VEC VIRTUAL ENGINEERING CENTRE / [dstl]

Track Analytics for Effective Triage of Wide Area Surveillance Data

The Virtual Engineering Centre's (VEC) Simulation Team has developed a state of the art Virtual Engineering Systems Laboratory (VESL) which is used to develop a wide range of digital test-beds to support client projects and research collaborations.

Following on from a preceding collaborative project where the VEC, the University of Liverpool's Professor Simon Maskell from the School of Electrical Engineering and Computer Science and the Defence Science and Technology Laboratory (Dstl) co-developed a system using existing Dstl data to improve on existing methods used to track, analyse and predict global maritime movement. Dstl wished to explore further how the use of these digital tools could be expanded upon by looking into other forms of transport and behavioural trends - the global urban traffic movement project was realised.

THE CHALLENGE

Urban traffic illegal activities and accidents are on the increase (1,870 road deaths in Great Britain, 2019). Dstl was keen to develop a system that would improve tracking of road vehicles to detect inconsistent, misrepresented road behaviour to predict and quickly intervene on dangerous or illegal activities before they occur. To improve the overall safety of urban traffic on a global scale.

The VEC needed to create a Wide Area Modelling Imagery (WAMI) simulation of a specific geographical area, where vehicle and pedestrian behaviours under different scenarios, i.e. UAV, HALE (High-Altitude Long Endurance UAV), LEO, GEO satellites were simulated through SUMO (Simulation of Urban MObility) and imported into a 3D urban environment to generate the synthetic video for use in commercial application.

The system needed to cover functions including the simulation of moving objects (pedestrians, trees and water), tracking, classification, clustering, anomaly spotting and the development of learning behavioural models.

THE SOLUTION

WAMI simulations of Portsmouth and Montreal were created using Presagis software product, Vega Prime. These methods can be applied to any global urban location and run remotely for analysing and predicting the behaviour of urban traffic.

A unique approach to detecting and tracking moving objects and their interactions in video was developed, with a focus on handling high target densities and stopped vehicles. The tracking software that processes detected sources was integrated within the Stone Soup framework and with a MongoDB database and can be applied at operationally relevant scales.

From here, learning behavioural models and algorithms in an

Virtual Engineering Centre
University of Liverpool
Daresbury Laboratory
Sci-Tech Daresbury
Warrington WA4 4AD

+44 (0)1925 864 853
vec@liv.ac.uk
virtualengineeringcentre.com

UNIVERSITY OF LIVERPOOL

intuitive graphical interface was developed to create and run complex data queries to identify a whole host of traffic and pedestrian movement activities, including:

- Identify the vehicle behavioural classes (car, motorbike, bus, lorry) according to vehicle appearance and trajectory.
- Interaction of all entities, vehicles and city inhabitants within the city - generating a pattern of life.
- The simulation follows exact motion of vehicles and pedestrians, calculating exact position at each simulated step.
- Urban environment construction - coordinates buildings, roads and terrain information.
- Unusual behaviour identification – alerting when behaviour deviates from the predicted behaviour of each entity.
- Destination – where the self-reported destination appears different to the intended destination.

Accessing a High-Performance Computer (HPC), the VEC can run hundreds of simulated scenarios within a short period of time for their client, allowing a range of different situations to be tested and considered. Analysis of activity, trends and the prediction of irregular behaviour could possibly highlight illegal activity such as speeding, car theft which could lead to road incidents.

The resulting solution successfully combines these multiple platforms to track, analyse and subsequently predict urban traffic movement, class, behaviours and destinations. This then allows alerts to be raised when inconsistent or suspicious behaviour is detected, and appropriate interventions activated.

BENEFITS

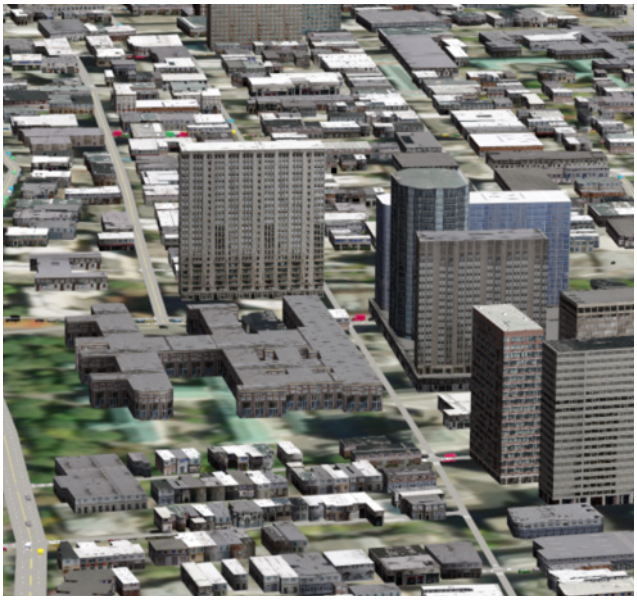
By working closely with Dstl and using its expertise and knowledge of the challenges and existing solutions, the VEC team was able to focus on areas which would add value to global road traffic analysts and help them in their daily roles.

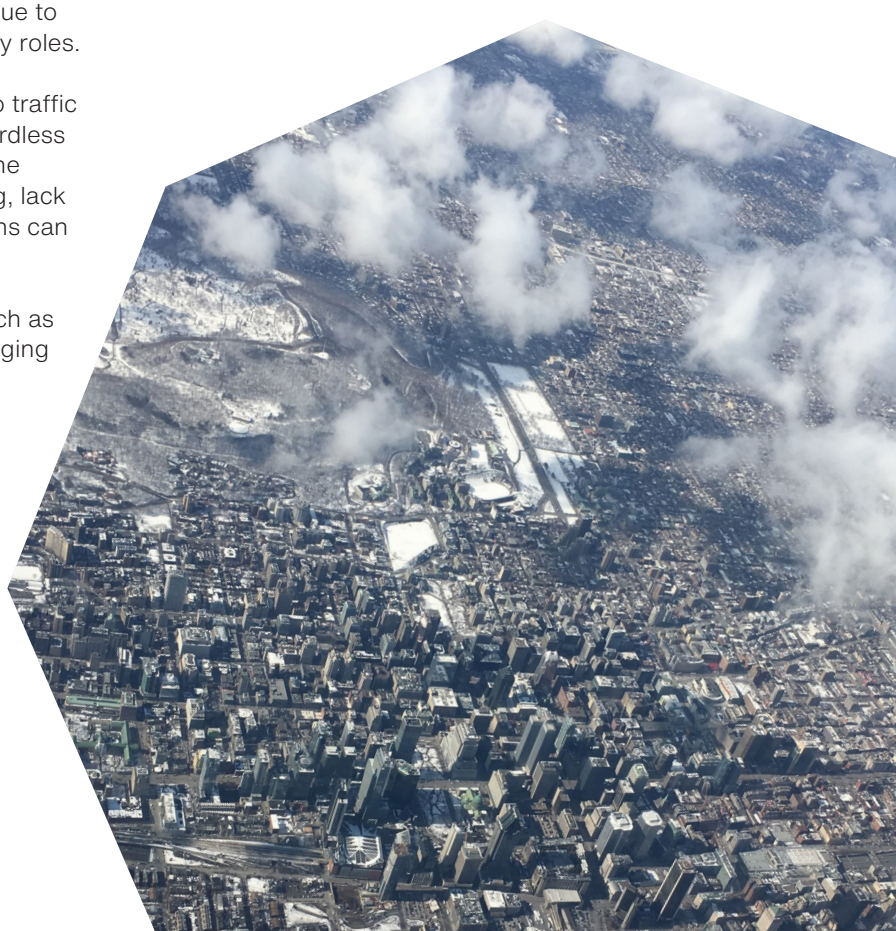
The system developed brings an intuitive approach to traffic surveillance and the reporting of road incidents, regardless of severity and impact. This solution helps highlight the cause of incidents, whether it is poor signage, lighting, lack of speed restrictions or traffic bottlenecks. Precautions can be planned in, increasing safety.

It identifies threats and potentially illegal activities such as speeding and car theft, by enabling predictions – bringing unrecognised behaviour to the attention of analysts; calculating actual vehicle types versus self-reported vehicle types, their coordinates discovering intended destinations rather than self-reported destinations. This allows data analysts to quickly build complex logical queries with multiple criteria, leading to greater insight compared to a manual system.

Improved detection rates and confidence levels of suspicious activities and increased time available to respond to alerts allows intervention resources such as the traffic police to make more informed decisions on deployment and ultimately help to reduce illegal urban traffic activities.

Information on geo-specific urban traffic activity could give insurance companies better insight on the cost charged for insurance cover in a specific area, reflective on the overall safety and predictive risk in each area.





PRESAGIS
MAKE IT REAL

We are the UK's leading digital innovation centre - find out how we can help your business: vec@liv.ac.uk

VEC VIRTUAL ENGINEERING CENTRE