Traffic Monitoring from Aerial Video Data

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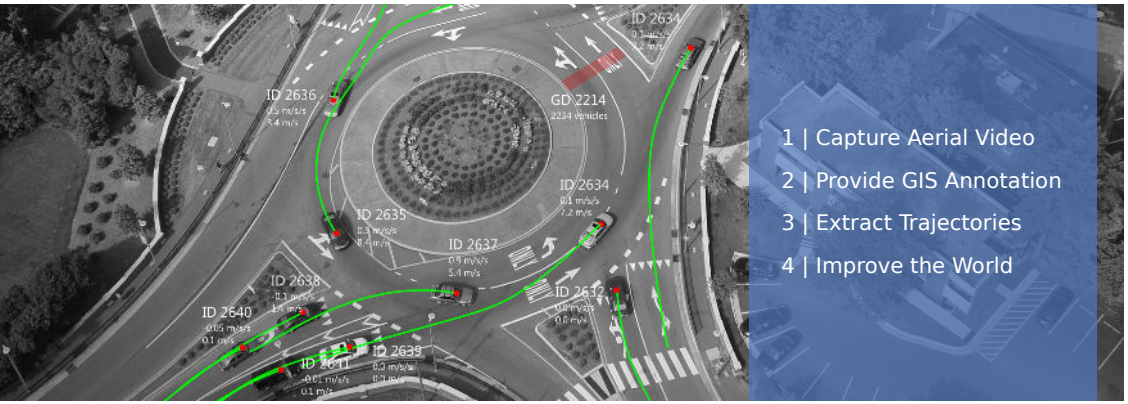
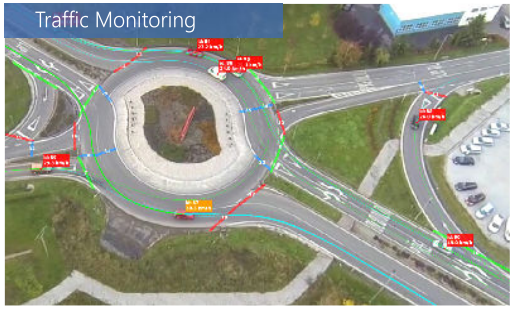
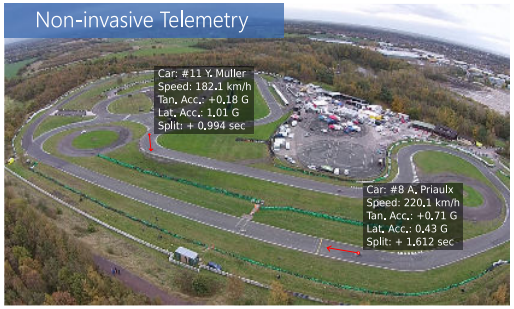


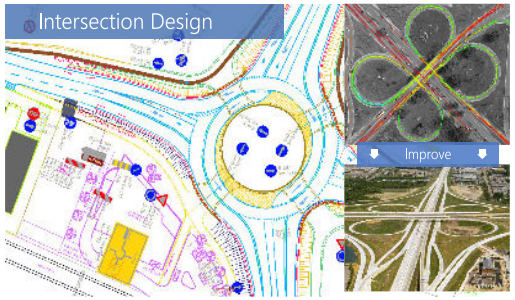
1 | Capture Aerial Video
2 | Provide GIS Annotation
3 | Extract Trajectories
4 | Improve the World

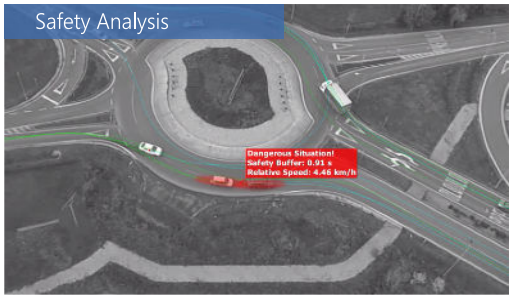
WHAT FOR?

This work emerged as an answer to the need for an inexpensive solution for a comprehensive and acurate vehicle movement data collection.
The proposed system analyses aerial video captured by low-cost UAV and generates a database of vehicle trajectories that passed through the scene. Each trajectory contains information about global position, tangential and lateral accelerations and entry and exit points of the trajectory in the scene.
Such data are crucial for novel approaches in transportation system analysis and management.





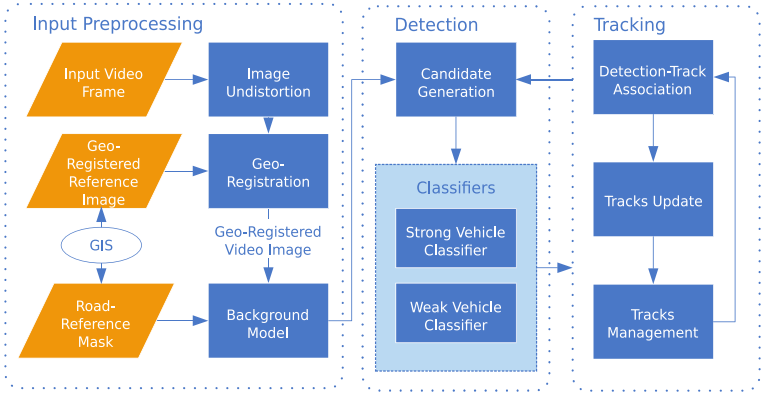




HOW DOES IT WORK?

APPROACH

The video sequence is **geo-registered** using visual similarity based on **ORB features** and custom **RANSAC** guided transformation estimation.
Detection candidates are generated using knowledge of road surface, moving object detection based upon **GMM model** of the scene and already tracked vehicles.
Candidates are resolved by **coupled** weak and strong **MB-LBP cascade classifiers** trained on vast hand annotated training dataset.
Positional offset error caused by perspective parallax is removed using **homography decomposition** and projective geometry.
Multi-object tracking is carried out in **RGB +ScharrEdge** colour space by a set of specialised **Bayesian Bootstrap Filters**, which incorporate **"noisy" initialisation** phase for fast moving objects and are **aided by attractors** generated by the weak classifier.
Invalid trajectories are rejected by application of **standard drive model** and **overlap detection and reasoning.**
The generated trajectories are postprocessed by application of **local approximating B-spline** curve in spatial domain and combination of **global interpolating spline** curve with **Monotone Piecewise Cubic Interpolation** in tempo-spatial domain.



RESULTS

The system was evaluated using a dataset consisting of total **73,5 km (3h 21min)** of vehicle trajectory data from video sequences captured in the Czech Republic and the UK. The **precision** (ratio of correctly estimated trajectories in generated output) was **92.3%**. The **recall** (ratio of correctly estimated trajectories from all true trajectories) was **83.9%**.

The work is continued as PhD research at FIT, BUT and is successfully implemented as a part of pioneering **DataFromSky traffic analysis service** used worldwide.

DATA FROM SKY
www.datafromsky.com

PUBLICATIONS

Apeltauer, J., **Babinec, A.**, Herman, D. and Apeltauer, T.: "Automatic Vehicle Trajectory Extraction for Traffic Analysis from Aerial Video Data". In *ISPRS Archives 2015*. Munich: TUM.

Babinec, A.: "Automatic Vehicle Trajectory Extraction from Aerial Video Data". In *EXCEL@FIT 2015*. Brno: BUT. (Awarded **first prize** in category Marketing Potential and **second prize** in category Public Contribution.)

Thanks to

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