

Impact Observatory: AI-Powered Geospatial Intelligence for a Changing World

Introduction: Impact Observatory is redefining geospatial intelligence through its advanced AI-driven solutions, spearheaded by its flagship product, the Geospatial Sidekick, also known as "Bob." This innovative natural language model translates complex location-based and remote sensing data into actionable insights, providing analysts with an intuitive and efficient interface for querying and visualizing geospatial information. By seamlessly integrating large language models (LLMs) with deep-learning computer vision algorithms, Bob enhances the speed and accuracy of data-driven decision-making across a wide range of industries.

AI-Powered Geospatial Intelligence

Geospatial Sidekick: AI-Driven Analysis and Integration The Geospatial Sidekick revolutionizes geospatial data access and interoperability by dynamically integrating proprietary and public datasets. Leveraging cross-domain AI, it synthesizes expert geospatial knowledge with real-time data streams to accelerate the generation of insights. The Sidekick's natural language interface allows users to interact conversationally, eliminating the need for extensive GIS expertise. Users can pose queries such as "Show me deforestation trends in the Amazon over the last five years," receiving precise, data-backed visualizations within seconds.

This tool offers secure deployment options in the cloud or on-premises, ensuring compliance with stringent data governance requirements. Its adaptability makes it suitable for government agencies, defense organizations, environmental groups, and private enterprises seeking cutting-edge geospatial intelligence capabilities.

Geospatial AI Copilot: Automating Intelligence Workflows Complementing the Sidekick, the Geospatial AI Copilot extends automation capabilities by introducing a natural language interface for surveillance and reconnaissance data. This tool optimizes analyst workflows by automating key functions such as tasking, monitoring, and reporting. With advanced contextual change ranking, the AI Copilot minimizes false positives, enhancing operational efficiency.

Analysts can leverage the AI Copilot to track infrastructure developments, monitor land use changes, and rapidly generate reports. Its automated change detection capabilities have been instrumental in monitoring deforestation, urban expansion, and strategic asset development, improving situational awareness for decision-makers.

AI-Powered Geospatial Intelligence Impact Observatory's AI solutions process vast amounts of satellite imagery to deliver automated monitoring and change detection. The company's pioneering achievements include the "Esri 2020 Land Cover global map created using over 2 million Copernicus Sentinel-2 satellite images, 10,000 compute nodes on Microsoft Azure's Planetary Computer, this dataset was produced in under a week, demonstrating the unparalleled scalability and accuracy of Impact Observatory's AI capabilities.

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High-Resolution Land Cover Monitoring: Impact Observatory has revolutionized land cover analysis by developing the world's first annual global maps using Sentinel-2 data. This innovation replaces traditional, slow, semi-manual national mapping methods with an automated system capable of rapid updates. The "Esri 2020 Land Cover" map, for example, was generated in just one week by processing 2.4 million Sentinel-2 images on Microsoft Azure. The company provides high-resolution land cover datasets with frequent updates—biweekly, monthly or annually—supporting applications such as agricultural assessments, disaster response, national security and urban planning. These datasets are accessible in multiple formats, including Cloud Optimized GeoTIFFs (COG), PNGs, and CSV files containing pre-calculated metrics.

Automated Change Detection: Impact Observatory's AI-powered Change Detection solution processes historical and current satellite imagery to detect changes in land use, infrastructure, water levels, and environmental conditions at varying time scales. This capability is instrumental in monitoring deforestation, infrastructure expansion, and disaster impact assessments. The system also enhances intelligence and defense applications by identifying infrastructure developments, such as those at China's Hainan Commercial Space Launch Complex and military installations in North Korea and around Israel.

Multi-Source Data Integration & Interoperability: Beyond traditional imagery analysis, Impact Observatory integrates multiple geospatial data sources, incorporating sensor networks, IoT data, and geospatial intelligence to provide a comprehensive view of dynamic environments. Multi-sensor fusion ensures interoperability between various remote sensing modalities, enabling precise correlations between data types and enhancing operational efficiency.

Real-World Applications

Environmental and Climate Monitoring: Impact Observatory's AI solutions play a critical role in environmental conservation and climate monitoring. The UN Biodiversity Lab utilizes AI-driven land cover maps to support global conservation efforts, while AI-generated assessments have been used to evaluate climate-induced flooding impacts in Pakistan and wildfire recovery efforts in California. In Ukraine, AI detected widespread tree loss due to ongoing conflict, providing crucial environmental impact data.

Agricultural and Food Security Monitoring: AI-powered geospatial intelligence helps assess agricultural trends and food security. In Japan's Gifu Prefecture, satellite analysis identified a reduction in active farmland from 2018 to 2022. Similarly, a 10m-resolution crop map of Kenya tracks crop types and irrigation patterns, aiding policy decisions. AI monitoring of monoculture farming in North Korea provides insights into food security dynamics in isolated regions.

Urban Expansion and Infrastructure Development: Geospatial AI aids urban planning and infrastructure development. In Doha, Qatar, 3.5m imagery was used to

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monitor rapid construction projects. In Bolivia, AI-driven land cover mapping identified agricultural expansion, while in Washington, DC, AI-assisted impervious surface mapping supports stormwater management and urban resilience planning.

Maritime and Island Monitoring: AI-based monitoring extends to maritime and island changes, crucial for geopolitical analysis. In the South China Sea, automated AI detected infrastructure changes on contested islands, including China's development on Jinqing Dao and the Philippines' expansion on Thitu Island. Across the Pacific Rim, AI continuously monitors thousands of remote islands, detecting land use and infrastructure modifications.

Disaster Response and Risk Assessment: AI-enhanced geospatial intelligence improves disaster response capabilities. Following the 2023 Turkey-Syria earthquake, AI rapidly assessed structural damage by analyzing pre- and post-event imagery, aiding emergency responders. Similarly, in Maui, Hawaii, AI-generated burn scar detection mapped wildfire damage for relief planning. Anomalous Change Detection (ACD) is being refined to improve disaster response accuracy by filtering out irrelevant variations.

Intelligence and Defense Applications: Impact Observatory's Geospatial AI Copilot provides critical intelligence for defense applications. The system has been used to monitor strategic developments such as the expansion of China's space launch facilities and military installations worldwide. Automated reconnaissance capabilities enable rapid surveillance and situational awareness in contested areas.

AI-Powered Decision Support

Automated Extraction of Insight: Impact Observatory accelerates geospatial analysis through AI-enhanced reporting, which includes AI-generated narratives, cartographic visualizations, and key performance metrics. These tools simplify complex data interpretation, enabling decision-makers to respond more effectively to evolving geospatial trends.

Recommendation Engine for Follow-Up Observations: Beyond initial detection, the system incorporates an advanced recommendation engine that suggests targeted follow-up observations. Automated analysis, including object detection and pattern recognition, ensures subsequent monitoring efforts yield maximum value.

Strategic Roadmap for AI-Powered Geospatial Intelligence: Impact Observatory is continuously enhancing its geospatial intelligence capabilities. Future developments include integrating Digital Elevation Models (DEM) for improved land-use classification, refining Anomalous Change Detection for disaster response, and expanding impervious surface mapping for urban planning.

Overcoming Challenges and Expanding Partnerships: A key challenge is the limited availability of high-quality commercial satellite imagery through existing partnerships. While public datasets and Planet imagery provide valuable insights, expanding

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collaborations with Airbus and Japanese satellite providers will unlock the full potential of AI-driven geospatial intelligence. Strengthening these partnerships will enable more comprehensive demonstrations and broader operational applications.

Conclusion: Impact Observatory is transforming geospatial intelligence by leveraging AI to automate data analysis, setting a new standard in satellite imagery interpretation. Led by innovations such as the Geospatial Sidekick and AI Copilot, the company integrates natural language interfaces with deep-learning models, enabling analysts to process vast amounts of geospatial data efficiently. These AI-driven solutions unlock new capabilities in environmental monitoring, disaster response, defense applications, and urban planning, empowering governments, industries, and humanitarian organizations to make informed decisions.

By providing a scalable, AI-powered platform, Impact Observatory enhances decision-making across multiple sectors, including security operations, infrastructure planning, and sustainability initiatives. As the global landscape continues to evolve, the company remains committed to advancing AI-driven geospatial capabilities, ensuring that organizations worldwide have access to timely, accurate intelligence for a more resilient, secure, and sustainable future.