Why do I need to articulate the value of AI in Geospatial?

Nigel CONOLLY, Australia

Key words: AI, value proposition, ROI, leverage, improvement, automation, geospatial

SUMMARY

This paper explores the transformative role of AI in the geospatial industry, emphasizing the need for professionals to adapt to AI-driven workflows to remain relevant. It begins by highlighting how embracing AI can significantly enhance a professional's value, suggesting a potential 600% increase in productivity. The historical development of AI in geospatial science is traced, from early rule-based systems and the integration of neural networks in the 1990s to the current era of real-time AI and big data analytics. Key applications of AI in geospatial fields are presented, such as automated land cover classification, disaster response, and predictive modeling, with examples like building detection and batch address validation.

The paper stresses the power of AI in achieving leveraged growth, where AI can drastically reduce the time required to develop geospatial applications. It further illustrates real-world use cases, from precision agriculture that boosts yields by up to 30% to AI-driven insurance assessments that improve premium rates. Additionally, AI is shown to revolutionize industries like real estate by providing more accurate property valuations and accelerating transactions.

Concluding, the paper stresses that adopting AI in geospatial applications is not merely optional but essential for future career success. Those who fail to integrate AI will risk falling behind in an increasingly AI-centric world.

Why do I need to articulate the value of AI in Geospatial?

Nigel CONOLLY, Australia

1. THE PROBLEM

The geospatial industry is evolving rapidly, yet many professionals remain stagnant, adhering to traditional methods. Those who fail to adapt risk becoming irrelevant or seeing their value diminish in an AI-driven landscape.

To stay ahead, embracing AI is no longer optional—it's essential. By integrating AI into geospatial workflows, professionals can significantly enhance their impact and unlock unprecedented opportunities.

1.1. Boost your value by 600%

You have a choice: continue down the familiar path or evolve by leveraging AI as a strategic advantage. Those who embrace AI can dramatically enhance their capabilities—potentially increasing their value by 600%.

So, how can we harness AI in geospatial to achieve this transformation? More importantly, how do we communicate that value effectively? This paper explores practical strategies for integrating AI into geospatial applications and articulating its impact to stakeholders.

2. HISTORICAL DEVELOPMENT OF AI IN GEOSPATIAL

To appreciate where we are today, we must first understand how we got here. The evolution of AI in geospatial science has been shaped by advancements in computing, remote sensing, and machine learning. Below are key milestones that highlight this progression:

- Early Rule-Based Systems (1960s–1980s): The foundation of AI in geospatial applications, relying on expert systems and manually defined rules.
- Neural Networks and GIS Integration (1990s): The introduction of neural networks enhanced pattern recognition and spatial analysis within GIS platforms.
- Machine Learning Revolution (2000s): Machine learning algorithms improved feature extraction, classification, and predictive modeling in geospatial data.
- Deep Learning and Cloud Computing (2010s): The rise of deep learning, combined with cloud-based processing, enabled large-scale geospatial analysis with unprecedented accuracy.
- Real-Time AI and Big Data (2020s–Present): The integration of AI with real-time data streams and big data analytics is driving automation, decision-making, and geospatial intelligence at scale.

2.1 Cartographic generalization (1960s to 1980s)

Cartographic generalization—the automatic simplification of map features for different scales—has been a long-standing challenge in geospatial science. While AI-driven methods are relatively new, computational approaches to feature simplification date back to the 1960s.

2.1.1. Early Computational Approaches

Douglas-Peucker Algorithm (1967) – Line Simplification
Developed by David Douglas and Thomas Peucker, this algorithm reduces the number of vertices in a polyline while preserving its overall shape. (Wikipedia, 2025).
Example: Used to simplify rivers and coastlines in topographic maps.

Polygon Merging for Land Cover Generalization (Late 1960s)
Techniques emerged to merge smaller polygons into larger ones at reduced scales, improving map readability. (Imhof, 1937).
Example: Aggregation of agricultural fields and urban blocks for small-scale maps.

2.1.2 The Rise of GIS and Esri (1969–1980s)

In 1969, Jack and Laura Dangermond founded Esri (Environmental Systems Research Institute) to assist land-use planners with geospatial analysis. Esri's work laid the foundation for modern GIS, culminating in the 1981 release of ARC/INFO, which standardized GIS implementation. (ESRI, 2025).

2.2 Artificial Neural Networks (ANNs) and GIS Integration (1990s)

Drawing on insights from my personal honours thesis in the late 1990s. Yep, last century!

In a supervised classification, as illustrated, satellite images are classified using predefined input or training data. I carefully selected representative areas with known class types, commonly referred to as training samples. These were used to create classifications across an entire broadscale area, eg: Sydney.

Landsat imagery was classified into four separate habitat types for a bird species: the Indian Myna. Counts of populations were conducted and statistically significantly different populations were observed in the different habitat types. Thus allowing one to determine the population and distribution of the bird species.

2.3 Cloud Computing and Computational Neural Networks (2010s)

"A Convolutional Neural Network (CNN) is a type of artificial neural network specifically designed for image analysis, excelling at identifying patterns within images by breaking them down into smaller parts and extracting features like edges, shapes, and textures, allowing it to perform tasks like image recognition, object detection, and image segmentation with high accuracy; making it a powerful tool in computer vision applications like facial recognition, self-driving cars, and medical imaging analysis." (Yamashita et al., 2018)

2.4 Real Time AI and Big Data

"Edge AI combines artificial intelligence with edge computing, allowing for AI processing directly on local devices instead of relying on cloud infrastructure. This enables real-time data processing, driven by the increasing volume of data from IoT devices, sensors, and connected technologies.

<u>Key Aspects of Edge AI</u>
Low Latency: Fast data processing, ideal for applications like autonomous vehicles.
Network Independence: Functions without a constant connection to the cloud, improving reliability.
Enhanced Privacy: Keeps data local, reducing exposure to cloud-based vulnerabilities.
Energy Efficiency: Operates with lower power consumption, suitable for wearables and remote devices.
Diverse Applications: Used across fields like industrial automation, smart cities, agriculture, and transportation.

<u>Edge Devices</u>
Edge devices collect and process data locally, including smartphones, smart cameras, industrial sensors, wearables, autonomous vehicles, and smart home appliances.

<u>AI Models</u>
Optimized for devices with limited resources, these models are lightweight, compressed, and efficient. Examples include CNNs for image tasks, RNNs for sequential data, and lightweight transformers for natural language tasks." (Toor 2025)

3. WHAT CAN AI IN GEOSPATIAL DO?

AI in geospatial applications offers significant value by efficiently handling and analyzing vast spatial data. AI-powered models, like CNNs, automate image classification to distinguish land cover types and detect vegetation. These models can also detect and extract features such as buildings, roads, and water bodies from satellite images, aiding in monitoring urban expansion or illegal deforestation. By enabling change detection through multi-temporal images, AI supports disaster response and climate change monitoring. Machine learning techniques like Random Forest and deep learning models classify land cover types, such as agricultural land. AI also facilitates predictive analytics, helping to model risks like wildfire spread based on environmental data. Geospatial data fusion, enabled by AI, integrates diverse datasets to enhance decision-making, such as combining satellite and drone imagery for precision agriculture. Finally, AI provides real-time geospatial insights through streaming data, such as GPS and IoT sensors, and leverages NLP to extract geospatial information from unstructured text, aiding in disaster response.

4. BOOST YOUR PRODUCTIVITY BY 600% USING YOUR LEVERAGE POINT

In a linear growth model, every additional hour of work results in just one more hour of production.

In contrast, leveraged growth occurs when a specific factor, like online content branding, acts as a multiplier. The more you refine and invest in your branding, the greater its impact on everything else. With effective branding, sales become easier, traffic increases and stays longer, and your audience will naturally spread your content, creating more organic reach.

4.1. Linear Growth

Mathematically there is a way to grow to 600% of where you are today over a 1 year timeframe.

1.005^365 = > 6 (if all you can do is a 0.5% improvement each day then over a year that is more than a six-fold increase 600%!); but that is crazy, because that actually means that by the end of the year, instead of working an 8 hour day – you would be working a 48 hour day, which is impossible.

4.2. Leveraged Growth

If I asked you to say – please create me a geospatial ML application from scratch; and asked you to quote me on the time it would take to build, most answers would be between 3 to 9 months. So let’s take the average – 6 months.

Now, instead, if I said – go ask an AI to help you write that. Within 10 minutes you could have the core of it written. So I’ll show you that over the next 90 seconds.

This is an ML supervised classification application that will point to imagery services from Google Earth Engine - and allow the end user to draw a training area. This would all run through a web application front end and backend server tech.

Back in the mid 90s, it would have taken a software company about 6 months to build that application.

So the improvement in time savings there are at least 600% if you are a good programmer … or if you are a beginner the productivity gains could be 1200%

5. MULTIPLE EXAMPLES OF AI IN GEOSPATIAL TODAY

5.1. Building Detection

AI detects building outlines from aerial or satellite imagery, even in dense urban environments or informal settlements. This can be used in urban growth analysis, disaster recovery planning, and infrastructure management. An example of this is Microsoft's "Global Building Footprints," which provides open-access building maps for various regions using deep learning.

Another example is the Buildings 3.0 from Geoscape. To transition the dataset, Geoscape Australia partnered with award-winning artificial intelligence company GeoX and Adelaide-based aerial capture company Aerometrex.

5.2. Batch Address Validation

Validate a batch list of addresses that have been provided in one field, but need to be cleaned and split into multiple fields to cater for State and Postcode as well as the street address. Use FME to build a workflow that connects to an OpenAI GPT model that checks the addresses.

5.3. Batch Text to Image

Take a list of textual descriptions of interesting spatial things; and then use OpenAI to create imagery from those descriptions in a batch process.

5.4.Multiple AIs run through a single process

Use the ETL tool to connect to multiple AI APIs through a single workflow to draw on multiple insights in one process. FME workflow to interpret some images using multiple external AI APIs, such as Google's Cloud Vision API; and Azure's AI Vision and AWS's Rekognition; each bring their own specific benefits and results and the end user may wish to choose the most appropriate result at the end.

5.5.AI for Retail & Site Selection

"AI automates the site selection and feasibility analysis process. It provides high-precision digital tools that enable site selection professionals to select the best sites for their clients, in record speed. A big part of AI's allure is its ability to analyze large volumes of data quickly. It can identify new patterns or trends that are hidden in the data, which can give a firm a competitive edge in identifying new opportunities.

- Mapping and data analytics
- Demographics and market analysis
- Compare similar sites
- Infrastructure specifics

Future expansion and growth potential. AI will assess the availability of additional space or adjacent land, as well as the potential for business growth in the area". (Crawford 2023)

6. VALUE PROPOSITIONS

6.1.**Precision Agriculture: increasing yields by up to 30%**

"AI-driven precision agriculture can increase crop yields by up to 30% while reducing water usage by 50%." (Farmonaut, 2025)

6.2.Insurance – AI for Rapid Damage Assessment: Increase Premiums by 15

"According to research from APE Analytics, insurers actively using AI and machine learning have seen loss ratios improve by 5% through reduced claims and premiums rising by as much as 15% due to better risk evaluations.

“Insurance carriers are using third party data, including imagery from drones, to detect excess debris and roof concerns on properties,” said Michelle Afflalo (pictured), broker and agent at Ives Insurance Services. “One of our carriers has infrared technology that can detect moisture on a roof, so it can tell you if a roof has fungus growing on it, which could potentially lead to other issues.

“Basically, they’re using this technology to go and look at real estate before true underwriting begins. What used to happen is that we would write a policy, the carrier would do an inspection and the client would have a certain amount of time to address any issues, now it’s different; it’s all happening in pre underwriting.” (Johnson 2024)

6.3.Real Estate – AI for property valuation and risk assessment

Using AI for property valuation and risk assessment could potentially increase valuation accuracy by up to 30% yielding transactions to occur potentially up to 40% faster.

Property platforms leverage AI to analyse geospatial factors such as building footprint size, total land size, combine that data with past sales data, current and historical market trends and property features, and then build a strong understanding of the value of land per sqm and building per sqm of the footprint.

7. Conclusion

We are at the beginning of the AI era, just like the beginning of the Internet ere, which began only about 30 years ago. There are careers leveraged by the internet that people would never have even imagined 30 years ago when the Internet began.

So how did they create the change? They adopted it! They created their leverage point.
So why do you need to articulate the value of AI in Geospatial? You need to so that you can adopt AI in your work. If you don’t you’ll get left behind.

REFERENCES

Crawford, M., 2023, “AI 101 for Site Selection,” Area Development, vol. Q4, 2023.

ESRI, 2025. [Online]. Available: https://www.esri.com/en-us/what-is-gis/history-of-gis

Farmonaut, 2025, “Revolutionizing Precision Agriculture: How AI and Remote Sensing Are Optimizing Crop Yields and Farm Profitability,” [Online]. Available: https://farmonaut.com/precision-farming/revolutionizing-precision-agriculture-how-ai-and-remote-sensing-are-optimizing-crop-yields-and-farm-profitability/#:~:text=%E2%80%9CAI%2Ddriven%20precision%20agriculture%20can,technology%20and%20sustainable%20farmin.

Johnson, L., 2024, “When AI meets ROI: How data-driven drones and declines are shaking up property insurance,” Insurance Business, vol. August 26, 2024.

Imhof, E., 1937, “As Sidelungsbild in der Karte,” Mittelilungen der Geographisch-Ethnographischen Gesellschaft.

Toor, D. S., 2025, “Edge AI: A Comprehensive Guide to Real-Time AI at the Edge,” [Online]. Available: https://www.scaleoutsystems.com/edge-computing-and-ai

Wikipedia, 2025, “Ramer–Douglas–Peucker algorithm,” [Online]. Available: https://en.wikipedia.org/wiki/Ramer%E2%80%93Douglas%E2%80%93Peucker_algorithm.

Yamashita, R., Nishio, M., Kinh Gian Do, R., and Togashi, K.; 2018, “Convolutional neural networks: an overview and application in radiology,” Insights into Imaging, vol. 9, pp. 611-629.

BIOGRAPHICAL NOTES

Nigel is a strategic consultant in the geospatial IT sector. For over 25 years Nigel has worked within the IT sector primarily focused on helping organisations understand the value that geospatial IT can deliver. Over the last decade Nigel has assisted three startups go from zero to hero, two of which went to acquisition. Nigel’s passion for using technology to help us understand our world began at university in the mid 1990s; where he did an Honours thesis leveraging remote sensing and GIS to understand the distribution of a pest bird species. Nigel has had over 20 articles published in the spatial industry magazines of *GIS User* and *Measure Map*, the precursors to *Position* magazine.

CONTACTS

Mr. Nigel Conolly
Valuible Pty Ltd
Suite 2, 161-163 Burns Bay Road
Lane Cove
AUSTRALIA
www.valuible.com