daffodil

Customer Success Story

Daffodil helps an urban planning firm to leverage AI and detect green space from geospatial data

GREEN CITY WATCH

Customer: Green City Watch

Country: Netherlands

Industry: Urban Planning

Our Role: Product Engineering

About the Client

Green City Watch is a geospatial AI firm specializing in urban ecological engineering. It leverages the Industrial Internet of Things (IIoT) technology to empower municipalities and local councils with data-driven urban ecology. Green City Watch empowers 30+ (mega)cities, from Boston to Amsterdam to Jakarta, to understand, monitor, and improve their urban forests through data-driven decision-making. Their TreeTect™ technology provides municipalities and urban foresters with a better overview of their tree inventory. By combining Industry 4.0 technologies with satellites, LiDAR, and drones, TreeTect™ allows municipalities to draw actionable insights about green space in near real-time.

>90%	11	30+
precision	machine learning models trained	cities mapped

The flexibility of allocating resources was impressive. The flexibility of the people we worked with to work with limited resources as we had a tight budget. The tree detection algorithm was significantly improved during this project.

CEO

The Situation

Urban foresters grapple to keep up with changing urban ecosystems. Low-fi solutions, diminishing budgets, and reliance on inaccurate & outdated data are some of the challenges that limit them to build a complete picture of their city's green space.

Municipalities and urban foresters of Amsterdam and Boston had the vision of maintaining the longevity of urban trees. It was realized that urban trees live just 13 years, while their rural counterparts live up to 100 or more.

Green City Watch wanted to leverage a combination of ecological engineering, machine learning techniques, and remote sensing methods, known as "geospatial AI", to boost urban tree longevity.

In order to help the urban foresters in improving the lives of urban trees, Green City Watch had the idea of building an AI-based solution that would give an overview of tree inventory in the Amsterdam and the Boston region. This inventory would further allow the foresters to derive actionable insights about green space in the near-time.

For building tree inventory and calculating the Normalized Difference Vegetation Index (NDVI) value, Green City Watch had geospatial data in the TIFF image format, captured from WorldView-1 & WorldView-3 satellites.

This geospatial data was captured with 30 cms spatial resolution with information of 8 bands.

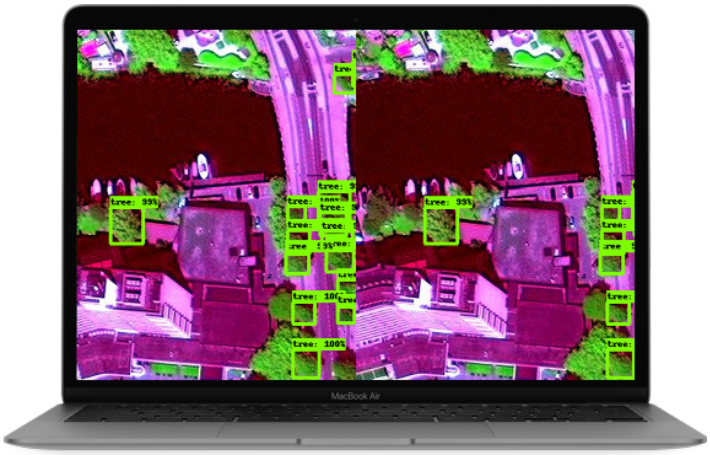
Hence, Green City Watch was on a lookout for a technology partner who could turn their vision into a software product. The client zeroed-in on Daffodil Software due to our unparalleled expertise in AI technologies, as exhibited in our past projects. The requirement was to:

In order to maintain the tree inventory, team GCW had two prime requirements:

- Conceptualize, design, and develop an AI-based solution that could identify green areas and provide a synoptic view of large areas at a high level of detail from a variety of sensors with a wide range of spatial and spectral resolution.
- Identify 80-90% trees in a defined location with an error rate of 3-meter radius, find out their geo-co-ordinates, and discover their crown area (in square feet).
- To calculate the Normalized Difference Vegetation Index (NDVI) value. This vegetation index is an indicator of greenness and has a strong correlation with green biomass, which is indicative of growth.

The Solution

The project began with our business analytics and software architects outlining the optimal architecture of the solution. They refined the functional requirements and developed a complete product vision and its development roadmap. Once the strategic plans were mutually finalized, Daffodil's team mapped the requirements onto the technology landscape and suggested technologies such as QGIS, Leaflet, Maply, WhirlyGlobe, Node.js, AWS, TensorFlow and GBDX as the core technologies for the solution development. In order to identify the location of urban trees, team Daffodil opted for object detection techniques. Object detection is a computer vision technique for locating instances of objects in images or videos.



These models were further ensembled for prediction in the Amsterdam and Boston region. More than 90% of trees, captured from different angles and in various seasons were identified using the models.

Along with this, Green City Watch had the requirement to make the solution scalable. Since the reflection in the bands varies according to the species, a similar solution won't work in different geographies. Therefore, for different geographies, a different band combination would be required.

In order to optimize the resources and cost involved in the development, a number of cloud services (AWS) were utilized. AWS SES for email notification, AWS ECR to store docker images, AWS Sagemaker to run docker containers in GPU environment, AWS S3 Bucket for data storage, AWS Lambda to scale up or down the resources, when required.

For building the data set for machine learning models, the spatial data captured through satellites were used. The data was stored in GeoTIFF files from which different band information was to be derived. Since different species of trees are identified in different bands, building a single ML model with numerous combinations couldn't be a solution. Thus, as a solution to the problem, multiple ML models were developed and ensemble modeling was used for prediction.

Ensemble modeling is a process where multiple diverse models are created to predict an outcome, either by using many different modeling algorithms or using different training data sets. The ensemble model then aggregates the prediction of each base model and results in a once final prediction for the unseen data.

Team Daffodil discovered the trees that could be identified in a specific band. Using a combination of 3 bands in a model, 11 machine learning models were created to identify the tree species and their location.

Impact

The client has been extremely satisfied by the way Daffodil has executed their vision and have planned for further updates to the system. The TreeTect technology provides municipalities and urban foresters with a better overview of their tree inventory. By combining Industry 4.0 technologies with satellites, LiDAR, and drones, TreeTect allows municipalities to draw actionable insights about green space in near real-time.

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precision

11
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30+
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Technology Stack

- Python
- Tensorflow
- AWS

About Daffodil

Daffodil Software is a software engineering partner to 100+ organizations across the globe and has been helping them in making their software products more robust, teams more productive and processes more efficient. Our ability to look beyond technologies to deliver innovative solutions with scale and speed has been lauded by our clients as well as the tech community worldwide.

Since our inception, we have invested in organic growth; building on our engineering capabilities, organizational processes, and culture required to deliver a truly collaborative ecosystem for solving technology challenges. At the core of Daffodil lies a culture rooted in innovation, learning and a result-oriented mindset.

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GRANDVILLE, USA

2885, Sanford Ave SW
#28585, Grandville,
MI 49418 USA

GURGAON, INDIA

9th Floor, Tower B1,
DLF SEZ Silokhera,
Sector 30, Gurgaon
122001

DUBAI, UAE

Suite No.: 407- 412,
Clover Bay Tower,
Business Bay, Dubai
United Arab Emirates

HISAR, INDIA

6th Floor, Metropolis Mall,
Industrial Area, Hisar,
Haryana - 125005