facial recognition systems are unable to determine the gender of famous black women, including Oprah Winfrey, Serena Williams and Michelle Obama.

Roles/Profiles

- Member of a visible minority group - frequent traveller
- Police investigator - crime unit
- Frequent attendee of large public events e.g. sport events, concerts
- Immigration applicant
- Developer of facial recognition technology

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are some benefits of facial recognition technology, in your opinion?
2. What concerns do you have and how would you address them?
3. Which applications of face recognition technology would you keep and which ones would you discontinue? Explain.
4. What would you change or recommend for future applications of this technology?

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YOUR ROLE

Developer of facial recognition technology

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of the facial recognition technology, in your opinion?

2. What concerns do you have, and how would you address them?

3. Which applications of face recognition technology would you keep and which ones would you discontinue? Explain.

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YOUR ROLE

Frequent attendee of large public events (concerts, sports events etc)

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YOUR ROLE

Applicant for immigration

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Various cities have already started using facial recognition to name and shame minor offenders, spot a criminal among thousands-strong crowds and verify the identities of passengers at airports. Facial recognition technology has also been put to use in other areas of Chinese society. A KFC outlet in Hangzhou, China, has rolled out a "Smile to Pay" system; retailers are using it to identify customers and their buying preferences and some toilets in Beijing use facial recognition science to limit the amount of toilet paper dispensed to each individual.

But this new type of facial recognition technology has deepened concerns about mass surveillance, mistaken identifications and the unfair targeting of minorities.
That is because facial recognition has never been perfect, and probably never will be. It cannot say with 100 percent certainty that the faces in two images are the same; most current systems provide a score indicating how likely the match is. A system's accuracy depends on several factors, starting with data used to "train" the algorithms. The broader the database of faces and conditions — people with varied skin tones, captured at various angles and distances and under different lighting conditions — the more accurate the algorithm will be.

Technological advances have improved the accuracy of facial recognition systems, which have evolved from old-style machine learning, based on comparisons of certain facial characteristics, to "neural networks" that take a more holistic view of faces. But the systems still are susceptible to misidentifying people of certain races. A recent MIT study found that facial recognition algorithms developed by Microsoft, IBM and China-based Face++ failed to correctly identify black women far more frequently than white men. One of the MIT researchers, Joy Buolamwini, has also showed that facial recognition systems are unable to determine the gender of famous black women, including Oprah Winfrey, Serena Williams and Michelle Obama.

Now turn the page.

YOUR ROLE

Police investigator - crime unit

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of the facial recognition technology, in your opinion?

2. What concerns do you have, and how would you address them?

3. Which applications of facial recognition technology would you keep and which ones would you discontinue? Explain.

4. What would you change or recommend for future applications of this technology?


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Read the following news story. Please do not look on the back of the page before you finish reading.

FACIAL RECOGNITION TECHNOLOGY
Source NBC news: Facial recognition gives police a powerful new tracking tool. It's also raising alarms. (July 2018)
Source South China Morning Post: Drones, facial recognition and a social credit system: 10 ways China watches its citizens (Aug 2018)

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YOUR ROLE

Person from visible minority group - frequent traveller

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of the facial recognition technology, in your opinion?

2. What concerns do you have, and how would you address them?

3. Which applications of face recognition technology would you keep and which ones would you discontinue? Explain.

4. What would you change or recommend for future applications of this technology?


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Case Study - HoloLens technology

Source: Microsoft Staff: Do not use HoloLens for war (BBC, Feb 2019)
Microsoft CEO: Selling HoloLens to Military is a 'Principled Decision'

HoloLens, first released to developers in March 2016 by Microsoft, allows the wearer to see digital images laid over the real world. The United States Military and Microsoft recently agreed to a $479 Million dollar deal to develop a platform within Hololens for soldiers to use in training.

Through the use of wearable glasses and headsets, key data points will be overlaid onto a battlefield – everything from mapping information to mission parameters to markers defining the movements of allied troops and enemy forces. The device is intended to "increase lethality by enhancing the ability to detect, decide and engage with the enemy." The Army calls this system IVAS, for Integrated Visual Augmentation System.

In February 2019, over 250 Microsoft employees sent a letter of protest to their own company, claiming that Microsoft had engaged in war profiteering when it signed a deal with the US military to provide HoloLens technology to soldiers in the field. Furthermore workers say augmented reality headsets provided to the US army risk 'turning warfare into a simulated video game' further distancing soldiers from the grim stakes of war and the reality of bloodshed.". The letter demands Microsoft cancel the IVAS contract, stop developing "any and all" weapons technologies, and draft a public policy statement on the matter. This appears to be the first time that Microsoft has moved from developing products that are used *by* the military to developing products that can be directly used to kill.

Employees claim that "Microsoft fails to inform its engineers on the intent of the software they are building. There are many engineers who contributed to HoloLens before this contract even existed, believing it would be used to help architects and engineers build buildings and cars, to help teach people how to perform surgery or play the piano, to push the boundaries of gaming, and to connect with the Mars Rover (RIP). These engineers have now lost their ability to make decisions about what they work on, instead finding themselves implicated as war profiteers."

The concern that HoloLens *will* be used in actual combat makes it understandable that some of the company's engineers would be fundamentally unhappy at this development.
This highlights the ethical dilemma that many workers face when working for a company that is involved in new technologies such as AR and AI, and Hololens has prompted workers to demand that Microsoft appoints an external ethics review board to enforce an acceptable use policy.

Roles/Profiles

- Engineer who built the technology
- United States Military Director
- US Soldier in training (new recruit)
- Microsoft President
- US Civilian / anti-war activist

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are some advantages of using Hololens in the military, in your opinion?
2. What concerns do you have and how would you address them?
3. Should the military use this technology, or not? Explain.
4. If the military is allowed to use hololens, what regulations would you put in place?

WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.
- As a group, create a **brief summary** of the case study and the technology involved, along with main benefits and concerns.
- With your group, discuss and agree on a set of (minimum 3) **rules and recommendations** for future uses and applications of the technology in a socially responsible way.
- Choose a representative of the group who will **share** your group's summary and recommendations with the rest of the audience. Write down any feedback received from the audience.

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YOUR ROLE

United States civilian anti-war activist

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YOUR ROLE

Engineer who built HoloLens

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1. What are some benefits of using HoloLens in the military, in your opinion?

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YOUR ROLE

Microsoft president

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YOUR ROLE

United States Military Director

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Now turn the page.

YOUR ROLE

United States Soldier - in training

Answer the following questions **from the perspective of your assigned role**

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JOB INTERVIEW WITH AI
Source CBC News article: Help wanted, apply to the AI: Why your next job interview could be with a machine

Companies often receive so many job applications that they have to resort to a lottery process to screen the applicants. If not done by lottery, the screening process is often biased based on the candidates' names, place of birth, or where they studied. A large 2017 Canadian employment study found that people with non-Anglo-Canadian names and foreign qualifications have a much lower chance to get a callback for a job interview. These hiring practices miss out qualified individuals and some great talent.

To make the hiring process more efficient and fair, a Canadian startup created an artificially intelligent (AI) system, which helps companies evaluate applications for jobs that involve dealing directly with clients, and shortlist candidates for job interviews.The algorithm uses facial and speech analysis to evaluate soft-skills such as confidence and collaboration - attributes that are particularly important for these types of jobs.
Here is how it works:

> On a screen, a manager pops up in a recorded video and asks a question like: "Why do you want a career in this field?"
> You have 10 seconds to think, and a minute and a half to record your response on webcam. Everything you say, how you say it — even where your eyes wander — gets analyzed by an algorithm. The algorithm evaluates whether you have the necessary skills, and rates you on how well you fit the job. Based on this rating, you get an in-person interview, or not.

How does the algorithm know what is "desirable" and what isn't? This is something that the system learns from historical examples and data provided by its human creators, which can't be free of biases. Because of this, some people are skeptical of the technology and view it as "outsourcing responsibility" for hiring to machines. Others see risks in using a hiring system that promotes diversity by corporations and businesses, which do not have inclusive work environments or policies to support it.

Now turn the page.

Roles/Profiles

- AI system engineer at the new startup
- Job seeker - foreign name and qualification
- Job seeker - Anglo-Canadian name and qualification
- Employer looking to hire for client-facing job
- Politician - Human Resources Ministry

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

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2. What concerns do you have and how would you address them?
3. Are you in favour of this technology, or not? Explain.
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YOUR ROLE

Engineer at new start-up - Developing the AI system

Answer the following questions **from the perspective of your assigned role**

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2. What concerns do you have, and how would you address them?

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YOUR ROLE

Employer looking to hire for client-facing job

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How does the algorithm know what is "desirable" and what isn't? This is something that the system learns from historical examples and data provided by its human creators, which can't be free of biases. Because of this, some people are skeptical of the technology and view it as "outsourcing responsibility" for hiring to machines. Others see risks in using a hiring system that promotes diversity by corporations and businesses, which do not have inclusive work environments or policies to support it.

Now turn the page.

YOUR ROLE

Job seeker with Anglo-Canadian name and qualifications

Answer the following questions **from the perspective of your assigned role**

1. What are the benefits of this technology, in your opinion?

2. What concerns do you have, and how would you address them?

3. Are you in favour of this technology, or not? Explain.

4. What would you change or recommend for future applications of this technology?

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Social impact activity: Perspectives

Read the following news story. Please do not look on the back of the page before you finish reading.

JOB INTERVIEW WITH AI
Source CBC News article: Help wanted, apply to the AI: Why your next job interview could be with a machine

Companies often receive so many job applications that they have to resort to a lottery process to screen the applicants. If not done by lottery, the screening process is often biased based on the candidates' names, place of birth, or where they studied. A large 2017 Canadian employment study found that people with non-Anglo-Canadian names and foreign qualifications have a much lower chance to get a callback for a job interview. These hiring practices miss out qualified individuals and some great talent.

To make the hiring process more efficient and fair, a Canadian startup created an artificially intelligent (AI) system, which helps companies evaluate applications for jobs that involve dealing directly with clients, and shortlist candidates for job interviews.The algorithm uses facial and speech analysis to evaluate soft-skills such as confidence and collaboration - attributes that are particularly important for these types of jobs.
Here is how it works:

> On a screen, a manager pops up in a recorded video and asks a question like: "Why do you want a career in this field?"
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YOUR ROLE

Job seeker with foreign name and qualifications

Answer the following questions **from the perspective of your assigned role**

1. What are the benefits of this technology, in your opinion?

2. What concerns do you have, and how would you address them?

3. Are you in favour of this technology, or not? Explain.

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YOUR ROLE

Member of Parliament - Human Resources portfolio

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Case Study: SELF-DRIVING CAR CRASH
Source BBC news article: Uber 'not criminally liable' for self-driving death

While testing one of its self-driving cars, the ride-sharing company Uber was involved in a car crash in which a woman died. The woman was walking a bicycle across a multi-lane road when she was struck by Uber's self-driving car moving at about 70 Km/hr. The human operator who was in the car at the time of the accident did not manage to take over control early enough to prevent the crash.

An investigation conducted by the National Transportation Safety Board (NTSB) found that the car sensors detected the woman 6 seconds before impact but failed to classify her as a pedestrian. She was first identified as a vehicle and then as a bicycle. Also, the emergency braking system may have been disabled.

There was a human operator in the car - as mandated by Uber. She took control of the car one second before the crash and didn't hit the brake until just after. The area was poorly lit at the time and the victim was wearing dark clothes. The reflectors and lights on the bike were perpendicular to the car's path. A toxicology test done on the victim after the accident returned positive results for methamphetamine and marijuana.

According to dash-cam footage released by police, the human operator was watching her phone instead of the road a few seconds before the collision. A police report suggests the back-up driver was watching a show on her phone instead of watching the road and that she looked up from her phone only one second before, which was too late. A statement made by police said that the crash had been "entirely avoidable" but the investigation is not yet concluded.

After the fatal crash, Uber stopped their self-driving tests and the company initiated an internal review of their self-driving program, and its readiness and safety. Hundreds of Uber jobs connected to the self-driving program, such as the back-up driver jobs, were terminated.

Legal authorities have investigated the case and decided the Uber corporation is not criminally liable. Investigations are continuing and the Uber driver involved in the crash may still be charged with manslaughter.

Roles/Profiles

- Victim's spouse
- Chief engineer at Uber
- Business manager at Uber
- Uber driver involved in crash
- Police investigator

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are some benefits of the self-driving car technology, in your opinion?
2. What concerns do you have in light of this crash, and how would you address them?
3. Would you discontinue the self-driving program, or not? Explain.
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WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.
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YOUR ROLE

Business manager at Uber

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YOUR ROLE

Chief engineer at Uber

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YOUR ROLE

Police investigator

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Now turn the page.

YOUR ROLE

Spouse of the crash victim

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of the self-driving car technology, in your opinion?

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YOUR ROLE

Uber driver involved in crash

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of the self-driving car technology, in your opinion?

2. What concerns do you have in light of this crash, and how would you address them?

3. Would you discontinue the self-driving program, or not? Explain.

4. What would you change or recommend for future applications of this technology?

Social Impact Activity: Perspectives

GROUP INSTRUCTIONS: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.

- As a group, create a **BRIEF SUMMARY** of the case study and the technology involved, along with main benefits and concerns.

- With your group, discuss and agree on a set of (minimum 3) **RECOMMENDATIONS** for future uses and applications of the technology in a socially responsible way.

- **SHARE YOUR GROUP'S SUMMARY AND RECOMMENDATIONS** with the rest of the audience. Write down any feedback received from the audience.

Social impact activity: Perspectives

CUBESATS AND DEMOCRATIZATION OF DATA

CubeSats are small artificial satellites and spacecraft placed into orbit to serve various purposes. First started about twenty years ago, as part of an academic space project based in California, the CubeSat technology is relatively cheap and easy to build, launch and operate, and therefore it is developing and diversifying quite rapidly.

At the beginning, CubeSats were created solely for academic research and Low Earth Orbit missions. However, in recent years, the range of applications expanded to outer planets and interplanetary missions, as well as to commercial uses like telecommunications and remote sensing. In fact this technology plays a critical role in the ongoing expansion of the internet of things (IoT), and therefore the global market for CubeSats is growing fast. At the same time, its low cost is making the technology increasingly accessible to individual hobbyists, third world countries, and potentially rogue agents.

Along with its many promises and benefits, the CubeSat technology poses risks and challenges especially around security and privacy. Being so tiny compared with more traditional satellites, CubeSats are harder to detect by radar, which results in more collisions and space junk, while making nefarious activities easier to conduct.

For example,a recent story that captivated the world's attention revealed how new applications of satellite data could have unintended harmful consequences. At the centre of this story is the popular fitness tracking app Strava, which employs satellite technology to allow its users to track their running or cycling routes and have the data shared online in the form of a global heatmap. However, Strava users located on US military bases overseas didn't realize that, along with their exercise data, they inadvertently publicized their secret locations and other sensitive information, which poses serious security risks.

Discovered accidentally by a young student and analyst, who first reported it on Twitter, the unintended yet very dangerous effect of satellite data usage uncovered in the Strava story, alarmed security and military organizations worldwide and led them to revise their policies and introduce new regulations. At the same time, this case shows how important it is to realize that our current technologies can have grave consequences and that we must use them responsibly. More specifically, Strava users should better understand how the app settings are meant to give them control over their data and privacy, and make sure to apply them according to their circumstances.

Roles/Profiles

- Hobbyist interested in space exploration
- Government official working on international security
- App developer at Strava
- Senior manager at Strava - responsible for security and privacy issues
- Strava user residing on a military base overseas
- Chief of fire department in rural area

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are some benefits of the CubeSat technology, in your opinion?
2. What concerns do you have, and how would you address them?
3. Which applications of CubeSats would you restrict or discontinue? Explain.
4. What would you change or recommend for future applications of this technology?

WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.
- As a group, create a **brief summary** of the case study and the technology involved, along with main benefits and concerns.
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Social impact activity: Perspectives

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YOUR ROLE

- **App developer at Strava**

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YOUR ROLE

- **Strava user residing on a military base overseas**

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Now turn the page.

YOUR ROLE

- **Government official working on international security**

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of the CubeSat technology, in your opinion?

2. What concerns do you have, and how would you address them?

3. Which applications of CubeSats would you restrict or discontinue? Explain.

4. What would you change or recommend for future applications of this technology?

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Social impact activity: Perspectives

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CUBESATS AND DEMOCRATIZATION OF DATA

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YOUR ROLE

- **Senior manager at Strava - responsible for security and privacy issues**

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YOUR ROLE

- **Hobbyist interested in space exploration**

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YOUR ROLE

- **Strava user residing on a military base overseas**

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Social impact activity: Perspectives
EXOSKELETONS

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Roles/Profiles

- Young patient with muscular dystrophy
- Parent of patient with spinal cord injury
- Manager in automobile manufacturing company
- Infantry soldier in the US army
- Engineer developing exoskeleton technology at Lockheed Martin
- Assembly-line worker in automobile industry

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

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WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.
- As a group, create a **brief summary** of the case study and the technology involved, along with main benefits and concerns.
- With your group, discuss and agree on a set of (minimum 3) **rules and recommendations** for future uses and applications of the technology in a socially responsible way.

- Choose a representative of the group who will **share** your group's summary and recommendations with the rest of the audience. Write down any feedback received from the audience.

Sources

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Social impact activity: Perspectives

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YOUR ROLE

- **Manager at automobile manufacturing company**

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YOUR ROLE

- **Engineer developing exoskeleton technology at Lockheed Martin**

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YOUR ROLE

- **Infantry soldier in the US army**

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YOUR ROLE

- **Young patient with muscular dystrophy**

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YOUR ROLE

- **Parent of patient with spinal cord injury**

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Social impact activity: Perspectives
ROBOTS FOR PUBLIC SPACES

Recent advancements in automation and robotics technologies have led to the development of a variety of service robots designed to function in common open areas and public spaces such as parks, sidewalks and city streets, or shopping malls.

For example, between 2006 and 2009 some European cities ran a program that used service robots for cleaning the streets and for collecting garbage from people's homes. Funded by the European Commission, the DustBot program involved a network of autonomous and collaborating robots designed to improve urban hygiene. There were two types of robots. One was DustClean and used cleaning tools and different sensors for air pollutants such as car exhaust gases. The other was DustCart and did collection and disposal of residential garbage on demand.

More recently, there has been a surge in the development and testing of delivery robots and automated courier services, most commonly used for parcels, foods, or medicines. For example, Amazon is currently testing its own parcel-delivery robot called Scout, which can navigate the streets autonomously and is able to detect and avoid pedestrians.

Surveillance and security robots are also being developed. Such robots are designed to patrol public areas such as shopping malls and train stations or airports, and they can detect and report incidents or unusual behaviour. Another type of public service robots are designed to provide information to visitors of parks, museums or trade shows, and can even take them to specific locations.

Regardless of their particular job, robots designed to function in public spaces use onboard sensors, digital maps, and machine learning, among other technologies. While the opportunities they offer are substantial, these robots pose risks and challenges as well. For instance, many people are not ready to share the streets and other public spaces with robots, and think that robots threaten 'the public right of way'. Some see the robots as competing with humans for space and energy, and are worried about safety, data protection and privacy loss. Also, these robots replace human workers and cause job losses, which is another grave concern.

Roles/Profiles

- Worker in food delivery services
- Garbage/Waste management official
- CEO of company building delivery robots
- Parcel delivery worker
- Legal worker investigating a robot-pedestrian collision
- Official responsible for urban hygiene
- CEO of online shopping company
- Security personnel at shopping mall
- City planner hired to redesign public spaces to include service robots

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INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are some benefits of public space robots, in your opinion?
2. What concerns do you have, and how would you address them?
3. Which public space robots applications would you restrict or discontinue? Explain.
4. What would you change or recommend for future applications of this technology?

WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.
- As a group, create a **brief summary** of the case study and the technology involved, along with main benefits and concerns.
- With your group, discuss and agree on a set of (minimum 3) **rules and recommendations** for future uses and applications of the technology in a socially responsible way.

- Choose a representative of the group who will **share** your group's summary and recommendations with the rest of the audience. Write down any feedback received from the audience.

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Social impact activity: Perspectives

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ROBOTS FOR PUBLIC SPACES

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More recently, there has been a surge in the development and testing of delivery robots and automated courier services, most commonly used for parcels, foods, or medicines. For example, Amazon is currently testing its own parcel-delivery robot called Scout, which can navigate the streets autonomously and is able to detect and avoid pedestrians.

Surveillance and security robots are also being developed. Such robots are designed to patrol public areas such as shopping malls and train stations or airports, and they can detect and report incidents or unusual behaviour. Another type of public service robots are designed to provide information to visitors of parks, museums or trade shows, and can even take them to specific locations.

Regardless of their particular job, robots designed to function in public spaces use onboard sensors, digital maps, and machine learning, among other technologies. While the opportunities they offer are substantial, these robots pose risks and challenges as well. For instance, many people are not ready to share the streets and other public spaces with robots, and think that robots threaten 'the public right of way'. Some see the robots as competing with humans for space and energy, and are worried about safety, data protection and privacy loss. Also, these robots replace human workers and cause job losses, which is another grave concern.

Now turn the page.

YOUR ROLE

- **CEO of company building delivery robots**

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of public space robots, in your opinion?

2. What concerns do you have, and how would you address them?

3. Which public space robots applications would you restrict or discontinue? Explain.

4. What would you change or recommend for future applications of this technology?

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YOUR ROLE

- **City planner hired to redesign public spaces to include service robots**

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YOUR ROLE

- **Worker in food delivery services**

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of public space robots, in your opinion?

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YOUR ROLE

- **Legal worker investigating a robot-pedestrian collision**

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YOUR ROLE

- **Official responsible for urban hygiene**

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YOUR ROLE

- **Garbage and Waste management official**

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YOUR ROLE

- **CEO of online shopping company**

Answer the following questions **from the perspective of your assigned role**

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YOUR ROLE

- **Parcel delivery worker**

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YOUR ROLE

- **Security personnel at shopping mall**

Answer the following questions **from the perspective of your assigned role**

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Social impact activity: Perspectives
SMART PROSTHETICS

Smart prosthetics are artificial body parts that are controlled by the brain. They are part of a next generation of prosthetic devices, which take advantage of new materials like silicone and urethane with novel and superior properties, and of recent advances in digital technologies, primarily machine learning and artificial intelligence.

By closely mimicking the functionality, feel and even the appearance of natural limbs, robotic limbs promise a much better quality of life for the vast number of people who undergo amputations around the world every year. This is made possible by advances in brain-computer interface (BCI) technology, which enables amputees to form control loops, predict and conduct precise moves, experience natural sensations and reflexes, and adapt to changes in the environment.

Smart prosthetics belong to one of two types of applications of BCI technology. This type of applications convert information produced in the brain, such as thoughts or intentions, into specific responses or outputs. Another example would be the 'smart headset' for converting brain information into text or speech, which is being developed at Facebook. In other types of applications of BCI technology, information flows in reverse, from the outside to the brain. Such applications aim to change brain activity in pre-determined specific ways and are being developed for the treatment of neurological and brain disorders such as epilepsy or Parkinson disease.

Both types of applications use machine-learning and Artificial Intelligence tools, which is key to their effectiveness, value and impact. In fact, given our still limited understanding of the brain and how information flows through the nervous system, none of this would be possible without the algorithms and computations generated by machine-learning and AI. However, because we can't predict or understand these computational processes either, we must trust the computer to act on our behalf. This puts our relationship with AI in a new light, and presents the huge risk of losing our autonomy and handing over control to computers.

The question is, can we continue to advance the positive beneficial applications of BCI technology, without developing their darker dangerous sides? In this regard, clinical trials conducted so far were informative but also somewhat worrisome. Patients said they lost their 'sense of self', or reported changes in behaviour, or described the experience as a 'radical symbiosis'. Such preliminary data highlight how urgent it is to create regulations for human-computer interactions, to minimize threats and protect basic human rights.

Roles/Profiles

- Patient amputee candidate for prosthetic arm
- Neuro-ethicist specialized in BCI technologies
- Sufferer of severe depression - candidate for clinical trial using BCI technology
- Developer of machine-learning software for BCI technology
- Government official responsible for regulating machine-learning and Artificial Intelligence
- Human rights activist concerned with threats from BCI technologies on humans autonomy

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INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are some benefits of BCI technology, in your opinion?
2. What concerns do you have, and how would you address them?
3. Which applications of BCI technology would you restrict or discontinue? Explain.
4. What would you change or recommend for future applications of this technology?

WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.
- As a group, create a **brief summary** of the case study and the technology involved, along with main benefits and concerns.
- With your group, discuss and agree on a set of (minimum 3) **rules and recommendations** for future uses and applications of the technology in a socially responsible way.

- Choose a representative of the group who will **share** your group's summary and recommendations with the rest of the audience. Write down any feedback received from the audience.

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YOUR ROLE

- **Developer of machine-learning software for BCI technology**

Answer the following questions **from the perspective of your assigned role**

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Social impact activity: Perspectives

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Smart prosthetics belong to one of two types of applications of BCI technology. This type of applications convert information produced in the brain, such as thoughts or intentions, into specific responses or outputs. Another example would be the 'smart headset' for converting brain information into text or speech, which is being developed at Facebook. In other types of applications of BCI technology, information flows in reverse, from the outside to the brain. Such applications aim to change brain activity in pre-determined specific ways and are being developed for the treatment of neurological and brain disorders such as epilepsy or Parkinson disease.

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YOUR ROLE

- **Government official responsible for regulating machine-learning and Artificial Intelligence**

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of BCI technology, in your opinion?

2. What concerns do you have, and how would you address them?

3. Which applications of BCI technology would you restrict or discontinue? Explain.

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YOUR ROLE

- **Human rights activist concerned with threats from BCI technologies on humans autonomy**

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YOUR ROLE

- **Neuro-ethicist specialized in BCI technology**

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YOUR ROLE

- **Patient amputee candidate for prosthetic arm**

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YOUR ROLE

- **Sufferer of severe depression - candidate for clinical trial using BCI technology**

Answer the following questions **from the perspective of your assigned role**

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Aquatic drones designed for ocean or seawater are called marine (or maritime) drones, and they have been attracting a lot of attention in recent years. As the technology is becoming increasingly reliable and affordable, marine drone applications advance and diversify at a particularly fast pace. And while many of these applications serve positive goals, some are deeply concerning.

Numerous positive applications of marine drones have been recently launched, such as ship and cargo control in harbors, environmental monitoring of oil spills, search and rescue sea operations, or underwater pipeline inspections. Indeed, water drones and especially marine drones could have a powerful positive impact on many industries as well as the environment.

Marine drones are also used for security, defense and military operations; for example, for border patrol in harbors and coastal areas, surveillance and intelligence gathering, underwater mine searches, and weaponry. It is these applications that pose the gravest risks and concerns, as they can easily serve harmful and ill-intended purposes.

Maritime areas tend to have high strategic importance and coastal cities are notoriously vulnerable to terrorist attacks. Hostile and terrorist organizations can use marine drones to target such areas for hostile surveillance purposes or attacks with harmful payloads such as explosives, chemical or biological agents, or even nuclear weapons.

The restrictions currently in place, which limit the operating range or the weight of drones, are insufficient for countering such threats. It is imperative that all stakeholders, including governments and security agencies, collaborate in weighing the benefits and risks of water drones and come up with new regulations and measures that will ensure their safe and responsible use.

Roles/Profiles

- Coastal police patrol
- Manager of water desalination plant from coastal area
- Environmentalist concerned about marine pollution
- National security agent
- Mayor of port city
- CEO of start-up building aquatic drones

INDIVIDUALLY: Answer the following questions from the perspective of your assigned role

1. What are some benefits of water drones, in your opinion?
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4. What would you change or recommend for future applications of this technology?

WITH YOUR GROUP: Work together to incorporate the different perspectives in your group

- Each group member shares their answers and viewpoints. Write down any ideas different from yours.
- As a group, create a **brief summary** of the case study and the technology involved, along with main benefits and concerns.
- With your group, discuss and agree on a set of (minimum 3) **rules and recommendations** for future uses and applications of the technology in a socially responsible way.

- Choose a representative of the group who will **share** your group's summary and recommendations with the rest of the audience. Write down any feedback received from the audience.

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YOUR ROLE

- **Coastal police patrol**

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YOUR ROLE

- **Environmentalist concerned about marine pollution**

Answer the following questions **from the perspective of your assigned role**

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YOUR ROLE

- **Manager of water desalination plant from coastal area**

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YOUR ROLE

- **Mayor of port city**

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YOUR ROLE

- **National security agent**

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Similar to aerial drones, water drones carry "payloads" specific to their particular jobs. For example, the payload of a drone designed to monitor chemical or biological pollutants consists of probes and other equipment allowing it to collect samples of water, measure amounts of pollutants, and even send the data to a control place for analysis and intervention.

Aquatic drones designed for ocean or seawater are called marine (or maritime) drones, and they have been attracting a lot of attention in recent years. As the technology is becoming increasingly reliable and affordable, marine drone applications advance and diversify at a particularly fast pace. And while many of these applications serve positive goals, some are deeply concerning.

Numerous positive applications of marine drones have been recently launched, such as ship and cargo control in harbors, environmental monitoring of oil spills, search and rescue sea operations, or underwater pipeline inspections. Indeed, water drones and especially marine drones could have a powerful positive impact on many industries as well as the environment.

Marine drones are also used for security, defense and military operations; for example, for border patrol in harbors and coastal areas, surveillance and intelligence gathering, underwater mine searches, and weaponry. It is these applications that pose the gravest risks and concerns, as they can easily serve harmful and ill-intended purposes.

Maritime areas tend to have high strategic importance and coastal cities are notoriously vulnerable to terrorist attacks. Hostile and terrorist organizations can use marine drones to target such areas for hostile surveillance purposes or attacks with harmful payloads such as explosives, chemical or biological agents, or even nuclear weapons.

The restrictions currently in place, which limit the operating range or the weight of drones, are insufficient for countering such threats. It is imperative that all stakeholders, including governments and security agencies, collaborate in weighing the benefits and risks of water drones and come up with new regulations and measures that will ensure their safe and responsible use.

Now turn the page.

YOUR ROLE

- **CEO of start-up building aquatic drones**

Answer the following questions **from the perspective of your assigned role**

1. What are some benefits of water drones, in your opinion?

2. What concerns do you have, and how would you address them?

3. Which applications would you restrict or discontinue? Explain.

4. What would you change or recommend for future applications of this technology?

Sources

- CTV Montreal (July 2019): Aquatic drone looks to protect Quebec's lakes from invasive plants
- ScienceDirect (June 2019): Can drones be used to conduct water sampling in aquatic environments? A review
- Today Singapore (October 2019): Aquatic drone terror attacks a growing possibility
- New America (International Security): The future of drone warfare: The rise of maritime drones