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MEMORANDUM

From: Homeland Security and Public Safety Division, NGA Center for Best Practices, National Governors Association

Re: Artificial Intelligence (AI) in Homeland Security and Emergency Management

Executive Summary

The National Governors Association Center for Best Practices (NGA Center) received a request for information on policies, current capabilities, and practices related to the use of specific Artificial Intelligence (AI) in homeland security and emergency management. The NGA Center subsequently studied AI usage in the areas of homeland security and emergency management and assessed AI's potential for use by states and in current homeland security and emergency management programs.

AI is broadly referred to as “machines that respond to stimulation consistent with traditional responses from humans, given the human capacity for contemplation, judgment, and intentions.”^{1 2} Furthermore, software systems identified as AI can “make decisions which normally require human level expertise” and therefore can then be useful in identifying and addressing problems in an “intentional, intelligent, and adaptive manner.”^{3 4} Many experts believe that power and efficiencies provided by AI will revolutionize private business and government, to include homeland security missions.⁵ The Department of Homeland Security has launched AI efforts that include the enforcement of immigration laws, securing cyberspace, preventing terrorism, and strengthening national preparedness and resiliency.⁶ Some states are beginning to integrate AI technologies into their homeland security and emergency management operations and have seen positive results across a broad range of capabilities from wildfire mapping to fusion center analytics.^{7 8}

Leveraging AI for Homeland Security and Emergency Management

AI in Homeland Security and Disrupting Terrorism

The 9/11 terrorist attacks launched a massive, intergovernmental effort to prioritize information sharing.⁹ While information silos persist (arising from bureaucratic, jurisdictional, or personal conflicts), AI has promising

¹ West, Darrell, and John Allen. “How Artificial Intelligence Is Transforming the World.” *The Brookings Institution*, The Brookings Institution, 9 May 2018.

² Shubhendu and Vijay, “Applicability of Artificial Intelligence in Different Fields of Life.”

³ *Ibid.*

⁴ *Ibid.*

⁵ Gross, Grant. “Government Ventures into AI.” *GCN*, *GCN Magazine*, 5 Sept. 2017.

⁶ “Quadrennial Homeland Security Review Subcommittee: Artificial Intelligence White Paper.” *DHS.gov*, Homeland Security Science and Technology Advisory Committee (HSSTAC), Mar. 2017.

⁷ Molteni, Megan. “The Science of Fighting Wildfires Gets a Satellite Boost.” *Wired*, *Conde Nast*, 11 Sept. 2017.

⁸ Wulf, John. “Artificial Intelligence and Law Enforcement.” *SANS Institute InfoSec Reading Room*, 21 Aug. 2017.

⁹ “Ten Years After 9/11: A Status Report On Information Sharing.” *The United States Senate*, 12 Oct. 2011.

capabilities that can incorporate best practices for information sharing and data collection, thereby empowering human operators to make final adjudications of what actions to take based on refined intelligence.¹⁰

As a result of these advantages, both agencies and private organizations charged with security have successfully used AI to support human operators in conducting counter-terrorism operations and disrupting organized crime, further incentivizing the development of more responsive and powerful software.^{11 12 13} Notable developments and usages of AI in this capacity include:

Large financial institutions are now using AI to identify **illicit money trails and money laundering** schemes that are used to **fund drug trafficking and terrorism**. AI has allowed large global financial institutions to remain in compliance with the regulatory obligations put forward by the U.S. government in the PATRIOT ACT to disrupt funding streams associated with organized crime and terrorist networks. These AI tools provide alerts on suspicious activity, providing valuable protection to financial institutions aiming to remain in compliance with the law and to the public at-large by assisting investigators in disrupting illicit funding.¹⁴

The Department of Homeland Security (DHS) has funded research to have virtual border agent kiosks at various ports of entry across the United States. The system is known as the **Automated Virtual Agent for Truth Assessment in Real-Time (AVATAR)**; it has already seen field testing on the U.S.- Mexico border. AVATAR asks entrants a series of questions and uses sensors and biometrics to assess the entrants' responses, including reactions like eye movements, facial expressions, and changes in voice and posture. It then flags individuals it identifies as being untruthful or a potential risk and will then alert a human agent to conduct a follow-up interview. The system currently has a **success rate between 60 to 75 percent** and is still being tested and researched before a major roll-out.¹⁵

The Pentagon has begun piloting AI systems to conduct intelligence analysis on terrorists' operations, the most notable being **Project Maven**. These AI programs have been integrated with small ScanEagle drones that use an AI algorithm to scan the landscape and identify people, cars, and multiple types of buildings. In the initial rollout, the algorithm was found to be **accurate 60 percent of the time**, but it rose to **80 percent** as human analysts provided corrective input. The Air Force has identified this initial trial as **the "future of human-machine teaming."** The Pentagon is aiming to **build an AI-ready culture** among its forces and hopes to be able to integrate these AI tools with warfighters.¹⁶

AI in Emergency Management

Natural disasters in the United States are increasing in frequency,^{17 18 19} straining both material and human resources. FEMA struggles to provide local assistance to all geographic regions of the country dealing with multiple billion-dollar disasters with little lay-over time in-between them.^{20 21 22 23} Emergency managers are beginning to use AI to bolster response and recovery capabilities, including supply chain management, situational awareness, and information sharing, thereby improving the efficiency and effectiveness of operations. Examples of some AI applications in emergency management include:

¹⁰ Terdiman, Daniel. "How AI Helps The Intelligence Community Find Needles In The Haystack." Fast Company, Fast Company, 24 Oct. 2017.

¹¹ Ibid.

¹² Shane, Scott, and Daisuke Wakabayashi. "'The Business of War': Google Employees Protest Work for the Pentagon." The New York Times, The New York Times, 4 Apr. 2018.

¹³ Greenfield, Patrick. "Home Office Unveils AI Program to Tackle Isis Online Propaganda." The Guardian, Guardian News and Media, 13 Feb. 2018.

¹⁴ Sadwick, Rebecca. "Your Money Helps Fight Crime: Using AI To Fight Terrorism, Trafficking And Money Laundering." Forbes, Forbes Magazine, 14 Jan. 2018.

¹⁵ Daniels, Jeff. "Lie-Detecting Computers Equipped with Artificial Intelligence Look like the Future of Border Security." CNBC, CNBC, 15 May 2018.

¹⁶ Weisgerber, Marcus. "The Pentagon's New Artificial Intelligence Is Already Hunting Terrorists." Defense One, 21 Dec. 2017.

¹⁷ Fischetti, Mark. "New Data: Hurricanes Will Get Worse." Scientific American, Scientific American Magazine, 16 May 2018.

¹⁸ Sullivan, Andy. "U.S. Disaster-Response Force Stretched Thin as Hurricane Season Starts." Reuters, Thomson Reuters, 13 June 2018.

¹⁹ Loria, Kevin. "Why Wildfire Season Is Getting Longer and More Destructive." Business Insider, Business Insider, 13 Oct. 2017.

²⁰ Atkin, Emily. "America's Natural Disaster Response Is Its Own Disaster." The New Republic, The New Republic, 26 Sept. 2017.

²¹ Holdeman, Eric. "FEMA's Recovery Resources Stretched Thin." Government Technology: State & Local Government News Articles, Government Technology, 9 Sept. 2017.

²² Ross, Erin. "Resources 'Stretched Thin' Fighting Massive Wildfires in the West." Axios, Axios, 2018.

²³ "US Disaster-Response Force Stretched Thin as Hurricane Season Starts." CNBC, Reuters, 13 June 2018.

California has been experiencing intense fire seasons more regularly, displacing and depleting resources necessary to combat wildfires and save both lives and property. As a result, California and other states at major risk of wildfires have needed to supplement their operations with more adaptive methods and tools to effectively combat the growing threat that wildfires have become. In 2017 the **Los Angeles Fire Department (LAFD) used Unmanned Ariel Vehicles (UAVs)** for the first time to help coordinate the battle against multiple major Southern Californian wildfires.²⁴ Wildfire experts are now assessing the potential of fully autonomous drones (requiring no pilot on the ground) **to scan landscapes with fires and provide continuous video streams, data, and supplies to responders on the ground.**²⁵ Other AI technologies in development include rapid iteration software that can predict where wildfires might occur and assessment algorithms that can identify fire-specific damage from satellite imagery.^{26 27 28}

Weather predictions have been a staple for early machine learning since the first weather prediction was made in 1948. Over time, especially with the developments related to computing power, this process has become more refined, and **AI has become essential in forecasting the conditions that precipitate severe weather events in the over 150 accepted weather models** used by the U.S. government. Outputs from machine learning models versus traditional ones have been **found to be 20 percent more accurate in predicting hurricane tracks and 30 percent better in predicting their intensity.**^{29 30} Additionally, AI is enabling emergency managers to predict the geographical areas that would be most heavily affected by the consequences of a major storm. In this case, the weather model uses **AI to combine information from utility networks with continuously updating storm data to predict where energy outages are most likely to occur,** allowing emergency managers to pre-position resources and plan responses more effectively.³¹

Limitations and Challenges of AI

AI researchers must overcome major limitations and challenges before it becomes a core element of homeland security and emergency management work.

Bias in AI

Artificial Intelligence and machine learning software programs are susceptible to bias³². Because algorithms are built by humans, they are subject to many of the same cognitive distortions, preferences, and irrationalities that cause inaccurate judgments in the people that built them, and therefore, can produce disparate outcomes.³³ For instance, AI programs may raise false flags regarding the risk posed by some individuals due to the biases in available data as well as the bias built into the process and programming.³⁴ Numerous law enforcement agencies are using AI-driven facial recognition technologies to identify criminals; however, many of those tools have poor accuracy in correctly identifying individuals from minority backgrounds. This can lead law enforcement officials to mistakenly investigate innocent individuals, possibly exacerbating already fragile relationships between communities of color and policing agencies.³⁵ Researchers have also identified that a major portion of bias in AI systems can come from two sources: the socially generated data used to design the fundamental baseline of an AI system and from the unconscious bias of the human engineer/programming team

²⁴ Baggaley, Kate. "Drones Are Fighting Wildfires in Some Very Surprising Ways." NBCNews.com, NBCUniversal News Group, 16 Nov. 2017

²⁵ Ibid.

²⁶ Gaskell, Adi. "Using AI To Predict Forest Fires - DZone AI." Dzone.com, AI Zone, 13 July 2018.

²⁷ Snow, Jackie. "To Spot Fire Damage from Space, Point This AI at Satellite Imagery." MIT Technology Review, MIT Technology Review, 8 Mar. 2018.

²⁸ Shah, Aditya. "Fighting Fire with Machine Learning: Two Students Use TensorFlow to Predict Wildfires." Google Technology, 4 June 2018.

²⁹ Gershgorn, Dave. "Artificial Intelligence Is Great at Predicting the Size of Hurricanes, but Humans Still Need to Figure out Their Impact." Quartz, Quartz, 8 Sept. 2017.

³⁰ Shepherd, Marshall. "Why Is Tracking A Hurricane Easier Than Predicting Its Intensity?" Forbes, Forbes Magazine, 29 Aug. 2015.

³¹ Woodie, Alex. "Predicting Hurricane Damage with Machine Learning." Datanami, 23 May 2017.

³² Baker, Jim. "Artificial Intelligence – A Counterintelligence Perspective: Part I." Lawfare, 15 Aug. 2018.

³³ Devlin, Hannah. "AI Programs Exhibit Racial and Gender Biases, Research Reveals." The Guardian, Guardian News and Media, 13 Apr. 2017.

³⁴ Angwin, Julia, et al. "Machine Bias." ProPublica, 23 May 2016.

³⁵ Frankle, Clare Garvie Jonathan. "Facial-Recognition Software Might Have a Racial Bias Problem." The Atlantic, Atlantic Media Company, 7 Apr. 2016.

that developed the AI system. These biases can be self-reinforcing: as the AI system begins to operate, positive feedback loops may strengthen the original algorithms as the machine engages in learning behaviors.^{36 37}

Data Limitations and Human Staffing of AI

Because AI systems require both large volumes of discreet data and intricate decision-making algorithms to be effective, they are currently well-suited to perform narrowly focused tasks. **AI solutions for more complicated problems are limited by complexity**, especially in relation to the availability of data and the construction of elaborate algorithms. For instance, Shazam is a highly accurate music identification app that can recognize a song (as well as associated data such as artist name, year of release, etc.) from a short audio sample or clip. The app compares the short sample to a database constructed by human engineers and quickly runs multiple permutations to identify the music being played. A similar framework is being used in the healthcare industry, where AI “bots” are being developed to help patients with non-critical medical questions in identifying medications to treat their basic symptoms. Both examples reveal a key limitation: **AI systems often rely on human support to ensure the availability, accuracy, and reliability of extensive amounts of data**. Both public and private sector interests are facing challenges in addressing these limitations, which are necessary to advancing the technology.³⁸

Additionally, **a major shortage of AI professionals worldwide is limiting AI’s growth**. Studies have identified that roughly 300,000 suitable AI professionals are available to fill the millions of jobs and opportunities. This issue is exacerbated by the exponential growth of the field. The AI workforce remains small as **the educational infrastructure in place to train AI professionals remains under-resourced**.³⁹ In response, there has been a push to bolster technical, digital, and mathematical education programs that emphasize AI competencies. The UK government announced greater investment in these fields surrounding AI in their *2017 Industrial Strategy* document and private sector companies like Google and Amazon have launched their own AI-focused institutes to better train employees on AI engineering competencies and data evaluation.⁴⁰

Challenges of AI in the Public Sector

Most of the innovation around AI is occurring in the private sector, and therefore, innovation efforts are often tied to perceived return on investment and the potential for profit. Many of the advances in AI are related to data-specific collections that can be monetized. As government entities contract for more of these services, an outstanding question remains: how will the personal and private information of millions of citizens be protected from an industry developed on the monetizing of data?⁴¹ This also brings to light the broader questions of what regulations will need to be put in place to govern how AI systems operate in the private sector as well as in public service. As AI outpaces traditional regulatory frameworks, the industry will need to develop “norms” to provide for security and protection, as has similarly been done in the financial and utility sectors.⁴²

NGA Contacts

The NGA Center for Best Practices will continue to monitor developments and keep state leaders informed as more information becomes available. For questions and additional information, please contact:

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³⁶ Osoba, Osonde, and William Welser. “The Risks of Bias and Errors in Artificial Intelligence.” RAND Corporation, RAND, 5 Apr. 2017.

³⁷ Clendaniel, Morgan. “Now Is The Time To Act To End Bias In AI.” Fast Company, Fast Company, 23 Apr. 2018.

³⁸ Guy, Peter. “Can Artificial Intelligence Lie, If It’s Served Inaccurate Data Sets?” South China Morning Post, South China Morning Post, 4 Feb. 2018

³⁹ Industrial Strategy Building a Britain Fit for the Future. Her Majesty’s Government

⁴⁰ Ibid.

⁴¹ Filer, Tanya. “Developing AI for Government: What Role and Limits for the Private Sector?” Bennett Institute for Public Policy

⁴² Etzioni, Amitai, and Oren Etzioni. “Should Artificial Intelligence Be Regulated?” Issues in Science and Technology, 15 Nov. 2018