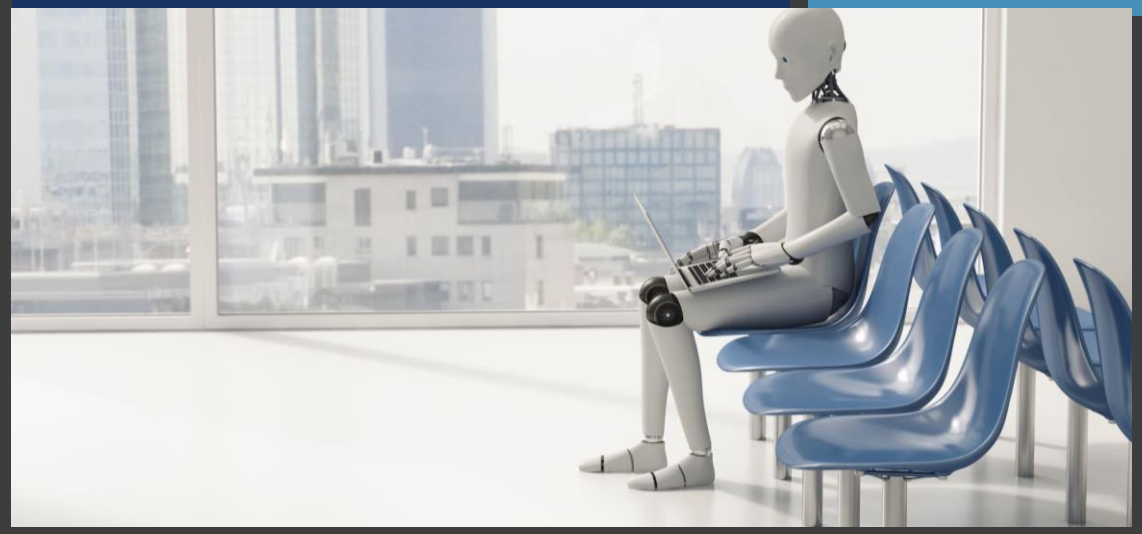


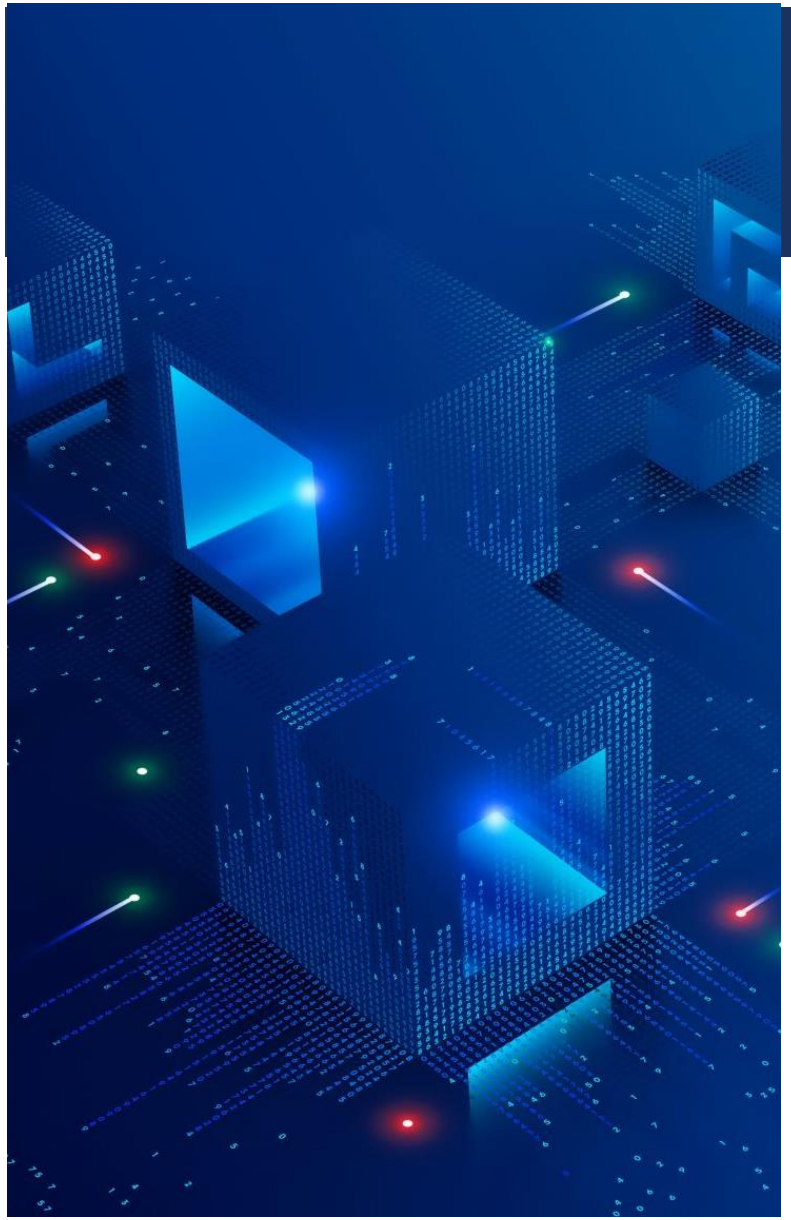
HARNESSING THE POWER OF AI FOR EMERGENCY MANAGEMENT

SARAH K MILLER, PHD, CEM

WHAT?

A BRIEF HISTORY

- 1921: First use of the term robot in a Czech play
- 1929: First robot built in Japan
- 1950: Alan Turing published "Computer Machinery and Intelligence"
- 1952: First autonomous computer game developed (checkers)
- 1955: First use of the term artificial intelligence
- 1957-1973: maturation of AI, programming languages, industrial robots, expert systems, and bots developed
- 1979: First autonomous vehicle created
- 1980-1987: Lots of AI activity, including commercial use and the first driverless car
- 1987-1993: Not a lot of forward momentum
- 1997: Deep Blue beats Kasparov at Chess.
- 1997: Dragon Systems releases speech recognition software
- 2002: Roomba released
- 2003: Spirit and Opportunity navigate Mars without human assistance
- 2006: Twitter, Facebook, Netflix begin using AI in advertising and marketing algorithms
- 2011: IBM Watson wins Jeopardy against two former champions
- 2011: Apple brings us Siri
- 2012-2019: Virtual assistants, search engines, deep learning, big data
- 2020: OpenAI beta tests GPT-3 to create code, poetry and other language-based tasks.
- 2021: OpenAI developed DALL-E, which could caption images



COMMON TERMS

- LLM: Large Language Model. Pre-trained language models built on vast amounts of data. Designed for natural language processing.
- RAG: Retrieval-Augmented Generation. Providing an LLM with an authoritative knowledge base to pull from.
- Generative AI: Systems that can generate new content based on patterns in language.
- Hallucinations: Plausible generative AI outputs that are wrong on nonsensical.
- Synthetic Data: Artificially generated data used to train AI models.

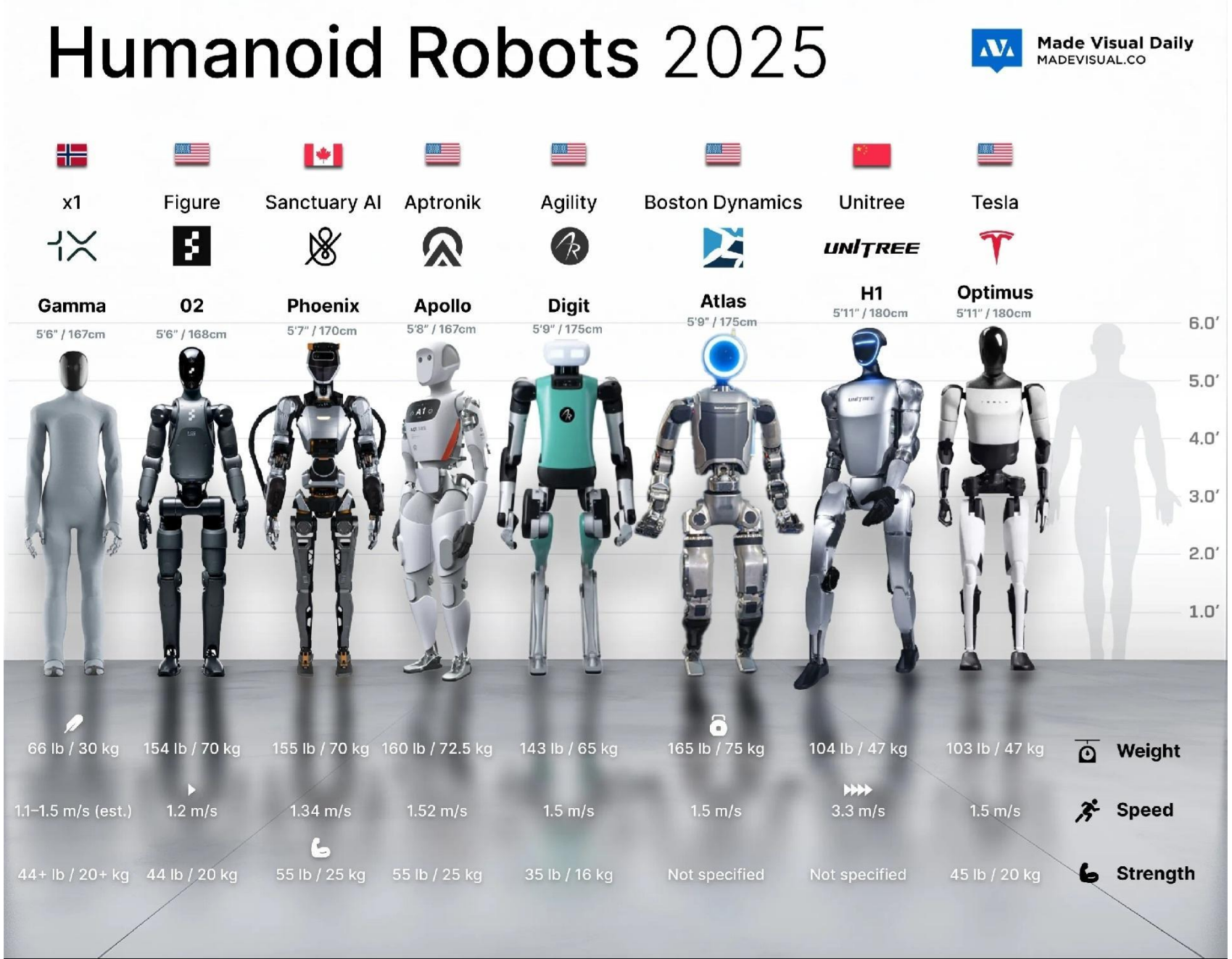
THE STATE OF AI TODAY

- Rapid evolution
- Reactive Machines
  - Same input always returns the same output.
  - IBM's Deep Blue (chess playing), shopping/movie recommendations, etc.
- Limited Memory Machines
  - Imitates the brain.
  - Acts based on past and present but doesn't "learn" from the present.
  - Can be trained with additional data.
  - Self-driving cars, natural language processing, etc.
- Not self-aware and cannot understand the world around it.

WHERE WE FIND AI RIGHT NOW

- E-commerce
- Healthcare
- Natural Language Processing
- Personalization
- Financial Services
- Robotics
- Autonomous Vehicles
- Social Media Monitoring
- Education
- Smart assistants
- And more

Video courtesy of whill.inc


Humanoid Robots 2025
Made Visual Daily
MADEVISUAL.CO
x1
Figure
Sanctuary AI
Aptronik
Agility
Boston Dynamics
Unitree
Tesla
Gamma
5'6" / 167cm
02
5'6" / 168cm
Phoenix
5'7" / 170cm
Apollo
5'8" / 167cm
Digit
5'9" / 175cm
Atlas
5'9" / 175cm
H1
5'11" / 180cm
Optimus
5'11" / 180cm
6.0'
5.0'
4.0'
3.0'
2.0'
1.0'
66 lb / 30 kg
154 lb / 70 kg
155 lb / 70 kg
160 lb / 72.5 kg
143 lb / 65 kg
165 lb / 75 kg
104 lb / 47 kg
103 lb / 47 kg
Weight
1.1–1.5 m/s (est.)
1.2 m/s
1.34 m/s
1.52 m/s
1.5 m/s
1.5 m/s
3.3 m/s
1.5 m/s
Speed
44+ lb / 20+ kg
44 lb / 20 kg
55 lb / 25 kg
55 lb / 25 kg
35 lb / 16 kg
Not specified
Not specified
45 lb / 20 kg
Strength

SO WHAT?

PREDICTIVE AND DETECTIVE PROCESSES

Challenges:

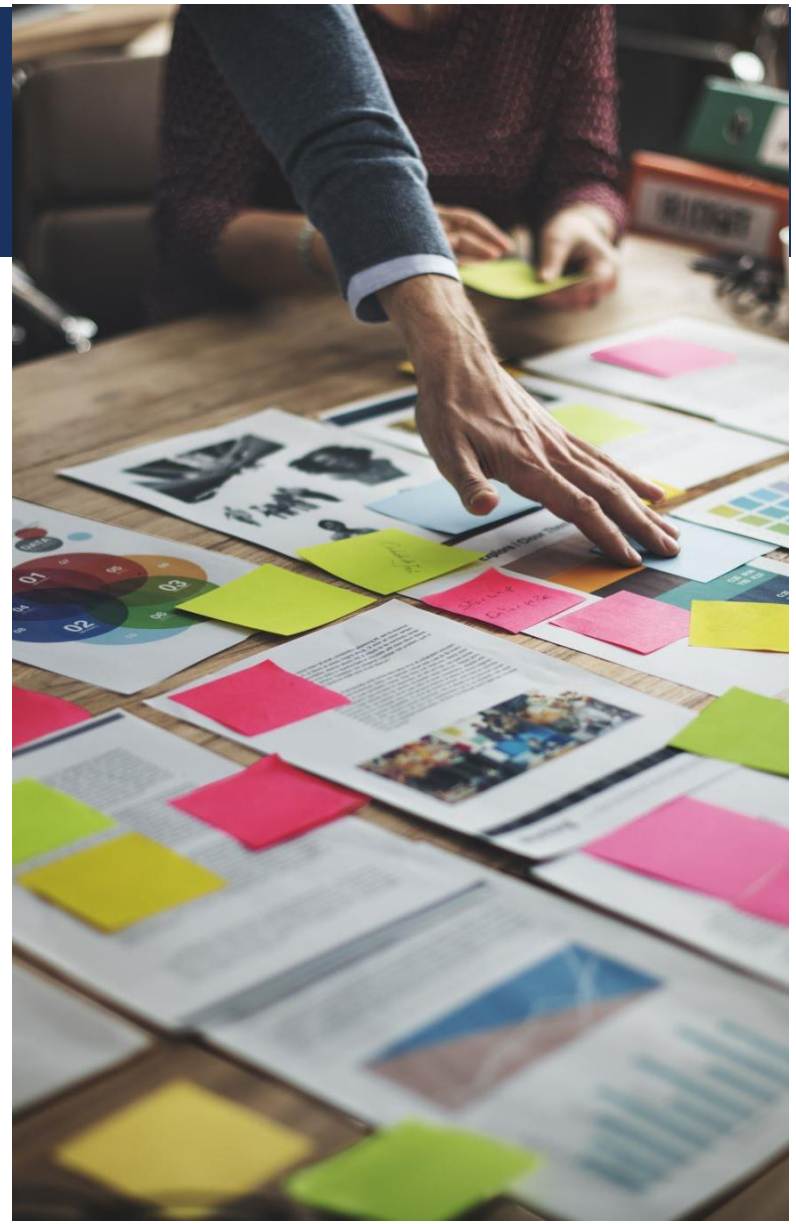
- Accuracy of information and ability to keep up with information flow

AI and Robotics Solutions:

- Weather Forecasting
  - Highly accurate and reliable
- Wildfires
  - Early detection. Robotic firefighting
- Supply Burn Rates
  - Can more easily account for supply chain issues
- Climate Change
  - Looks beyond past analysis and includes future forecast
- Others

EMERGENCY PLANNING

- Challenges
  - Conflicting plans, lack of planning resources, full incorporation of available data
- Solutions
  - Locally hosted RAGs based on reputable LLMs
  - Basic plan generation as an augment to existing staff
  - Plan deconflicting based on directed queries
  - Incorporation of demographic and other data



SHELTERING

Challenges:

- Managing overcrowding and ensuring accessibility for diverse populations.

AI and Robotics Solutions:

- AI for Resource Optimization:
  - Predictive analytics to identify optimal shelter locations based on population density and disaster impact zones.
  - Real-time monitoring of shelter capacity and resource allocation using AI systems.

- Robotic Assistance:
  - Robots to assist in setting up shelters quickly and efficiently.
  - Automated systems for distributing essentials like bedding and hygiene supplies within shelters.

FEEDING OPERATIONS

Challenges:

- Large-scale food preparation and addressing dietary restrictions.

AI and Robotics Solutions:

- AI in Supply Chain Management:
  - Predictive models to forecast food demand based on population demographics and disaster severity.
  - AI-driven logistics to optimize food delivery routes.

- Robotic Food Preparation:
  - Robotic kitchens for rapid meal production tailored to dietary needs.
  - Autonomous food delivery systems within shelters or affected areas.

MEDICAL AND HEALTH SUPPORT

Challenges:

- Limited medical personnel and facilities during disasters.

AI and Robotics Solutions:

- AI-Driven Health Monitoring:
  - Syndromic surveillance systems powered by AI to detect disease outbreaks in shelters.
  - AI tools for triaging patients by analyzing vital signs remotely.

- Robotic Medical Assistance:
  - Autonomous robots conducting initial triage in mass casualty events.
  - Robots delivering medical supplies or providing basic care to patients in shelters or disaster zones.

REUNIFICATION SERVICES

Challenges:

- Tracking separated families or individuals during evacuations.

AI and Robotics Solutions:

- AI-Powered Tracking Systems:
  - Facial recognition integrated into registration systems for reunification purposes.
  - AI algorithms analyzing social media or other data sources to locate missing persons quickly.

- Robotic Support:
  - Robots assisting at reunification centers by guiding individuals through the process or providing emotional support.

SUPPLY DISTRIBUTION

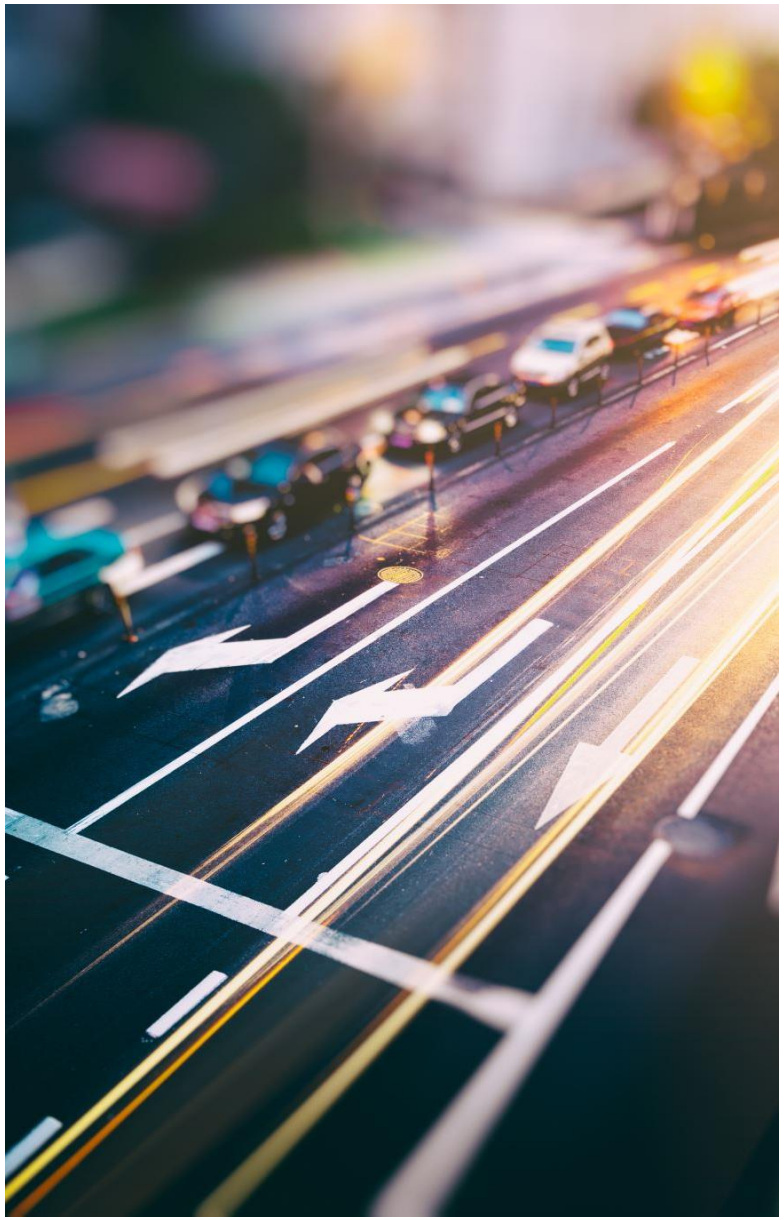
Challenges:

- Equitable distribution of resources across affected areas.

AI and Robotics Solutions:

- AI in Logistics Coordination:
  - Real-time tracking of supply chains to prevent bottlenecks.
  - Predictive analytics to anticipate shortages before they occur.

- Robotic Delivery Systems:
  - Drones or autonomous vehicles delivering supplies to remote or inaccessible locations.
  - Robots managing inventory at distribution hubs.



TRANSPORTATION MANAGEMENT DURING EVACUATIONS

Challenges:

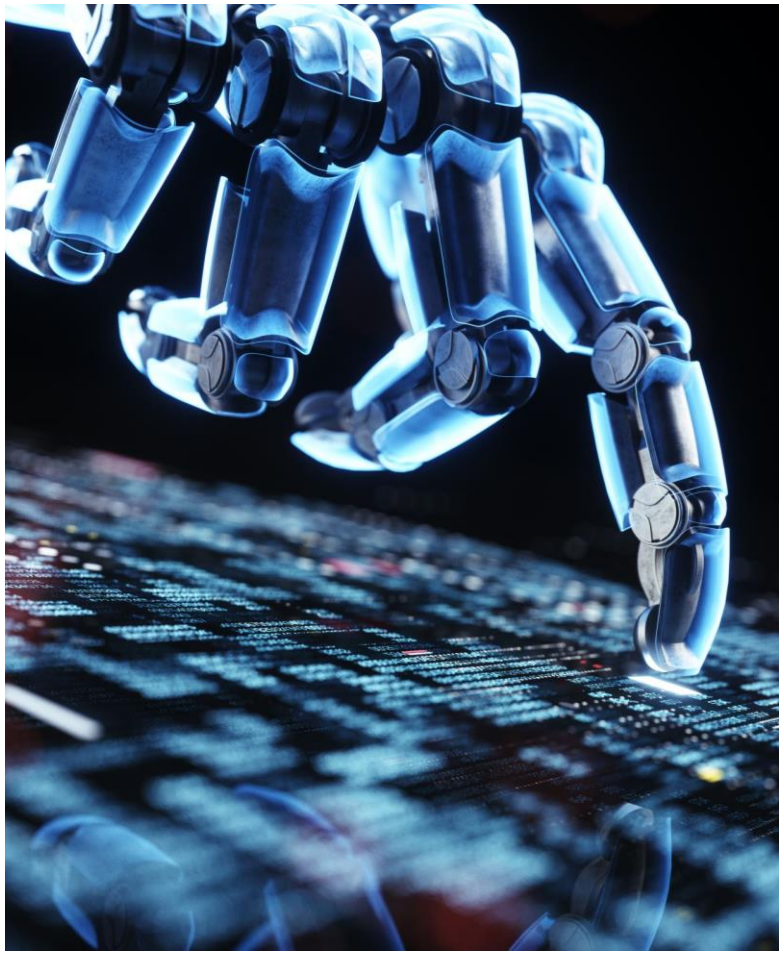
- Coordinating transportation for diverse populations, including those with disabilities.

AI and Robotics Solutions:

- AI Traffic Management Systems:
  - Dynamic route optimization based on real-time traffic data.
  - AI-enabled systems identifying transportation needs for vulnerable populations.

- Autonomous Vehicles:
  - Self-driving buses or vans transporting evacuees safely.
  - Autonomous vehicles equipped for medical transport or pet evacuation.

PUBLIC INFORMATION AND COMMUNICATION



Challenges:

- Disseminating accurate, timely, and accessible information to the public during emergencies.
- Overcoming barriers such as language differences, disabilities, and technological access limitations.
- Combatting mis/disinformation

AI and Robotics Solutions:

- AI Chatbots and Virtual Assistants:
  - Multilingual chatbots providing real-time updates on evacuation routes, shelter availability, and emergency resources.

- Robotic Communication Aids:
  - Robots deployed in public spaces to relay critical information dynamically through audio or visual displays.

ETHICAL CONSIDERATIONS AND OTHER CHALLENGES

Challenges:

- Ensuring data privacy
- Ensuring agency information security is maintained.
- Addressing biases in AI algorithms that could affect equitable service delivery.
- Intense resource use (water, power)
- Balancing human oversight with autonomous robotic operations to maintain accountability.
- Ethical frameworks are evolving and figuring out the "right thing to do" can be challenging.

NOW WHAT?

IMPLEMENTATION ROADMAP

AI Objectives & Strategy

SHORT TERM
0-1 YEAR

OBJECTIVE

AI Adoption Accelerates

Target Return

50%

Internal understanding

KPIs

- 75% AI adoption rate by personnel
- Reduce manual task completion time by 20%
- Reduce average response times by 15% from previous year

Strategies

- Conduct AI workshops and training sessions
- Implement AI-Powered tools and platforms
- Establish data sharing and integration within your agency and jurisdiction

MID TERM
1-2 YEARS

OBJECTIVE

AI Implementation Evolves

Target Return

65%

Private sector engagements

KPIs

- Achieve an accuracy rate of 85% for AI-driven decision-making
- Increase engagements by 30%
- Enhance sustainable funding mechanisms for AI for 80% of costs

Strategies

- Integrate AI-Drive Decision-Making protocols
- Measure public engagement and awareness
- Expand AI training and education and establish an innovation hub with private sector partners

LONG TERM
3+ YEARS

OBJECTIVE

AI-Driven Excellence Emerges

Target Return

85%

Established solutions

KPIs

- Secure 20+ additional partnerships
- Launch the first overarching EM Annual Report
- Secure 10+ members from diverse backgrounds for the committee

Strategies

- Rewrite all Emergency Management Plans integrating AI data, solutions, and partnerships
- Establish a PPP AI Center of Excellence
- Develop a jurisdictional AI Ethics Committee for EM

CALL TO ACTION

Advocacy for Ethical AI Policies

Next Steps:

- Develop policy frameworks that outline ethical guidelines for using AI in emergency management, emphasizing transparency and equity.
- Host professional discussions on the implications of AI adoption, including bias mitigation and data privacy concerns.
- Advocate for funding at the local level to support ethical AI implementation in public agencies.

Immediate Post-Emergency Action:

- Conduct post-disaster audits using AI tools to ensure accountability in recovery efforts and equitable distribution of resources.

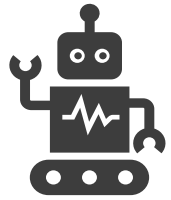
Pilot Projects for AI

Next Steps:

- Launch small-scale pilot projects within local agencies to test specific AI applications (e.g., damage assessment via drones or automated triage systems).
- Partner with private tech companies or academic institutions to co-develop solutions tailored for public administration needs.
- Share findings from pilot projects as case studies for broader adoption.

Immediate Post-Emergency Action:

- Use insights from pilot projects during the emergency response phase to refine recovery strategies and share lessons learned with other chapters.



Community Engagement

Next Steps:

- Develop citizen-facing apps powered by AI that provide real-time updates during emergencies (e.g., evacuation routes, shelter availability).
- Host workshops or town halls educating communities about how AI improves emergency preparedness and response efforts.
- Create multilingual communication tools using natural language processing (NLP) to ensure inclusivity during crises.

Immediate Post-Emergency Action:

- Use sentiment analysis tools powered by AI to gauge community satisfaction with recovery efforts and identify areas needing improvement.

FUTURE TRENDS IN AI FOR EMERGENCY MANAGEMENT

Generative AI for Emergency Communication and Decision Support

- Next Steps:
  - Implement generative AI tools (e.g., ChatGPT-like systems) to draft emergency response plans, press releases, and public announcements.
  - Train public administrators to use generative AI for real-time decision-making during emergencies.
  - Develop templates for emergency communication that can be quickly customized using AI tools.
- Immediate Post-Emergency Action:
  - Use generative AI to analyze post-crisis data (e.g., citizen feedback, media reports) and identify gaps in the response.
  - Leverage AI to create follow-up communication plans addressing community concerns and outlining recovery initiatives.

FUTURE TRENDS IN AI FOR EMERGENCY MANAGEMENT

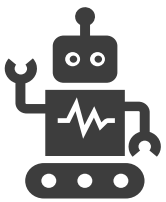
Predictive Analytics for Proactive Risk Management

- Next Steps:
  - Collaborate with local universities or data science firms to develop predictive models tailored to specific regional risks (e.g., flooding, earthquakes).
  - Integrate predictive analytics into public dashboards to provide real-time updates on potential hazards.
  - Use historical disaster data to refine forecasting models and improve accuracy over time.
- Immediate Post-Emergency Action:
  - Deploy predictive analytics to identify secondary risks (e.g., aftershocks, disease outbreaks) and prioritize mitigation efforts.
  - Use AI-driven forecasts to guide resource allocation for recovery operations (e.g., rebuilding infrastructure in high-risk areas).

FUTURE TRENDS IN AI FOR EMERGENCY MANAGEMENT

AI-Driven Resource Allocation During Emergencies

- Next Steps:
  - Implement AI-powered tools for optimizing resource distribution (e.g., food, medical supplies) based on real-time needs assessments.
  - Test algorithms that prioritize aid delivery to vulnerable populations during crises.
  - Build interagency platforms powered by AI to streamline coordination between federal, state, and local governments.
- Immediate Post-Emergency Action:
  - Use AI systems to track the effectiveness of resource allocation during the emergency and adjust distribution plans accordingly.
  - Analyze post-emergency data with AI tools to identify inefficiencies in supply chain management and improve future responses.



QUESTIONS

Contact info:

Sarah K. Miller, PhD, CEM

linkedin.com/in/skmiller

Special thanks to
Ryan Rockabrand, PhD, CEM
for his contributions.

Join the conversation on Discord: https://discord.gg/yK46GuAfeg