



ARTIFICIAL INTELLIGENCE AND THE EMERGENCY SERVICES SECTOR – BENEFITS AND CHALLENGES



HOW AI HAS ASSISTED THE ESS

Artificial intelligence (AI)-powered tools are being used by the Emergency Services Sector (ESS) community to help overcome operational challenges. However, these tools come with a set of advantages and challenges in assisting first responders in fulfilling their mission. AI is being used in various areas such as video surveillance, emergency medical services, healthcare decision-making and guidance, 911 call center auto prioritization and recommendation, facial recognition, fraud prevention, anomaly detection, unmanned aircraft systems navigation, wildfire prediction, and more. With the assistance of AI, first responders can perform their duties more effectively.

Fire and Rescue	EMS	Law Enforcement	Emergency Management	Public Works
The Colorado Division of Homeland Security and Emergency Management now uses an AI Wildfire Risk Mapping tool that has improved wildfire response coordination and resource allocation in the state	The Pittsburgh Medical Center EMS department uses AI to analyze EKGs in real-time, helping emergency medical technicians prioritize patients with a higher risk of cardiac events and provide prompt and critical care	The Massachusetts State police uses an AI-powered robot to enter dangerous environments such as collapsed buildings or chemical spills. This enables the robot to collect essential data and transmit it to first responders without endangering their lives	DOE launched an initiative to use AI to research and develop solutions for disaster response, including wildfire prediction, damage assessment, search and rescue, and natural disasters like hurricanes and tornadoes	Cities in California are using AI chatbots in multiple languages to assist residents. The chatbots are reliable and can handle service requests. One chatbot provided a list of policy changes and dates with ease

DATA SHOWING AI BENEFITS

AI employs statistical models, data analysis, and machine learning algorithms to make predictions based on past events or outcomes (such as algorithms that analyze patients' data or model fire behavior). In addition, AI relies on large language models to learn from previous data and create new solutions. Research demonstrates the benefits of AI in a variety of ESS subsectors. The specific results and impact of AI will differ based on the application, context, and implementation.



Fire and Rescue	Researchers conducted 5,041 simulations to study an AI-powered tool's ability to predict flashovers after heat detectors fail. The researchers found the tool correctly predicted flashovers one minute beforehand for about 86% of the simulated fires. Even when it missed the mark, it mostly produced false positives, which is better than giving firefighters a false sense of security.
EMS	A 2022 study showed that an AI accurately predicted the need for critical care in prehospital EMS. The performance of the AI exceeded that of conventional triage tools and scoring systems and was better than the accuracy of medical staff decision-making.
Law Enforcement	A recent study showed AI could help cities reduce crime by 30-40% and emergency response times by 20-35%. Cities are investing in AI technologies such as real-time crime mapping and gunshot detection, facial recognition and biometrics, vehicle and body cameras for police, unmanned arial systems, and emergency apps for public safety. Private security firms are also adopting AI, notably a multinational company that deployed technology to accurately differentiate between human and vehicle movements, significantly reducing false alarms in video surveillance.
Emergency Management	FEMA has implemented an AI-powered system to simplify travel reconciliation for its employees, especially emergency responders. The system is crucial during times of disaster, as it enables deployed personnel to handle travel-related expenses such as airfare and rental cars efficiently, enabling faster response to affected areas. Furthermore, FEMA's automated payment reconciliation processes have improved relief efforts by streamlining the payment process and ensuring timely payments to individuals impacted by disasters while minimizing errors in payment.
Public Works	The city of Philadelphia implemented an AI-powered tool that captured images every half second, with a width of 30 feet, to evaluate the quality of pavements. This initiative covered 1,200 miles of pavement in three months and resulted in the development of a five-year pavement strategy. The city is also working on is currently training its AI to map out manhole locations and street signs.

AI LIMITATIONS FOR THE ESS

AI has the potential to assist in managing risks within ESS subsectors, but various limitations and challenges could hinder its implementation. Some of the challenges that need to be addressed for effective use of AI include hiring trained professionals, gathering high-quality data, conducting training sessions with the data, and adapting the obtained results. Other challenges and limitation s include the following:

Data Quality & Quantity: In many scenarios, data can be scarce, unreliable or inconsistent which can make it difficult to train AI models and to make accurate predictions.

Cost: AI-powered software for ESS can be costly, especially for stakeholders needing more resources and adequate infrastructure to support AI.

Integration: Integrating AI with existing systems, such as command and control centers, can prove to be a difficult task, especially when it comes to dealing with a variety of systems and data formats.

Responsibility & Accountability: AI can raise questions about the persons responsible and accountable for the decisions made by AI algorithms. Establishing clear rules of responsibility and accountability for AI decision-making is essential.

Ethical and Legal Considerations: AI must be designed and deployed ethically and legally compliant, which should include considerations such as privacy, data protection, and liability.

AI VERSUS TRAINED PROFESSIONALS

When comparing the costs of implementing AI versus utilizing trained professionals in the ESS, it can be difficult to provide a specific monetary comparison due to the wide range of variables involved. The cost of AI support will depend on factors such as the level of assistance required, while human expertise can vary widely in cost. In addition, integration and maintenance costs for AI systems can also impact the overall cost comparison. Ethical considerations should also be considered regarding the use of AI in the ESS. AI's effectiveness depends on human oversight, so trained professionals are necessary to ensure responsible implementation. This ensures that AI complements (rather than replaces) existing services.

Emergency Call Centers

- **Trained Professionals:** Meteorologists analyze weather patterns and historical data to predict potential floods, sometimes with limited accuracy and lead time.
- **AI:** AI can analyze massive datasets of weather data, sensor readings, and historical patterns to predict floods with greater accuracy and longer lead times.
- **Potential Cost Savings:** AI-powered triage can reduce call wait times, improve resource allocation, and potentially save lives by ensuring that critical calls receive priority.

Wildfire Detection

- **Trained Professionals:** Monitor vast areas of forests using cameras and lookout towers, often relying on manual inspection and judgment.
- **AI:** Analyze real-time satellite imagery and sensor data to detect wildfires early, often before humans can. This can lead to faster response times, reduced damage, and lower firefighting costs.
- **Potential Cost Savings:** Early detection can significantly reduce wildfire suppression costs, which can reach billions of dollars annually.

Disaster Response

- **Trained Professionals:** Emergency responders rely on human dispatchers and paper maps to navigate routes during disasters, potentially leading to delays and inefficiencies.
- **AI:** Analyze aerial and satellite imagery to rapidly assess damage to buildings and infrastructure, providing crucial information for relief efforts and recovery planning.
- **Potential Cost Savings:** AI-optimized routing can reduce response times, improve resource allocation, and potentially save lives.

For more information, visit [CISA | Emergency Services Sector](https://cisa.gov/emergency-services-sector) or email the Emergency Services Sector Management Team at EmergencyServicesSector@cisa.dhs.gov.

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