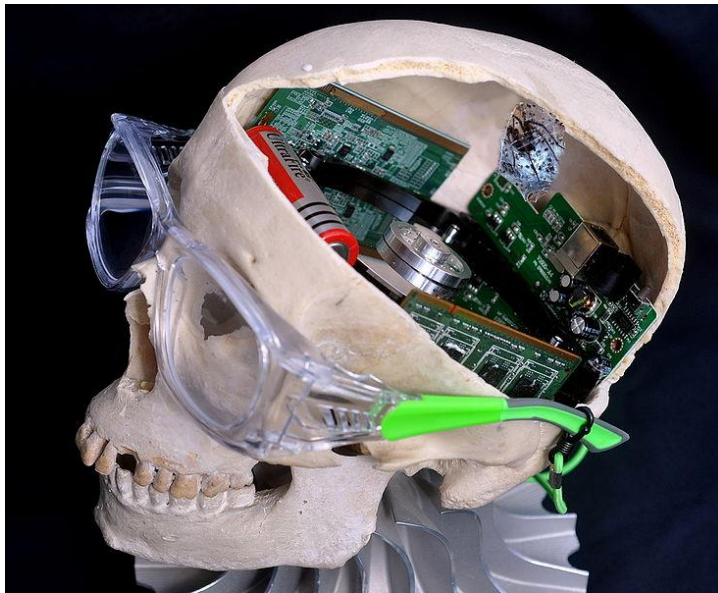


AI and Disasters

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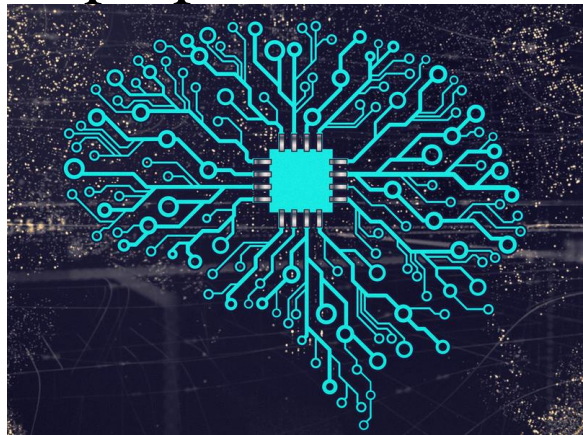
Rutgers University



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Severe Storms Laboratory (NSSL)

AI Uses – Past, Present, Future

- Machines and algorithms have been used in disaster situations for a long time.
- But now we are in an age of dramatic progress in artificial intelligence and the development of numerous uses for intelligent machines.
- I will describe past, present and potential future uses of AI in disaster preparation and response.



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Situational Awareness in Hazardous Environments

- Sending unmanned vehicles into disaster areas or above them can aid in understanding what is going on.
- Unmanned vehicles have been used that way for a long time.
 - Unmanned robotic machines were used during the Chernobyl disaster in 1986. Radiation was too high for humans to enter.



- This vehicle is at the Chernobyl Remote Controlled Vehicle Park.
- Radiation levels prevented humans from working longer than 40 seconds.
- Robots were developed to do it but mostly didn't succeed as high radiation destroyed electronic parts.
- Most of the robots are still radioactive.

credit: [Commons.wikimedia.org](https://commons.wikimedia.org/), [Clay](#)

Situational Awareness

- What is different now: Today's unmanned vehicles don't need human control, can maneuver themselves and can learn from previous usage.
- Unmanned aerial vehicles or drones are already used for situational awareness, flying over disaster scenes.
- More: Information they provide can be combined with data from other disasters to *predict what might happen*:
 - To where will an oil spill spread?
 - In which direction will a forest fire burn and what techniques might work best to control it?



Credit: Wikimedia commons, US Navy



Credit: Wikimedia commons, [Cameron Strandberg](#)

Search and Rescue

- Autonomous vehicles or robots can go into dangerous environments such as collapsed buildings or areas that are too difficult for people to see or reach.
 - Snakebots and other bio-inspired robots
- Moreover, they can *learn from previous searches and identify best strategies for the search.*
- Similarly, AI can guide humans in the best way to search, e.g., for people missing after a flood or hurricane.



Snakebot

Rescue robot



credit: Commons.wikimedia.org, (L) NASA,
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Damage Detection, Repair, Cleanup, Decontamination

- MIT has been developing a fleet of marine robots (Seaswarm) designed to clean up oil spills
- Starting early during COVID, China used remote-controlled robots to disinfect neighborhoods.
- Already such robots are used for disinfection in hospitals.
- *The future is for these applications to be carried out in full autonomy without human intervention.*



credit: Commons.wikimedia.org, [The Official CTBTO Photostream](#)

Controlling a Disaster

- Unmanned robotic vehicles have already been used in firefighting.
 - But there are challenges of maneuvering in highly unstructured environments and performing complex manipulations.
- Still, *as AI progresses, robots can learn how to do such things without human intervention.*

Robotic firefighting vehicle

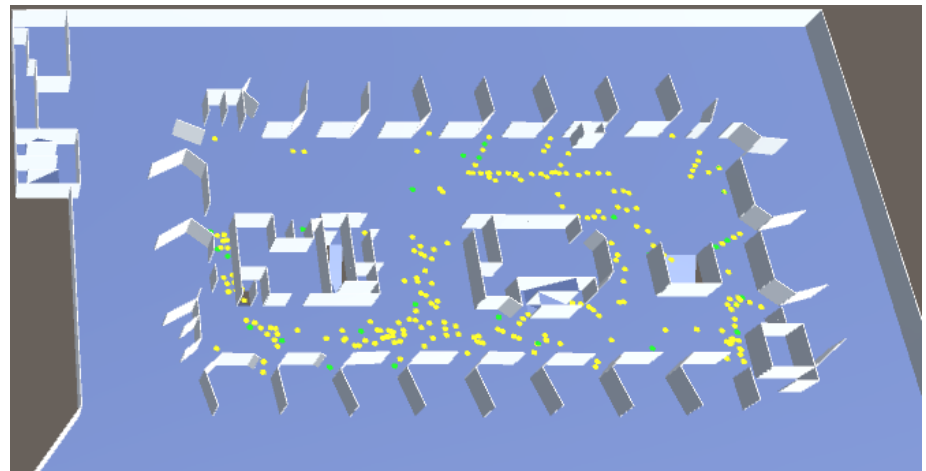


Credit: Commons.wikimedia.org, [Branko Radovanović](#) (no changes)

Evacuation

- Inside a building when there is an emergency, people tend to follow the crowd looking for an exit.
 - Can cause gridlock and injuries
- *Humanoid robots could influence “follow the crowd” behavior.*
 - Mobile shepherding robots can lead crowds to a particular exit. And do so autonomously.
 - Stationary robots could give verbal or hand signal instructions.

Simulation modeling aids in design of AI-based evacuation.



Medical and Disease Applications

- When there is a shortage of medical staff at a disaster site, telepresence robots can help make diagnoses.
 - A developing area.
- In case of an infectious disease such as COVID-19, robots already deliver medical supplies, medications, etc. in hospital situations.
- Algorithms using location identification and face recognition help in determining if you have been exposed to COVID.
 - Apps on smartphones.
 - Face recognition helps in contact tracing.
- AI tools proposed to teach robot to do COVID tests with swabs – have to learn appropriate tilt of the head.

COVID-19.nj.gov/app



Enforcing Emergency Rules

- Sometimes a disaster area needs to be cordoned off with only eligible people allowed in.
 - AI tools are being developed for smartphones and through face recognition for *identity & access management*.
 - The EU is already exploring use of robots at borders to interview people and, based on machine learning tools, decide if a human needs to intervene in the decision to allow them in.
- During COVID, authorities have used drones:
 - To see where people might not be wearing masks.
 - In some cases, face recognition has been used to identify those violating the mask rules or quarantine rules.

Surveillance drone with camera



Detecting Disasters

- *The earlier we can detect or predict a disaster, the better chance we have of minimizing its impact.*
- The SARS outbreak in China was detected in the West by using machine learning on keywords from rural newspapers.
- In Canada, early during the COVID-19 pandemic, Canadian startup BlueDot used AI and machine learning to detect areas of coronavirus outbreaks.
 - Its AI algorithm analyzed multiple sources such as news reports, social media platforms and government documents to predict where we would see outbreaks.
- Other tools use satellite images of vegetation and height of lakes and rivers to predict outbreaks of mosquito-borne diseases 6 months down the road.



credit: Wikimedia commons, NASA

Delivering Emergency Supplies

- During a disaster, need deliveries of first aid supplies, food and water, firefighting equipment, masks and other personal protective equipment.
- *“Intelligent” delivery services* are being developed to make such deliveries without human intervention.
 - During COVID, DoorDash developed food deliveries using robots, with minimal human involvement.
 - Hybrid solution: unmanned trucks or ships for long distance delivery, then drones/robots for the “last mile.”
- Stocking supplies for an emergency is important. AI has a critical role to play in determining what should be stocked, when it should be replaced, etc.



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Questions?

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