# AI for Crisis Response

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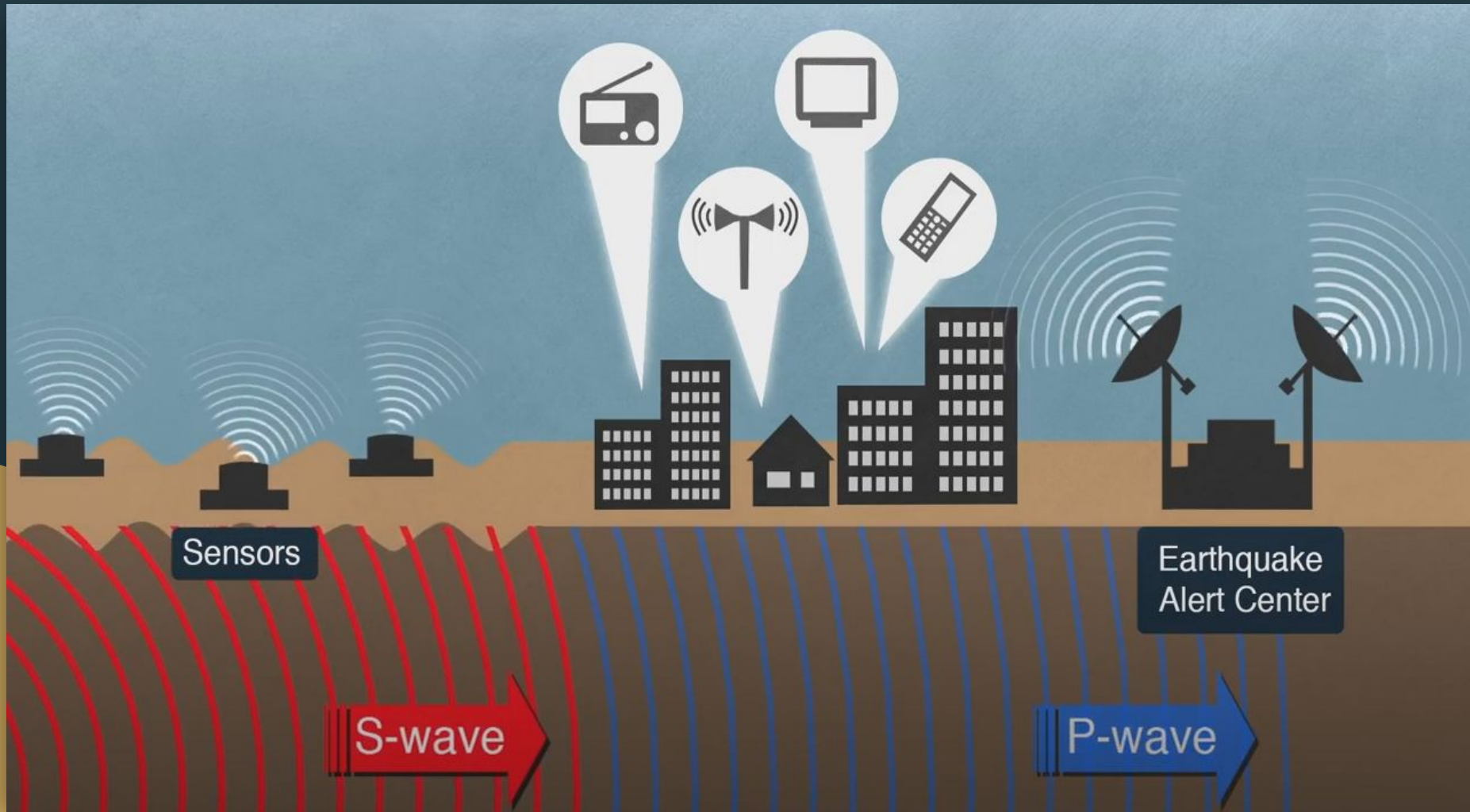
# Different Types of Crisis

# Earthquake Early Warning System

https://www.youtube.com/watch?v=J5vErz7WuiU - Early warning system alerts people before quake in China's Sichuan

# DARPA's LORELEI

THOR is a LORELEI situation awareness system that has been developed in collaboration with research partners at Next Century Corporation and it uses open-source technology, utilising data from social media, and from other externally developed AI systems, and translating the data into English.

Tweets and text messaging offers a ready supply of data information during a crisis, and interdisciplinary AI research is providing a platform for information extraction that can detect and resolve urgent situations using this information.



Low Resource Languages for Emergent Incidents (LORELEI)
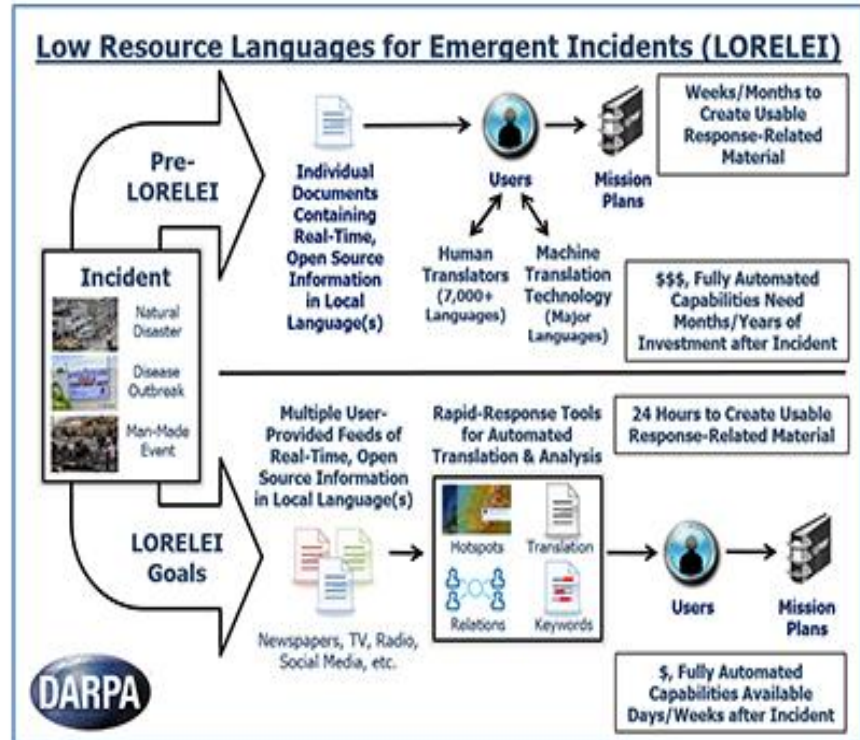
# COVID-19
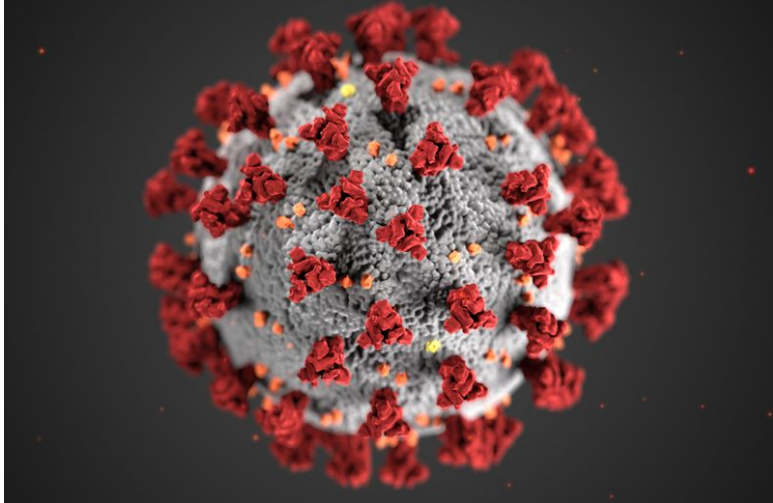


AI in prediction & tracking

AI in genomics

AI in curbing spread of misinformation

AI in development of vaccines

AI in development of therapeutics

AI in protein structure prediction

AI in reducing the burden from medical practitioners & healthcare staff

AI in early diagnosis

AI in monitoring of COVID-19 cases

AI in contact tracing

# COVID Color Code

After users fill in a form on Alipay with personal details, the software generates a QR code in one of three colors. A green code enables its holder to move about unrestricted. Someone with a yellow code may be asked to stay home for seven days. Red means a two-week quarantine.

# NYC Zone Finder

# Natural Disaster Prediction

Multiple countries across the globe are deploying AI to predict and detect natural disasters.

Japan is launching a network of satellites to aid in AI input collection, with the output being predicted locations of floods and landslides.

Google is also developing an AI-based system that can predict floods in India.

**SMART CITIES GLOBAL NETWORK**

# Identifying Natural Disaster Damage and Rebuilding Efforts

Technology discussed by the World Economic Forum hope to build a system in which after a disaster occurs, areas most affected and allocation of aid resources can be done more effectively using AI tools.



## AI for Disaster Resilience

**Example of how AI can improve disaster resilience efforts:** Identifying damage and rebuilding after a disaster can take months of manual effort, leaving affected people vulnerable for a long time. AI can assess damage and help workers deliver aid much faster, improving recovery and shortening the time that affected people stay without resources

### Predicting and classifying damage

Undamaged
Minor Damage
Major damage
Destroyed

**Predicted damage probability:**
Undamaged: 0%
Minor Damage: 41%
Major Damage: 56%
Destroyed: 3%
Damage Score: Major damage
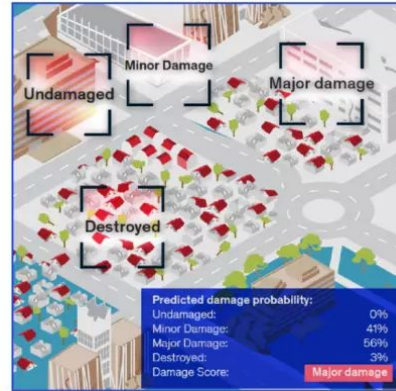
AI model can use satellite and other data to predict areas at risk

### Geotagging damage for relief workers

Heavy damage — Minor damage
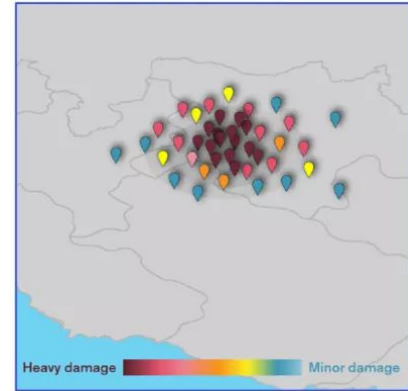
Damaged buildings and routes can be geo-tagged to help relief workers identify vulnerable areas and allocate resources optimally for faster response and recovery

## Planning optimal delivery routes



Predicted flooding and road outages

Estimated vulnerable populations

Optimized distribution routes
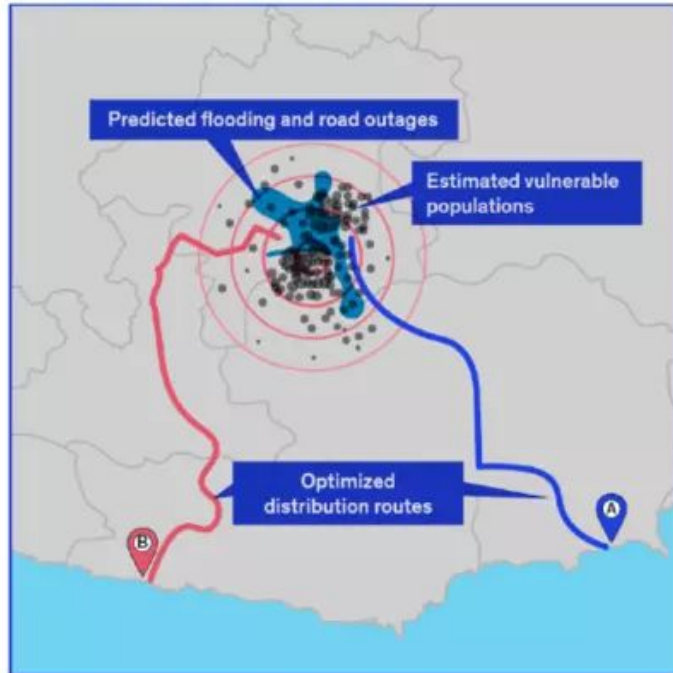
AI can provide optimal route planning based on the damage assessment maps for faster aid delivery in post-disaster areas

## Estimate funding requirements



Area X

**Aid requirements for Area X**

| | | |
|---|---|---|
| Food and water: | | 4,500 people |
| Shelter: | | 900 families |
| Healthcare: | | 2,000 people |
| Monetary aid required: | | $3 million |

Faster damage assessments can help governments and funders understand and provide necessary resources faster

# Giving this data to first responders

In the case of natural disasters such as wildfires, human intervention needs to be taken to stop further damages.

According to TechRepublic, the first 5 minutes of response to a fire will drastically affect the outcome.

Microsoft is developing AI alongside Department of Energy to respond to these threats quickly and efficiently.

# Natural Disaster Prediction in Japan (cont)

In the aftermath of the Fukushima nuclear event, Japan is investing heavily in AI to predict future natural disasters.

By analyzing offshore waveforms at the time of previous earthquakes, Japan can predict using AI if a tsunami will strike afterwards.

This could give invaluable time to those evacuating or shutting down power systems such as nuclear reactors.

# Responses to Human Error

# Apple's Face ID

Apple's **Face ID** is an easy way to securely unlock Apple devices that doesn't involve remembering passwords.

Face ID is a bio-authenticator that is secure because your face is one-of-a-kind.

Face ID is also used as verification to make purchases in the App Store or to use Apple Pay.

# Apple's Face ID
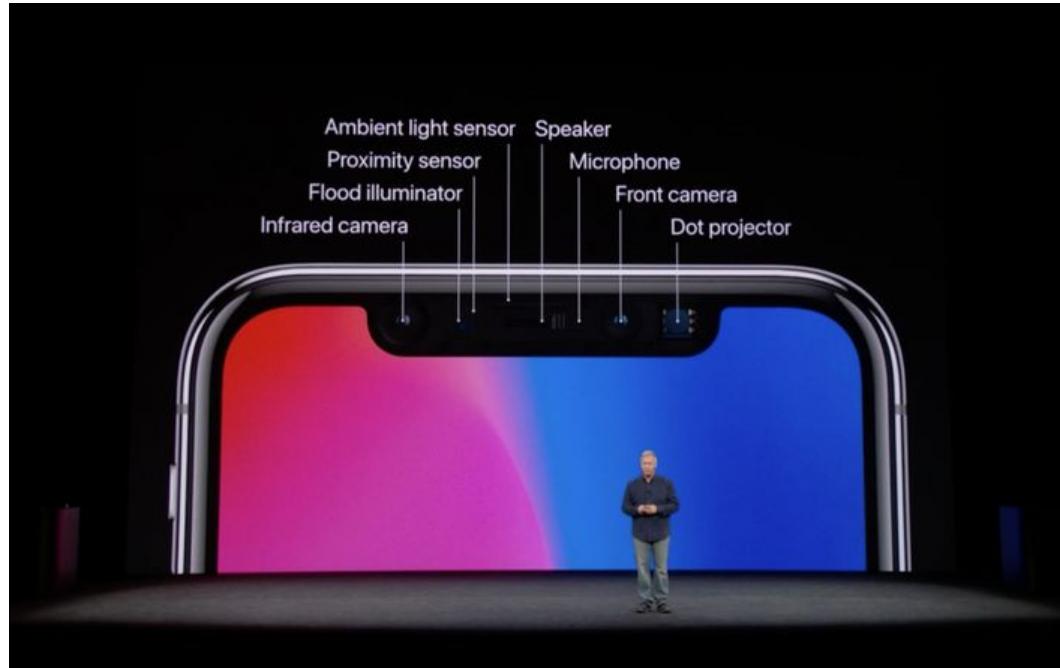
# Driverless Vehicles

Nearly all car companies are developing and releasing versions of driverless cars (enhanced **autopilot** systems) for safer roads

**Tesla** uses "Autopilot" and other technologies to automatically "lane change", "navigate interchanges", engage turn signals, and take exits.

Vehicles like Tesla's are at **Level 2-3 Automation** as indicated by National Highway Traffic Safety Administration (NHTSA)

# Driverless Vehicles - Automation Levels

**SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS**

Full Automation

| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **No Automation** | **Driver Assistance** | **Partial Automation** | **Conditional Automation** | **High Automation** | **Full Automation** |
| Zero autonomy; the driver performs all driving tasks. | Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design. | Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times. | Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice. | The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle. | The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle. |

# Driverless Vehicles - Lane Detection
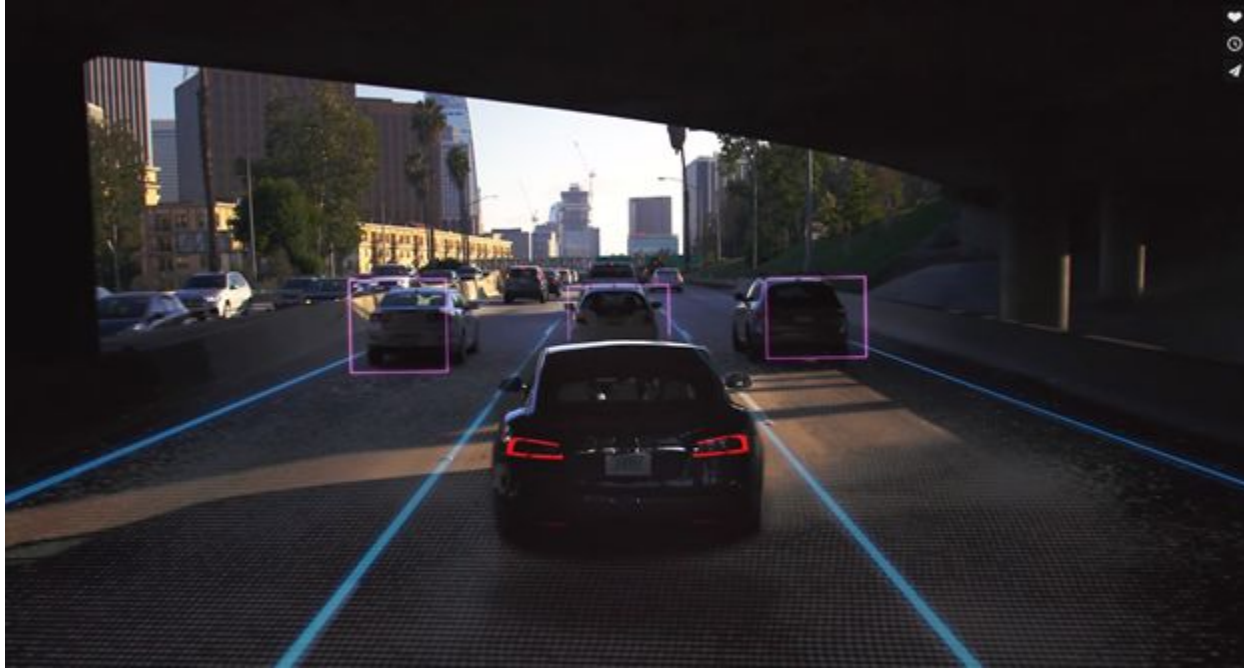
# Driverless Vehicles - Object/Vehicle Detection

# Driverless Vehicles - Hands on the Wheel

# Missile Defense

AI-sensor models are also equipped on defense systems, since AIs can engage missiles in the "boost phase, midcourse and terminal phases of flight"

Complexity comes from handling data received from land, air, sea, and space all at once to make battle decisions.

# Nuclear Power Plants (NPP)

*"As a typical and complex man-machine-network integration system, various faults, insufficient automation and stressed human operators limit the further popularization of nuclear power plants (NPPs) while these issues can be addressed by the aid of artificial intelligence (AI) technologies"* - Lu et al.

Lu et al. introduce a Human-Cyber-Physical System as a framework for future NPPs (**NPPHCPS**)

"Autonomous control for fixed procedures" is the current limit of AI in NPPs. As AI grows in this field, the cyber layer can expand to include more processes.
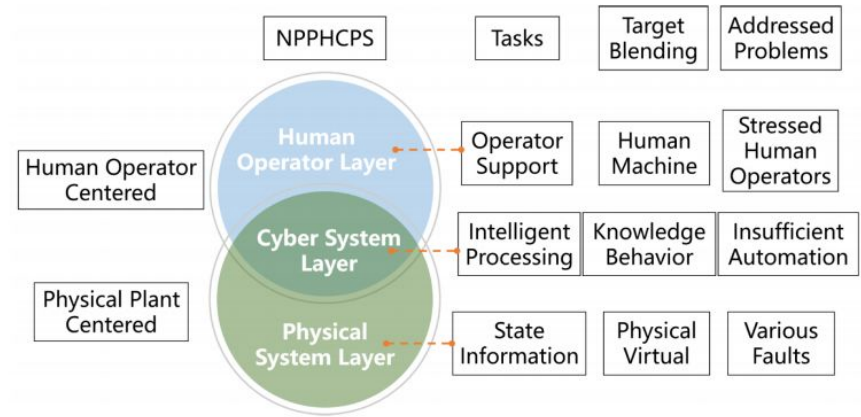


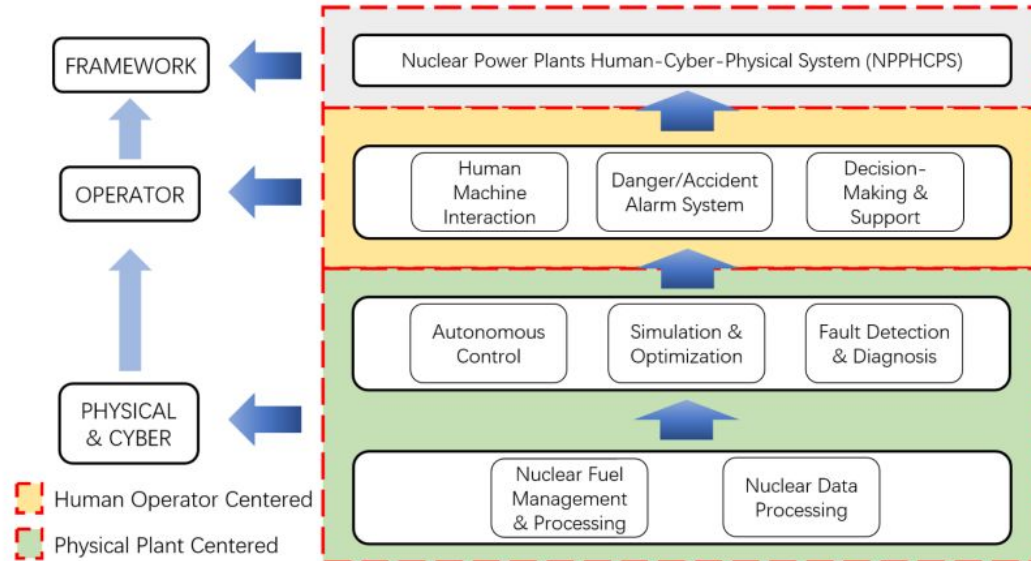**FIGURE 1.** General Framework of NPPHCPS.

# Nuclear Power Plants



FIGURE 2. Basic Architecture for NPPHCPS.

# Financial Crisis

AI can:

-Identify the warning signs of a potential crisis

-Manage bank information

-Identify fraud in transaction data

-Calculate risks and manage customer info



## THE 2008 FINANCIAL RECESSION BY NUMBERS

Housing prices fell **31.8%**

Unemployment was still above **9%** in 2010

**$30 billion** federal guarantee for deal between Bear Stearns and JP Morgan Chase

Fannie Mae and Freddie Mac guarantee **90%** of all mortgages

US Treasury Department spent **$350 billion** buying bank and car stocks

AIG **$150 billion** federal bailout for AIG

**$140 billion** moved from money markets to treasury bonds

By 2010, banks paid back **$194 billion**

Source: The Balance

BANGKOK POST GRAPHICS

# Agriculture

RISK: By 2050 the world will need to produce 50 percent more food in order to survive.

-AI can help farmers get more out of their land and be more sustainable by monitoring climate change, population growth, and other food security issues.

-AI robots and machines can help with the manual labor of the job and make yielding crops more efficient

-AI can also recognize and identify possible defects in crops and provide soil restoration techniques, tips, and other possible solutions with a 95% accuracy.

# Traffic

-Roadside sensors, traffic cameras and vehicles collect data on things like road works, accidents and congestion. This data is then fed into a central system and a prediction model creates a comprehensive view of traffic conditions in real-time. The system is then able to adjust the timing of traffic light signals, so that they improve the flow of vehicles.

-AI can then inform motorists what the best routes are for them to take to avoid congestion and the optimum speeds they should take.

-Could reduce congestion by 70% saving large cities millions of dollars every year

# Cyber Crysis

-AI helps save time hunting for threats

- 73 percent reported a single alert investigation can take hours or even days
- 53 percent said they use three or more data sources to get to the bottom of an investigation
- 54 percent said critical alerts go completely uninvestigated
- 30 percent of their alerts that have been prioritized never get investigated

-The Cybersecurity workforce is shrinking and AI can fill it

-69 percent of enterprises believe AI is necessary to respond to cyberattacks.

# Cyber Security

Aim: to protect applications that are based on machine learning and are at risk of new adversarial threats.

Example,

A sticker placed on a sign to make an automated system in a self-driving car make the wrong decision, to more sophisticated cyber security methods going by specialized names, like evasion, data poisoning, trojaning or backdooring.

# Security Cameras

AI security cameras use artificial intelligence software to detect objects and recognize detailed features. Object detection such as vehicle detection, person detection, facial recognition, and license plate recognition can be used to trigger events on Viewtron NVRs.

For example, when a person enters a certain zone of an area under surveillance, recording can be triggered on the DVR. An alarm can also be triggered such as a push notification to the Viewtron mobile app.