daffodil

Success Story

Developing a machine learning-based surveyor solution for a rapidly growing civil engineering consultancy

Client:

A Leading Civil Engineering Consultancy

Industry:

Civil Engineering

Country:

India

Our Role:

Software Product Engineering

About the Client

The client is a rapidly growing civil engineering consultancy which was established in 2012 and is located in Delhi NCR, India. It provides survey services, material testing, designing, consultancy, and supervision to real estate development companies. They hold quality, accuracy, and time-bound completion at the core of their civil engineering services. Several of their survey solutions have delivered over 140% improvement in efficiency for private enterprises and large-scale government highway projects.

Key Facts

95%	93%	90%
reduction in throughput time	algorithm accuracy	reduction in manual work

The Situation

The client was tasked with providing survey insights to the National Highways Authority of India (NHAI) for concise planning of road development work. The client has been using cars with multiple mounted cameras for capturing images along a particular route that is due for construction. A human surveyor, based on a live feed from the cameras, would label each road element using shortcut keys as it appeared in real-time. A final report of all the highway signs, cautionary culverts, beams, barriers, and other elements seen on the particular stretch of road would be presented to the NHAI.

As they had to manually label the images and video clips, this would often lead to several human errors making their way into the survey report. The data captured had to go through multiple reviews to reach a conclusive survey report. This was highly time-consuming and the results were never error-free. Their system wasn't identifying all the objects, locations, and distances accurately and distinctly.

They sought solutions in Artificial Intelligence (AI) and Machine Learning (ML) to automate the survey system and this led them to Daffodil Software. The client wanted to leverage Daffodil Software's capabilities in AI applications for implementing the solution in the following ways:

- Utiilize ML to devise a system that would eliminate the need for human intervention to create road survey reports
- Calibrate the identification of location details for each road survey element

- Accurately differentiate between one-time objects and continuous objects
- Offer possibilities of various hardware specifications for optimised reporting
- Implement the system on existing local servers of the civil engineering consultancy

The Solution

The Daffodil team tapped into its vast reserve of skills and know-how around AI domains such as AI image processing, analytics, and training ML models for industry-specific applications. They created a wireframe for an ML-based image recognition system to fit aptly into the vision and requirements brought to them by the civil engineering consultancy.

The system was built using a deep learning API known as Keras, which leverages the tools provided by the TensorFlow ML modeling platform. The final system created by them consisted of the following capabilities and modules:

The Algorithm

Earlier, a human surveyor had to label each element on the road in real-time based on the camera feed from the car mounts. Daffodil rehashed the whole system by eliminating the need for human intervention completely through an original ML-based algorithm. An ML-based computer vision technique was employed to identify instances of objects in the images and videos captured.

A variety of categories for the objects were defined including high tension wires, guard rails, beams, barriers, etc. The ML algorithm has been trained by feeding it 1000 images for each category of elements so that the survey report generation can be accurate and quick at the same time.

Continuous Improvement In Accuracy

An average of 87,000 image frames are generated per video recording, out of which 15,000 images are distinguished as relevant, finally filtering down to 1500 elements. This is after false positives, false negatives, and visibility limitations are factored in. This entire filtering process, despite its complexity, is completed in a matter of seconds with the new ML-based surveyor.

Location Calibrations

The camera captures the latitude, longitude, and altitude in the frame in video mode. Each image frame is separately analyzed by the ML algorithm converting the image to text and recording the location details as well. Additionally “chainage” is identified automatically, which means that the algorithm identifies where a long-running road element such as a barrier beam starts and stops. This helps differentiate between long-running elements and point objects such as signages and culverts.

Predictive Analysis

To further expedite the process of creating a road survey report, the ML system comes with predictive analysis capabilities also. A particular threshold has been prepared for recording probabilities for object detection. Based on these probabilities and advanced mathematical logic, the high probability objects appearing on a road being surveyed are recorded much faster through multiprocessing.

Leveraging Existing Infrastructure

There was a large volume of video and image data on the local servers of the consultancy which had to be run through the new ML model for training it. So the newly implemented system was exported and installed into the existing infrastructure of the consultancy which led to an immense reduction in the anticipated overhead.

The Impact

The ML-based surveyor application is able to achieve a 95% reduction in throughput time from the previously used manual system. Predictive object location has been able to maintain a margin of error of 5-10%, which is among the best in industry standards. The average accuracy of the algorithm is about 88%, with continuous improvement expected to potentially take this figure to 93%. By leveraging Daffodil's AI CoE, the civil engineering consultancy received commendations from the NHAI for expedited and concise survey reporting.

Services Used

- Product Engineering
- AI Solutions

Technology Stack

- python
- TensorFlow
- Keras

About Daffodil

For more than 20 years, Daffodil Software has been a trusted software technology partner to organizations across the globe. We take pride in our ability to look beyond technologies & deliver innovative solutions.

Daffodil is a CMMI level 3 accredited organization with innovation, tech agility & process orientation rooted deep within the core. Our team of 1000+ technologists strive to shape the tech industry and help businesses elevate their value proposition through technology.

Technology Partnerships & Certifications

Microsoft Partner – Silver Application Development partner Microsoft Partner – Silver Collaboration and Content	Google Cloud – Premier Partner	aws partner network – Advanced Consulting Partner
salesforce – registered consulting partner	CMMI level 3	PubNub
ISO 9001:2015 Certified Company	ISO 27001:2013	International Organization for Standardization ISO 20000

Awards & Accolades

Deloitte. Technology Fast500 APAC Winner	IT EUROPA – European IT & Software Excellence Awards	zinnov ZONES	Great Place To Work. Certified India
mobileweb award 2020	India's Most Admired Brand	Muse Design Awards 2022 Silver Winner	The Economic Times Brand Equity Best Tech Brands 2021