

Optimizing Municipal Asset Management Through Imagery and Object Detection

Case Study

THE CHALLENGE

Google Street View is frequently unavailable in private gated communities. To bridge this gap, GEO Jobe created an Oriented Image Catalog to aid in our user's asset coverage. Collecting comprehensive imagery data for the entire property and creating a web application empowered stakeholders with enhanced situational awareness to make the best decisions possible. This innovative solution provides access to imagery, offering a valuable alternative when Google data is nonexistent.

The Partner

GEO Jobe is a geographic information system (GIS) consulting and technology firm headquartered in Gulfport, Mississippi. The company has been an Esri partner since 2002 and is focused on helping customers configure and extend Esri's Web GIS System and ArcGIS Enterprise technology. GEO Jobe also provides professional services, such as custom software development, GIS services, and 24/7 support services for a range of industries.



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GIS Consulting



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CONSULTING PARTNER

THE SOLUTION



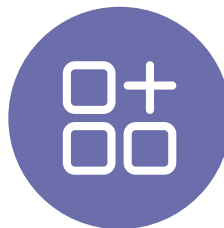
Data Collection

GEO Jobe collected over 14,000 oblique terrestrial images, meticulously oriented perpendicular to streets using a high-accuracy GNSS camera. All survey and camera equipment are provided by GEO Jobe, ensuring a seamless data collection process. The images were georeferenced to the local projection system, and a truck-mounted camera traversed every street within the community to capture the necessary data.



AWS Hosting for Oriented Imagery

GEO Jobe configured Amazon Web Services (AWS) hosting for the oriented imagery, allowing users to access the imagery on any mobile device. By adequately configuring AWS accounts and uploading the image data, GEO Jobe not only facilitated data accessibility but also laid the foundation for streamlined operations and collaboration. Implementation of AWS hosting facilitates seamless access to the imagery and translates into significant time and resource savings. Users can easily retrieve and utilize critical data on the go, fostering improved decision-making and operational efficiency.



Custom Widget and Web Mapping Application for ArcGIS Online

Recognizing the importance of user-friendly interfaces, GEO Jobe created a custom image viewer widget and web mapping application for ArcGIS® Online. This app enables users to view and display attribute information on mobile devices. Additionally, existing asset management layers are incorporated, confirming the precise location of utilities and reducing the time needed to locate assets. Our custom widget and web mapping app empowers users to view images and display GIS data in a single application. Asset management becomes streamlined, reducing the time and effort required for inspections and enhancing overall operational efficiency.



Object Detection Model Implementation

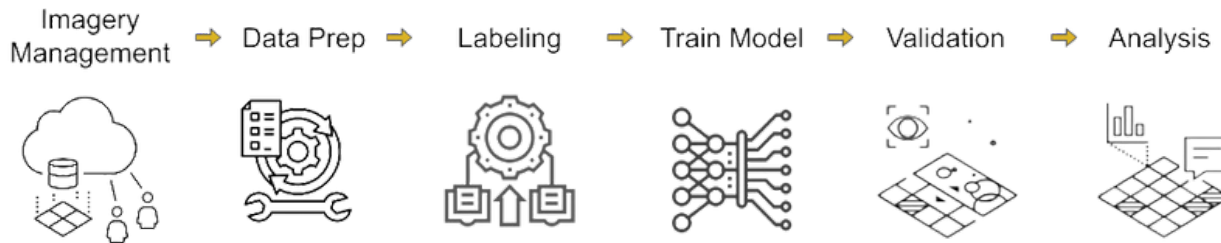
GEO Jobe incorporated a machine learning model specifically trained for license plate detection. This advanced model not only identifies license plates but also distinguishes between various numeric characters, including house and mailbox numbers. Implementation of this object detection model addresses privacy concerns and results in significant time savings.

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Over 14,000 georeferenced images collected along 40 miles of street



THE METHODOLOGY



1

Model Configuration and Hyperparameter Tuning

An object detection model was configured to identify numerical text data. Improvements were made to the model to enhance license plate identification, then a layer was added to blur the identified text. It was critical not to blur necessary information, such as house numbers, which are important to keep for address confirmation.

Hyperparameter tuning was then performed to optimize the model and provide the highest accuracy and recall practicable. This involved adapting the model to match the image resolution and spectral signature of the target data. By tailoring the model to the specific characteristics of the imagery, accuracy and efficiency were significantly improved. This precision directly translates into increased accuracy identifying license plates, reducing false positives, and enhancing the overall reliability of the system.



License plates are identified by the object detection model and then blurred for privacy.

2

Fine-Tuning with Blurring Parameters

GEO Jobe applied a blurring parameter to the license plate detection model to address privacy concerns. This involved fine-tuning the system to obscure license plates in a manner that complies with privacy regulations while maintaining the model's efficiency in identifying other numeric characters. Users benefit from enhanced privacy protection without compromising the model's primary objective of accurate license plate detection.

3

Reinforcement Learning for Continuous Improvement

GEO Jobe implemented reinforcement training for the machine learning model. This process allows the model to adapt and improve its performance, ensuring sustained accuracy in license plate detection as environmental conditions or data characteristics evolve. Reinforcement training improves long-term value by enabling the system to continuously adapt to changing conditions. This adaptability ensures that the license plate detection model remains effective and reliable, providing enduring benefits to users.

Unexpected Challenge: Loss of Metadata

During the implementation of the machine learning model, a challenge emerged as the model caused loss of metadata. GEO Jobe swiftly addressed this issue by repopulating the image data from a backup dataset, programmatically. Quick resolution of the metadata loss challenge underscores the project's commitment to maintaining data integrity. By efficiently mitigating the issue, GEO Jobe ensured that the valuable metadata associated with the imagery was preserved, preventing any disruptions to downstream processes and maintaining the overall reliability of the system.

THE RESULTS



GEO Jobe's strategic integration of AWS hosting, a custom GIS application, and a meticulously trained license plate detection model has transformed municipal asset management. The seamless accessibility of oriented imagery on any device, coupled with a user-friendly interface, ensures maximum efficiency and data utilization. Moreover, the implementation of machine learning not only enhances accuracy in license plate detection but also safeguards privacy, exemplifying GEO Jobe's commitment to delivering innovative solutions that save time and enhance operational efficiency.

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