GeoAI in Focus

A Special Report

Pennsylvania
State Geospatial
Coordinating Board

Executive Summary

This Special Report by the State Geospatial Coordinating Board (GeoBoard) explores the potential of Geospatial Artificial Intelligence (GeoAI), which is the convergence of geospatial technologies with artificial intelligence, machine learning, and deep learning. GeoAI is already reshaping how data are collected, analyzed, and applied to generate advanced insights and analysis, automate processes, improve predictions, and provide faster responses. Pennsylvania is well positioned to become a leader in this emerging field.

The GeoBoard finds Pennsylvania benefits from several strategic advantages to implementing GeoAI including its robust energy infrastructure, academic institutions, growing AI investments, and leadership in geospatial governance. Case studies from across the Commonwealth demonstrate real-world applications of GeoAI, such as SEPTA's AI-powered transit enforcement, PennDOT's freight signal priority systems, and PEMA's post-disaster damage assessments using aerial imagery and machine learning. These examples show how GeoAI can improve public safety, infrastructure planning, and emergency response.

While the possibilities of GeoAI applications are promising, the report also highlights challenges, such as data bias, privacy concerns, and the need for workforce readiness. The report emphasizes the importance of ethical implementation, transparent governance, and continued investment in our spatial data and broadband infrastructures to ensure equitable access and responsible use.

To support Pennsylvania's leadership in GeoAI, the GeoBoard recommends expanding workforce development to include GeoAI training; advancing the statewide PA BaseMap 2030 and 3DPA initiatives; and closing broadband gaps to enable all of Pennsylvania to access GeoAI tools and geospatial data and applications. With thoughtful planning and collaboration across sectors, Pennsylvania can harness GeoAI to drive innovation, resilience, and economic growth statewide and become a true leader in the GeoAI world.

State Geospatial Coordinating Board
RA-PAGeoCoordBoard@PA.GOV

Introduction

Geospatial information positively impacts daily life by enhancing navigation, location-finding, pattern analysis, and decision-making. Technologies such as location-enabled databases, drones, geographic information systems (GIS), global navigation satellite systems (GNSS, GPS), light detection and ranging (lidar), and satellite imagery are central to data collection and analysis across many sectors. Geospatial Artificial Intelligence (GeoAI) is the powerful convergence of these geospatial technologies and analytics with artificial intelligence, machine learning, deep learning, and even generative AI (Figure 1). GeoAI enables GIS systems to extract meaning from large datasets, model complex processes, automate decisions, and generate insights from geographic data faster, easier, and more in depth than ever before.

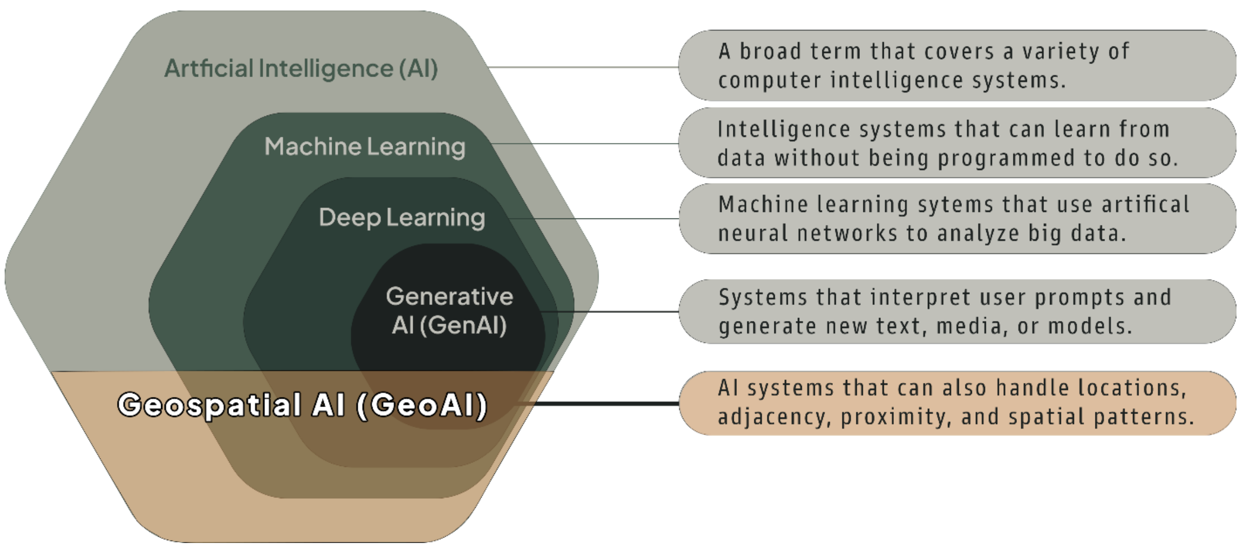

Figure 1. GeoAI is the intersection of artificial intelligence and geographic information systems.

The National Context

GeoAI has academic roots dating back to the 1980s,[1] but recent growth is driven by accessible user interfaces and scalable cloud computing capabilities. These advances have made powerful GeoAI tools available to non-experts and more affordable for widespread use.

The cloud computing infrastructures that support AI rely on essential human and physical resources that are commonly described in terms of '*ping*' (diverse networks of high-speed wireless and underground fiber connectivity), '*power*' (energy for sensors, servers, and data centers), and '*pipe*' (water for cooling).[2] Locations where these resources overlap are prime locations for cloud and AI infrastructure investment.

The Brookings Institution's research on the U.S. AI economy found a small but rapidly growing sector that was highly concentrated geographically in 2021.[3] The greater Silicon Valley area in California was leading the way and characterized as the conspicuous "superstar" hot spot on its national heatmap. In the east, the Boston-Washington corridor contained more hot spots. In Pennsylvania specifically, Pittsburgh and State College were characterized as "early adopter" hubs because of their proximity to strong academic institutions driving AI research.

By 2025, the Brookings Institution found the U.S. AI economy was still growing and concentrated, but it had also expanded into at least 190 metro areas.[4] The Philadelphia metro area was noted for a relatively large number of recent job postings that included at least one AI qualification. The greater Allentown, Harrisburg, Lancaster, and York metros were recognized as nascent AI adopters. And the Pittsburgh metro, bolstered by AI research at Carnegie Mellon University, was characterized again as an Emerging AI Hub.

Pennsylvania's growing role in the national AI economy is not a coincidence. The Keystone State has the essentials needed for cloud computing and AI because it has many highly developed data networks and abundant talent, energy, and water resources. Locations with ping, power, and pipe are attracting the attention of global players in AI. Google recently announced $25 billion in investments in AI and data centers in the Pittsburgh area[5] and new education partnerships with Pennsylvania universities.[6,7] Also, Constellation Energy is investing in the Crane Clean Energy Center near Harrisburg, formerly the Three Mile Island nuclear plant, to provide Microsoft with 20 years of electricity to power its data centers.[8] Investments like these will help Pennsylvania shine even brighter on our national heatmap.

The State Geospatial Coordinating Board

The State Geospatial Coordinating Board (GeoBoard)[9] is interested in GeoAI and how it will reshape Pennsylvania's future. In 2024, the GeoBoard established an Emerging Technologies Subcommittee and tasked it with monitoring advancements in geospatial technology, including drones, remote sensing advancements, and advancements and applications of GeoAI. The Emerging Technologies Subcommittee collaborated with the Pennsylvania Spatial Data Access (PASDA) team at Penn State University to sponsor three education panel discussions to learn more about GeoAI and how it is being used in Pennsylvania. The lessons learned from experts and published literature provided material used in this report.

1

The Evolution and Applications of Environmental Twin Technology [10]

by Kat Kraft @ Teren

Learned: The current practice of using GIS data to create static digital models (twins) of physical assets and earth systems can be improved upon with digital models that reflect conditions and changes in real-time by combining GeoAI, live data streams, and advanced computer simulation technology.

2

Using 3D GIS, Machine Learning, and AI for a Quality-of-Life Project in Pittsburgh and Beyond [10]

by Professor Kristen Kurland @ Carnegie Mellon University.

Learned: GeoAI models can be used to analyze big data involving a broad range of topics and business questions. Topics can range from land development and infrastructure scenarios to human sentiment and behavior analyses.

3

GeoAI & AI-Driven Geospatial Workflows [11]

by Grace McDonough and Kyle Talbot @ Esri.

Learned: The technology marketplace is creating new GeoAI solutions and integrating GeoAI features and capabilities into their products and services, e.g. Esri is building pre-trained machine learning models and tools for use in common geospatial workflows.

Applications of AI and GeoAI in Pennsylvania

Executive Order 2023-19 established the Commonwealth of Pennsylvania as a leader in the responsible use of AI in state government.[12] The order established a comprehensive framework for AI governance in Pennsylvania state government and underscores the Commonwealth's commitment to 10 core values. Central to this initiative was the formation of the Generative AI Governing Board to oversee the responsible, efficient, and ethical use of generative AI and identify opportunities for pilot projects in which the use of generative AI could significantly empower state employees in their work.

10 Core Values

- Accuracy
- Adaptability
- Employee Empowerment
- Equity and Fairness
- Innovation
- Mission Alignment
- Privacy
- Proportionality
- Safety and Security
- Transparency

By 2025, the Commonwealth was sharing lessons learned from a yearlong pilot program giving Commonwealth employees access to ChatGPT Enterprise.[13] On average, employees reported saving approximately 95 minutes daily by using ChatGPT for various tasks. These time savings translated into increased productivity, allowing employees to complete tasks more quickly and focus on more complex and value-added activities. Importantly, the pilot reinforced the notion that AI serves as an augmentative tool, enhancing human capabilities rather than replacing them. The pilot also acknowledged that generative AI is not a substitute for the judgment and experience that employees bring to their work, as well as the importance of reviewing outputs for accuracy.[14]

The National Association of Counties (NACo) published a toolkit to help local governments thoughtfully implement Generative AI.[15] The "*AI County Compass*" highlights an array of perceived benefits, challenges, and opportunities (Table 1); and a set of recommendations. The County Commissioners Association of Pennsylvania (CCAP) reviewed the NACo report and commissioners have continued to discuss how best to align AI implementation with county missions.

Pennsylvania is not only an emerging leader in AI, but also an established leader in the use of geospatial technology. The Commonwealth's State Geospatial Coordinating Board and Office of Geospatial Services, and the PASDA program are three examples of Pennsylvania's commitment to developing its spatial data infrastructure. As testament, Pennsylvania received an A- grade during the latest National States Geographic Information Council's Geospatial Maturity Assessment, which measures geospatial capabilities across state governments.[16] The high grade reflects strong policies and governance, and decades of expertise with geographic information systems (GIS), global navigation satellite systems (GPS, GNSS), and remote sensing systems (e.g., aerial imaging and lidar). Leadership in AI and leadership in geospatial technology could evolve naturally into leadership in GeoAI. To take best advantage of GeoAI, however, Pennsylvania needs to continue developing its spatial data[17] and broadband[18] infrastructures.

Table 1. Benefits, challenges, and opportunities for counties. Source: NACo.[15]

Benefits	Challenges	Opportunities
Enhance productivity and cost savings	Ensure governance, compliance, and accountability	Optimize social services
Generate new ideas and solutions	Manage trust, change, and decision-making	Improve public safety and security
Improve service delivery	Deal with copyright issues	Personalize service delivery
Increase equity and accessibility	Validate the accuracy of results	Create tailored local solutions
	Precent bias and ethical issues	Forecasting
	Protect security and privacy	Increase community engagement among the most vulnerable and underserved.
	Train county staff	

Transportation

Pennsylvania's transportation sector was among the first sectors to leverage GeoAI. Successful implementations include improvements to public transportation services, traffic monitoring, and queue control.

In 2023, SEPTA temporarily mounted camera systems on seven buses serving a limited section of downtown Philadelphia, and it used a machine learning model that was trained to detect parked cars from the camera feeds. The project identified more than 4,000 vehicles parked illegally in bus lanes or bus stops per week during the 60-day trial.[19] The extent of illegal parking underscored the difficulties bus operators were having while deploying wheelchair access ramps, and the difficulties people with disabilities have while trying to board or exit buses safely. In 2025, the Philadelphia Parking Authority (PPA) launched a more capable GeoAI system to solve these problems. The new system, this time deployed on more than 180 SEPTA buses and trolleys,[20] automatically takes and flags photos of vehicles parked illegally in bus stops or bus lanes, pinpoints the locations of those vehicles, reads license plates, and integrates with violation processing systems. To build trust in the new system and mitigate against possible hallucinations, all flagged photos are reviewed by PPA officers before any violation notice is issued.[21]

Pennsylvania's Department of Transportation (PennDOT) is evaluating Freight Signal Priority (FSP) technology that relies on artificial intelligence to map truck locations with GPS, calculate truck speeds, and interact with traffic signals. When an equipped truck approaches an equipped traffic signal, the truck will send a request to the traffic signal controller (Figure 2). If the signal light is green and other conditions are met, then the duration of the green light can be extended by several seconds. A green light extension allows the moving truck to continue safely through the intersection instead of stopping, which keeps freight moving and reduces emissions produced by idling.[22] In short, PennDOT is testing a form of GeoAI that can monitor streams of location-enabled truck data and automatically make intelligent signaling decisions.

PennDOT recently received an America's Transportation Award for its Automatic Queue Protection System project.[23] The ongoing project involves a computer model that is trained to process a live stream of anonymized vehicle-generated data being mapped in real time, detect traffic slowdowns along pre-defined highway segments, and automatically decide which digital message boards will receive updated traffic messages. Driving distances to queues are calculated automatically and the messages adjust as traffic conditions change. Self-adjusting messaging systems help drivers develop situational awareness before they reach slowdowns (Figure 3). Crash data indicate crashes have decreased 11% over the 600 road-miles where this new GeoAI system is operating.[23]

Figure 2. A freight signal priority system relies on good geospatial information and several vehicle-to-infrastructure connections. Source: Image generated in Microsoft Copilot and edited for illustration purposes.

Figure 3. Self-adjusting messaging systems, like the one shown here along I-83 in Dauphin County, can help drivers develop situational awareness before they reach a slowdown.

A common element among all these intelligent transportation systems is big data volume. Each pilot project has the potential to be scaled up to process data streams representing thousands of traffic signals, tens of thousands of road lane-miles, and millions of drivers. Emerging GeoAI systems promise to not only improve traffic conditions in real-time but also to generate information and statistics that support secondary uses, like informing infrastructure planning and investment-making.

Emergency Management

Governor Shapiro secured federal recovery aid to offset disaster costs associated with Tropical Storm Debby in August 2024. Torrential downpours brought up to six inches of rain to some areas, with the hardest hit in Cambria, Cameron, Clearfield, Elk, Indiana, Lycoming, Potter, Sullivan, Susquehanna, Tioga, Wayne, and Wyoming Counties.

Pennsylvania's Emergency Management Agency (PEMA) was already cooperating with leading AI scientists at Carnegie Mellon University and Texas A&M University when Tropical Storm Debby hit and looking for ways to test GeoAI models in emergency management situations. Debby provided the group with a natural opportunity to see if a GeoAI model could accelerate post-storm building damage assessment.

PEMA and PennDOT, already working together on the GeoBoard, coordinated action to obtain 456 gigabytes of digital aerial imagery immediately after the storm. PEMA shared images of the flooding Cowanesque River in Potter and Tioga Counties (Figure 4) with the AI scientists at Texas A&M. The scientists' GeoAI model reads aerial imagery and building footprint data as inputs, and it outputs building damage data for emergency managers and decision-makers to review.

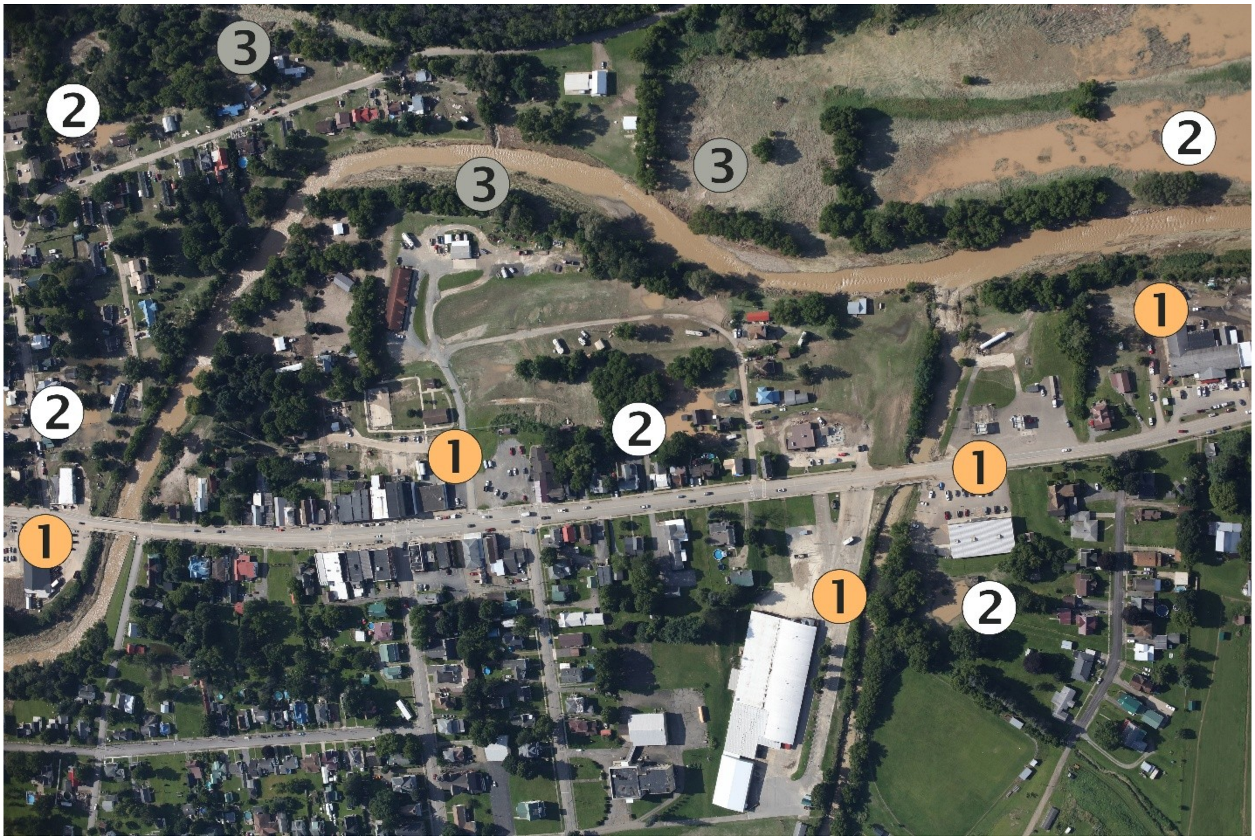

Figure 4: This aerial image was captured over the Cowanesque River by the Civil Air Patrol after Tropical Storm Debby. It contains a lot of information and context clues that, historically, have been very difficult to interpret using machines. Visual evidence of water inundation includes: 1) stranded sediment and debris; 2) stranded pools of turbid water; and 3) vegetation that was flattened in the direction of water flow. An experimental GeoAI model processed images like these and tried to automatically identify structures that were damaged by the flood.

The team at Texas A&M compared their Pennsylvania experiment during Tropical Storm Debby against similar experiments conducted in Florida during Hurricane Helene. They reported mixed results and identified several "operational challenges" and opportunities for improvement: [24]

1. Projects like these generate a lot of data. Limited wireless connectivity was identified as the most impactful factor that delayed the delivery of digital imagery collected over each flood site to the compute site, and delayed delivery of building damage information from the compute site back to emergency managers and

decision-makers. In all three experiments, the large volumes of data could not be moved quickly enough. **Gaps in broadband connectivity were obstacles.**

2. The machine learning model that promised to accelerate building damage assessment did so, but it did not perform as well in Pennsylvania as it did in Florida. During training, the model seemingly developed biases for interpreting coastal flood events and coastal architecture because it was trained using historical storm imagery representing Gulf Coast landscapes only. The apparent regional bias limited the ability of the GeoAI model to completely "understand" the storm images representing Appalachian terrain and to correctly assess building colors, materials, and shapes that are more common in Potter and Tioga Counties than in Florida. **Geography matters.**
3. During the experiment, geospatial building footprint data were expediently obtained from a third-party vendor instead of from an authoritative source in Pennsylvania. The research team discovered the building footprint data had coordinates that were offset from the aerial imagery coordinates. **The misalignment between map layers limited the GeoAI model.**

In brief, one rapid experiment with GeoAI produced some useful results but also revealed how gaps in broadband service, an obsolete coordinate system, and unintended biases in training data can slow innovation with GeoAI. The gaps in broadband service highlight the documented need for wall-to-wall broadband infrastructure across Pennsylvania.[25] The coordinate system discrepancy underscores the documented needs for a) authoritative basemap layers[26] that b) adhere to a set of statewide data standards.[27]

From PEMA's perspective, the experiment highlighted benefits of the GeoBoard. PEMA had an urgent need for post-storm imagery and PennDOT had a ready contract, and each was aware of the other to coordinate immediate action. The experiment also revealed needs to streamline workflows and standards for collecting post-storm imagery with unmanned aircraft systems.

The Commercial Sector

Keeping an eye on the commercial sector can be helpful because private companies are working with public entities to build AI capacity in Pennsylvania. In June 2025, Governor Shapiro announced plans by Amazon to invest over $20 billion to build multiple state-of-the-art AI data center campuses in Pennsylvania, creating over 1,200 new jobs and positioning the state as a technology and innovation hub for years to come.[28] As mentioned above, Google recently announced $25 billion investment in AI and data centers in the Pittsburgh area[29] and new partnerships with Pennsylvania universities, including PASSHE universities.[30,31] Constellation Energy Corporation is investing in the Crane Clean Energy Center near Harrisburg to provide Microsoft with 20 years of electricity to power its data centers.[32]

It is worth noting that Google launched Google Maps in 2005 and now more than 1 billion people around the world are using it. In 2023, the company reported receiving about 20 million user contributions per day on Google Maps and Search[33] and it described how it uses AI to handle the massive volume of data and automatically assess the quality and validity of each contribution.[33,34,35] So, as Google integrates AI with Google Maps, the company is, in effect, inter-weaving GeoAI into the fabric of everyday life.

Wildfire Detection and Mapping

In 2020, Google started using satellite imagery and building machine learning tools that can spot, track, and map wildfire.[36] The goal of the project was to provide users searching for information about a wildfire with current information and a visual representation of its footprint on Google Maps. Fast forward to 2025, Google and its partners in the AI Wildfires Collaborative have sponsored the launch of a new type of satellite (called FireSat) that was purpose-built for remotely sensing wildfire from space and for feeding the GeoAI models that automatically map their footprints.[37] The FireSat/GeoAI system promises, once all 50 planned satellites are in orbit, to find and map new instances of wildfire, as small as 70 square feet, anywhere around the world.[36,37]

Flood Prediction

In 2018, Google started work to improve flood forecasting in vulnerable regions of the world. By 2024, the project was using an ensemble of three independently trained GeoAI models to predict how much water will be flowing in rivers and streams, in 80 different countries, during a 7-day forecast horizon.[38]

Each AI model has two main parts, an *encoder* and a *decoder*. Each encoder gets trained by reading geospatial earth data and weather data within gaged watersheds to learn historical streamflow patterns. Next, each decoder uses what its encoder learned, combines it with a fresh 7-day weather forecast, and predicts future streamflow.

Google uses what the three independent AI models generate to calculate an average streamflow forecast along with statistical measures of how well the three models agree or disagree. The ensemble approach mitigates against single-model hallucinations and produces flood predictions and lead times that perform, on average, better than the best models currently available for those vulnerable regions.[38] The goal of this massive GeoAI project is to provide better early warnings about flood hazards to everyone around the world by 2027.

Weather Forecasting

Another way to improve flood prediction is to improve weather forecasting. In one recent example, NOAA's National Hurricane Center (NHC) and Google announced a partnership to improve hurricane weather forecasts.[39,40] The partnership will conduct experiments during the 2025 hurricane season and compare the hurricane forecasts produced by human experts and their best physics-based weather models against the experimental forecasts produced by Google's GeoAI models. Key performance indicators will involve storm intensity, the location of the hurricane track, and the timing and magnitude of changes to storm intensity and the track.

Putting Commercial Innovations into a Pennsylvania Context

Pennsylvania is a large state with beautiful and varied terrain that is home to more than 13 million people. Our Commonwealth also has well-documented histories of wildfires, storms, and flood events. Notable recent fires have occurred near Jim Thorpe (April 2025) and in the Michaux State Forest (April 2025, see Figure 5). Also, the Susquehanna River Basin is one of the most flood-prone watersheds in the United States. Hurricanes Connie and Diane (1955), Irene (2011), Sandy (2012), Henri (2021), and Ida (2021), along with tropical storms Agnes (1972), Ivan (2004), Lee (2011), Fred (2021), and Debby (2025), have brought substantial rainfall to Pennsylvania that caused substantial flooding and damage. With Pennsylvania's history of natural disasters, innovations in GeoAI applications to assist hazard mitigation, prediction, and response could prove invaluable.

Figure 5. An aerial view of the April 2025 wildfire in Michaux State Forest, Cumberland County. Image source: Grant Michaels; used with his permission.

The Future of GeoAI in Pennsylvania

Our Commonwealth has the essentials needed for cloud computing and AI because it has many highly developed data networks and abundant talent, energy, and water resources. Already, locations with ping, power, and pipe are attracting the attention and investments of global players in AI. Pennsylvania is an established leader in the use of geospatial technology and an emerging leader in AI. Such leadership could evolve naturally into leadership in GeoAI.

GeoAI offers transformative potential for strengthening infrastructure, managing weather and geologic hazards, modernizing emergency response, summarizing large data and document collections, and other purposes yet to be imagined. GeoAI also poses some challenges with respect to bias, sustainability, and workforce readiness. So, Pennsylvania stands at a crossroads. The question is not whether we embrace GeoAI, but how carefully and how ethically we will do so.

Enthusiasm and Caution

Advocates within the geospatial community are enthusiastic about GeoAI and maintain the Commonwealth cannot afford to delay. GeoAI is not just a technological upgrade, it is a strategic imperative. Pennsylvania must harness the innovation now to improve environmental and infrastructure resilience, foster economic growth, streamline workflows, and become a leader in the use of this technological leap forward. Pennsylvania has an impressive geospatial talent base, with research institutions like Carnegie Mellon, Penn State, and Temple University leading GeoAI research, and with PASSHE institutions having well-regarded geospatial education programs and new AI training programs. GeoAI will be a force multiplier because it promises to replace routine tasks and free geospatial professionals to increase their focus on better planning and analysis. The state's cross-sector collaborations among academia, government, and private industry are positioning the Commonwealth as a national model for GeoAI governance and workforce development. History is on the side of the advocates because precedent shows technological advancement—when guided by public purpose— elevates society.

On the other hand, critics within the geospatial community insist well-documented concerns over inaccuracies, increased surveillance, unsustainable energy and water consumption, and workforce unreadiness require proceeding with caution and intention. One of the most frequently discussed challenges of GeoAI is the potential to amplify historical biases lurking in the volumes of historical data that are being used to train AI models. Historical biases in training data could easily regenerate outdated or unjust outcomes in critical areas like housing, environmental management, zoning, or even voter access. These issues must be addressed with transparency and robust governance before moving forward. History is on the side of the critics because precedent shows disruptive technological advancements—even when guided by the best intentions— can disrupt workers, industries, and governments with generational consequences.

Looking Ahead

The State Geospatial Coordinating Board (GeoBoard) recognizes it is impossible to predict the future trajectory of any technological advancement, especially an advancement that is evolving as rapidly as AI. One of the challenges of building a report like this one has been keeping up with the rapid pace of innovation. The range of possible futures is broad and could include anything from a near-term capabilities plateau to exponential improvements that result in unimagined capabilities with sweeping economic or social consequences.

The GeoBoard is keenly interested in GeoAI and how it will reshape Pennsylvania's future, which is why it established an Emerging Technologies Subcommittee and tasked it with monitoring advancements in GeoAI. At every stop along the way, the Emerging Technologies Subcommittee has found enthusiasts and others advocating caution. The spectrum of perspectives is reflected in this report.

At the recent *2025 AI Horizons Summit in Pittsburgh*, Governor Shapiro spotlighted the need for tools that can showcase where Pennsylvania is ready for economic development with speed, clarity, and predictability. To answer these where-type questions, our mapping tools will rely on Pennsylvania's spatial data infrastructure.

The GeoBoard constantly considers GeoAI within the contexts of the "Pennsylvania BaseMap 2030" and "3DPA" statewide mapping initiatives,[41] which are ongoing efforts to build an authoritative spatial data infrastructure that Pennsylvanians can use to find optimum locations and answer economic development questions as well as ensure public safety, mitigate geologic and weather hazards, and build other infrastructures needed to support safety and economic growth. To take best advantage of GeoAI, our spatial data infrastructure must be current, complete, correct, logically consistent, and shared broadly; and it must adhere to uniform data standards that ensure trust and interoperability across all levels of decision-making.

GeoAI is here and its expected value is illustrated by multiple examples in this report. Fortunately, our state and county governments are demonstrating ethical leadership in AI through pilot programs like the Commonwealth's with ChatGPT Enterprise, the National Association of Counties' recommendations for implementing AI, and now the GeoBoard's treatment of GeoAI. The usefulness of GeoAI will continue to grow as it is paired with Pennsylvania's improving broadband and spatial data infrastructures.

Recommendations

1

Pennsylvania should expand its workforce development, training, and capacity building efforts to help Pennsylvania's workforce use GeoAI and train AI models appropriately.

Geospatial Artificial Intelligence (GeoAI) is a powerful convergence of geospatial technologies and analytics with artificial intelligence, machine learning, deep learning, and even generative AI. GeoAI can automate repetitive tasks; summarize large volumes of data; enhance planning, scenario, coding, and documentation workflows; and support a variety of new applications. However, working with AI models requires specialized knowledge and care because the user can see the inputs and outputs but not the inner workings of the model (or models) involved.

2

Pennsylvania should continue pursuing the PA Basemap 2030 & 3DPA initiatives so our next GeoAI models can be trained using authoritative geospatial data.

It is vital to build trust in AI models, including GeoAI models, by ensuring they are trained with and use the most current, complete, correct, and unbiased authoritative data.

3

Pennsylvania should continue to close our gaps in broadband access so all Pennsylvanians can take advantage of internet-based GeoAI tools, data sharing and mapping services, mobile data collection and management systems, and real-time data streaming.

The geospatial community will continue to inform, encourage, and support efforts and investments to close the remaining gaps in broadband service coverage so that advancements in geospatial technology, including GeoAI, do not outpace completion of this critical infrastructure.

Acknowledgements

This report was prepared by the State Geospatial Coordinating Board to increase awareness of the rapid advancements in GeoAI occurring across Pennsylvania. Much of the work was accomplished by volunteers, including members of the Board's Emerging Technologies Subcommittee and Service Delivery Task Force. All contributors and contributions are appreciated, especially given how quickly the artificial intelligence landscape is evolving.

References

[1] Mai, Gengchen with Yiqun Xie, Xiaowei Jia, Ni Lao, Jinmeng Rao, Qing Zhu, Zeping Liu, Yao-Yi Chiang, and Junfeng Jiao. (2025). Towards the next generation of Geospatial Artificial Intelligence. *International Journal of Applied Earth Observation and Geoinformation*, Vol. 136:104368.

[2] Ginwala, Aadil with Sean Farney, Nay Newell, and Mike Sicoli. (2025, Sept. 12). *The Invisible Backbone of AI & Innovation*. Panel discussion at AI Horizons Summit, Pittsburgh, PA.

[3] Muro, Mark and Sifan Lu. (2021, Sept.). *The geography of AI*. Metropolitan Policy Program at The Brookings Institute. Last accessed 4 Sept. 2025 at https://www.brookings.edu/articles/the-geography-of-ai/

[4] Muro, Mark and Shriya Methkupally. (2025, July). *Mapping the AI Economy: Which Regions are Ready for the Next Technological Leap*. Brookings Metro Program at The Brookings Institute. Last accessed 6 Oct. 2025 at https://www.brookings.edu/articles/mapping-the-ai-economy-which-regions-are-ready-for-the-next-technology-leap/

[5] Jad, Chloe. (2025, July 15). Google to Invest Billions in Pennsylvania's AI Industry. *Government Technology*. Last accessed 14 Nov. 2025 at https://www.govtech.com/artificial-intelligence/google-to-invest-billions-in-pennsylvanias-ai-industry

[6] Lott, Ethan. (2025, Jul. 15). Google launches program to include free AI training in Pittsburgh through Carnegie Library. *Pittsburgh Business Times*. Last accessed 12 Sept. 2025 at https://www.bizjournals.com/pittsburgh/news/2025/07/15/google-free-ai-training-carnegie-library.html

[7] Meadville Tribune, The. (2025, Sept. 11). Penn. Universities Join Google AI for Education Accelerator. *Government Technology*. Last accessed 12 Sept. 2025 at https://www.govtech.com/education/higher-ed/penn-universities-join-google-ai-for-education-accelerator

[8] Constellation Energy. (2024, Sept. 20). *Constellation to Launch Crane Clean Energy Center, Restoring Jobs and Carbon-Free Power to The Grid*. Constellation Energy. Last accessed 6 Oct. 2025 at https://www.constellationenergy.com/newsroom/2024/Constellation-to-Launch-Crane-Clean-Energy-Center-Restoring-Jobs-and-Carbon-Free-Power-to-The-Grid.html

[9] The State Geospatial Coordinating Board ('GeoBoard' for short) is responsible for providing advice and recommendations to the Governor and the citizens of this commonwealth on geospatial issues and providing uniform data standards, coordination, and efficiency in geospatial policy and technology issues among Federal, State, and local government agencies; academic institutions; and the private sector (1929 PL 177, No 175, Sec 432.1). In 2024, the GeoBoard established an Emerging Technologies Subcommittee and tasked it with monitoring advancements in geospatial technology, including drones, satellite remote sensing, and geospatial applications of artificial intelligence (AI).

[10] Kraft, Kat and Kristen Kurland. *A Future Powered by AI: Digital Twins and Quality of Life Innovations*. Video hosted by Penn State University. Last accessed 14 Nov. 2025 at https://psu.mediaspace.kaltura.com/media/A+Future+Powered+by+AI%3A+Digital+Twins+and+Quality+of+Life+Innovations/1_omseeuer

[11] McDonough, Grace and Kyle Talbot. *GeoAI and Ai-Driven Workflows*. Video hosted by Penn State University. Last accessed 14 Nov. 2025 at https://psu.mediaspace.kaltura.com/media/PA+Geospatial+Coordinating+Board+Seminar%3A+Esri+GeoAI++AI+Assistant+Tools/1_901aqj4y

[12] Governor's Office. (2023, Sept. 20). *Executive Order 2023-19*. Commonwealth of Pennsylvania. Last accessed 25 July 2025 at https://www.pa.gov/content/dam/copapwp-pagov/en/oa/documents/policies/eo/2023-19.pdf

[13] 'ChatGPT' is a large language model that is trained to produce text. See https://help.openai.com/en/articles/6783457-what-is-chatgpt

[14] Commonwealth of Pennsylvania. (2025, March). *Lessons from Pennsylvania's Generative AI Pilot with ChatGPT*. Commonwealth of Pennsylvania. Available at https://www.pa.gov/content/dam/copapwp-pagov/en/oa/documents/programs/information-technology/documents/openai-pilot-report-2025.pdf

[15] NACo. (2024, Dec.). *AI County Compass*. National Association of Counties. Last accessed 14 Nov. 2025 at https://www.naco.org/resource/ai-county-compass-comprehensive-toolkit-local-governance-and-implementation-artificial

[16] NSGIC. (2023). *Geospatial Maturity Assessment*. National States Geographic Information Council. Last accessed 14 Nov. 2025 at https://nsgic.org/initiatives/geospatial-maturity-assessment/

[17] GeoBoard. (2023). *Special Report on PA BaseMap 2030 & 3D PA*. GeoBoard. Available at https://www.pa.gov/content/dam/copapwp-pagov/en/oa/documents/programs/information-technology/documents/geoboard-3dpa-basemap-special-report-2023.pdf

[18] GeoBoard. (2022). *Special Report on the Importance of Broadband Access to the Commonwealth's Geospatial Community*. GeoBoard. Available at https://www.pa.gov/content/dam/copapwp-pagov/en/oa/documents/programs/information-technology/documents/gis-broadband-special-report-2022.pdf

[19] SEPTA. (2023, Jun. 8). *SEPTA Partners w/AI Developer for Camera-Assisted Transit Pilot*. SEPTA.org. Last accessed 11 Aug. 2025 at https://wwww.septa.org/news/camerapilot/

[20] HaydenAI. (2025, Apr. 16). *Hayden AI Partners with the Philadelphia Parking Authority and SEPTA to Launch Automated Transit Zone Enforcement*. Hayden.AI. Last accessed 11 Aug. 2025 at https://www.hayden.ai/press/hayden-ai-partners-with-the-philadelphia-parking-authority-and-septa-to-launch-automated-transit-zone-enforcement-

[21] Stamm, Dan and Hayden Mitman. (2025, Apr. 7). *SEPTA, PPA to start using AI-powered bus cams to ticket illegally parked drivers*. NBC Philadelphia. Last accessed 4 Aug. 2025 at https://www.nbcphiladelphia.com/news/transportation-and-transit/septa-ppa-ai-powered-cams-bus-tickets/4153519/

[22] COPA. (2025, Jan. 16). *Getting Stuff Done: PennDOT Receives $1.3 Million USDOT Grant to Keep Goods Moving, Ease Traffic Congestion, and Reduce Pollution from Trucks*. Commonwealth of Pennsylvania. Last accessed on 28 Jul. 2025 at https://www.pa.gov/agencies/penndot/news-and-media/newsroom/statewide/2025/shapiro-admin-makes-fast-progress-on-scranton-to-nyc-rail-corrid

[23] ASSHTO. (2024). *Pennsylvania Department of Transportation's Automatic Queue Protection System*. American Association of State Highway and Transportation Officials. Last accessed 11 Aug. 2025 at https://americastransportationawards.org/about-the-competition/

[24] Manzini, Thomas with Priyankari Perali, Robin R. Murphy, and David Merrick. (2025, Jun. 18). Challenges and Research Directions from the Operational Use of a Machine Learning Damage Assessment System via Small Uncrewed Aerial Systems at Hurricanes Debby and Helene. *arXiv* 2506.15890. Last accessed 4 Sept. 2025 at https://arxiv.org/abs/2506.15890

[25] GeoBoard. (2022). *Special Report on the Importance of Broadband Access to the Commonwealth's Geospatial Community*. GeoBoard. Available at https://www.pa.gov/content/dam/copapwp-pagov/en/oa/documents/programs/information-technology/documents/gis-broadband-special-report-2022.pdf

[26] GeoBoard. (2023). *Special Report on PA BaseMap 2030 & 3D PA*. GeoBoard. Available at https://www.pa.gov/content/dam/copapwp-pagov/en/oa/documents/programs/information-technology/documents/geoboard-3dpa-basemap-special-report-2023.pdf

[27] GeoBoard. (2023). *Special Report on the State Plane Coordinate System of 2022*. GeoBoard. Available at https://www.pa.gov/content/dam/copapwp-pagov/en/oa/documents/programs/information-technology/documents/geoboard-111623-state-plane-coordinate-system-special-report.pdf

[28] Governor's Press Office. (2025, June 9). Governor Josh Shapiro Announces Amazon Plans to Invest $20 Billion in Pennsylvania for AI Infrastructure in Largest Capital Investment in Commonwealth History. Commonwealth of Pennsylvania. Last accessed 14 Nov. 2025 at https://www.pa.gov/governor/newsroom/2025-press-releases/gov-announces-amazon-to-invest--20b-in-pa--largest-capital-inves

[29] Jad, Chloe. (2025, July 15). Google to Invest Billions in Pennsylvania's AI Industry. *Government Technology*. Last accessed 14 Nov. 2025 at https://www.govtech.com/artificial-intelligence/google-to-invest-billions-in-pennsylvanias-ai-industry

[30] Lott, Ethan. (2025, Jul. 15). Google launches program to include free AI training in Pittsburgh through Carnegie Library. *Pittsburgh Business Times*. Last accessed 12 Sept. 2025 at https://www.bizjournals.com/pittsburgh/news/2025/07/15/google-free-ai-training-carnegie-library.html

[31] Meadville Tribune, The. (2025, Sept. 11). Penn. Universities Join Google AI for Education Accelerator. *Government Technology*. Last accessed 12 Sept. 2025 at https://www.govtech.com/education/higher-ed/penn-universities-join-google-ai-for-education-accelerator

[32] Constellation. (2024, Sept. 20). *Constellation to Launch Crane Clean Energy Center, Restoring Jobs and Carbon-Free Power to The Grid*. Constellation. Last accessed 6 Oct. 2025 at https://www.constellationenergy.com/newsroom/2024/Constellation-to-Launch-Crane-Clean-Energy-Center-Restoring-Jobs-and-Carbon-Free-Power-to-The-Grid.html

[33] Pritchett, Dan. (2024, Feb. 13). *How machine learning keeps contributed content helpful*. The Keyword. Last accessed on 6 Jun. 2025 at https://blog.google/products/maps/how-machine-learning-keeps-contributed-content-helpful/

[34] Google Maps. (2022, Feb. 02). *How Google Maps reviews work*. YouTube. Last accessed on 6 Jun. 2025 at https://www.youtube.com/watch?v=TMjezeeGVfY

[35] Gupta, Ashish. (2023, Mar. 31). *New ways we tackle fake contributions on Google Maps*. The Keyword. Last accessed on 6 Jun. 2025 at https://blog.google/products/maps/google-maps-fake-contributions-ai-machine-learning/

[36] Matias, Yossi. (2020, Aug. 20). *Mapping wildfires with the power of satellite data*. The Keyword. Last accessed on 10 Jun. 2025 at https://blog.google/products/search/mapping-wildfires-with-satellite-data/

[37] McHugh-Johnson, Molly. (2025, Mar. 17*). Inside the launch of FireSat, a system to find wildfires earlier*. The Keyword. Last accessed 10 Jun. 2025 at https://blog.google/technology/ai/inside-firesat-launch-muon-space/

[38] Nearing, Grey with Deborah Cohen, Vusumuzi Dube, Martin Gauch, Oren Gilon, Shaun Harrigan, Avinatan Hassidim, Daniel Klotz, Frederik Kratzert, Asher Metzger, Sella Nevo, Florian Pappenberger, Christel Prudhomme, Guy Shalev, Shlomo Shenzis, Tadele Yednkachw Tekalign, Dana Weitzner, and Yossi Matias. (2024). Global prediction of extreme floods in ungauged watersheds. *Nature*, 627: 559-563. Last accessed on 6 Jun. 2025 at https://www.nature.com/articles/s41586-024-07145-1

[39] Bukvich, Alexander. (2025, Jul. 8). *NOAA and Google team up to advance the use of AI hurricane and tropical weather forecast models*. NOAA Technology Partnership Office. Last accessed 11 July 2025 at https://techpartnerships.noaa.gov/noaa-and-google-team-up-to-advance-the-use-of-ai-hurricane-and-tropical-weather-forecast-models/

[40] Weather Lab Team. (2025, Jun. 12). *How we're supporting better tropical cyclone prediction with AI*. Google Deep Mind. Last accessed 11 Jul. 2025 at https://deepmind.google/discover/blog/weather-lab-cyclone-predictions-with-ai/

[41] GeoBoard. (2023). *PA Basemap 2030 & 3D PA Report*. GeoBoard. Available at geoboard-3dpa-basemap-special-report-2023.pdf

Pennsylvania
State Geospatial Coordinating Board
https://oa.pa.gov/geoboard