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DATA FROM SKY

Automatic vehicle trajectory extraction from aerial video data

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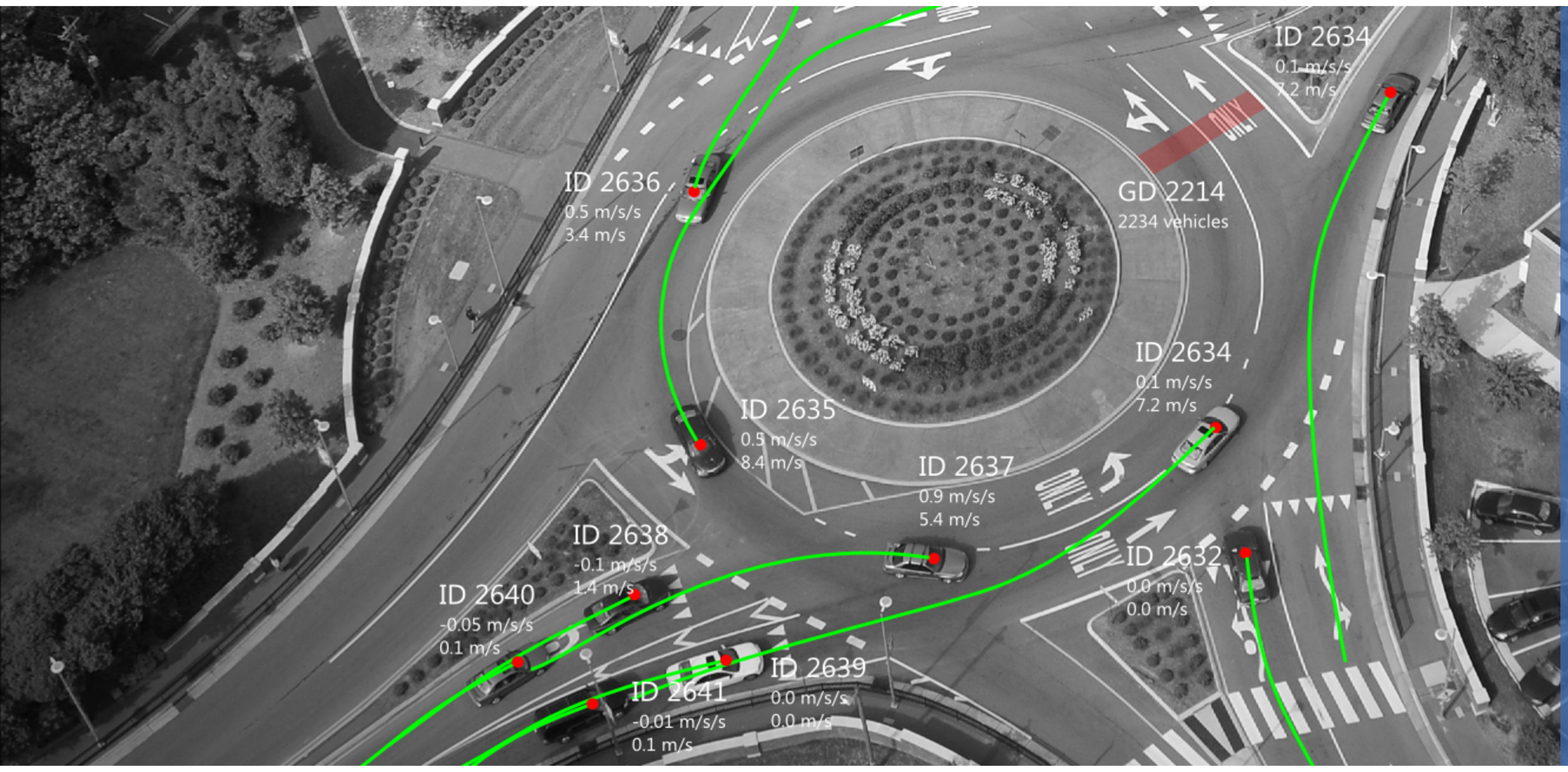


1 | Capture Aerial Video

2 | Provide GIS Annotation

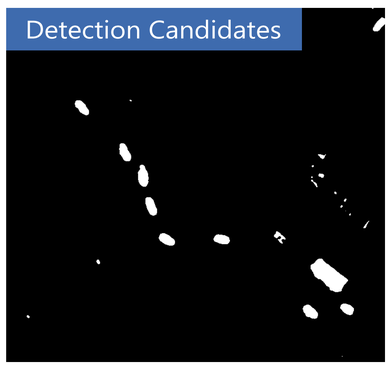
3 | Extract Trajectories

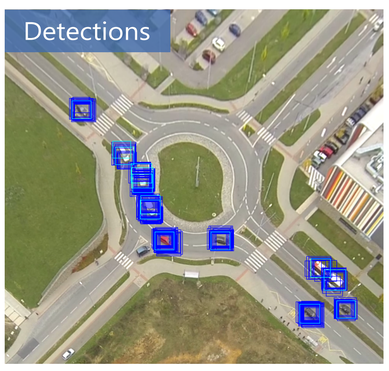
4 | Improve the World

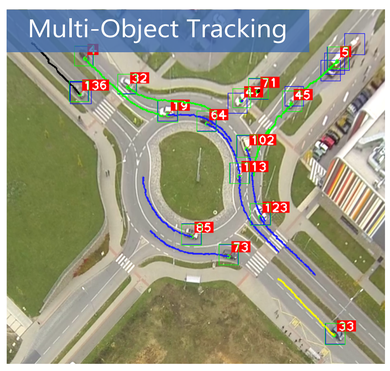
This poster presents a system for automatic vehicle trajectory extraction from aerial video data. The input video sequence can be captured by regular action camera mounted on a multicopter drone or balloon flying in altitudes from 40 to 200 m.

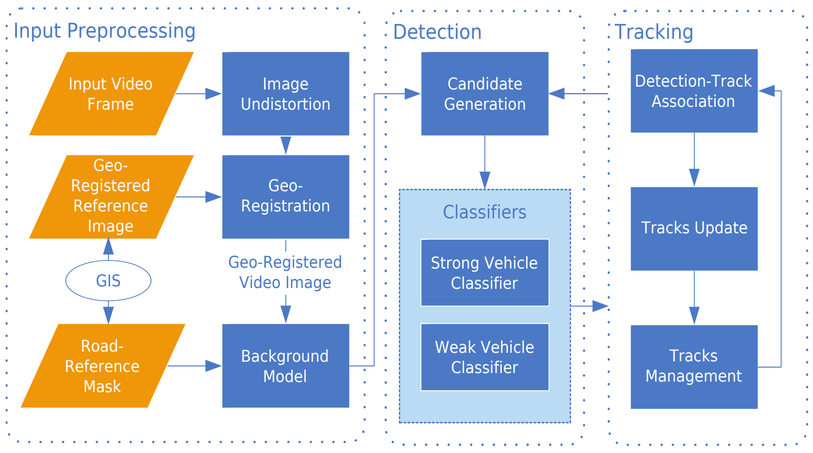
The geo-registration of video sequence is based upon transformation estimation of two ORB feature sets extracted from a reference image and video sequence frame. To provide the robustness of the estimation, RANSAC procedure is employed to guide the algorithm.

Vehicle detection candidates are produced by video sequence analysis in temporal dimension to detect moving objects. This is carried out by background subtraction algorithm using Gaussian Mixture Models. Its output is fused together with a road surface mask and currently tracked objects database to produce set of detection candidates.





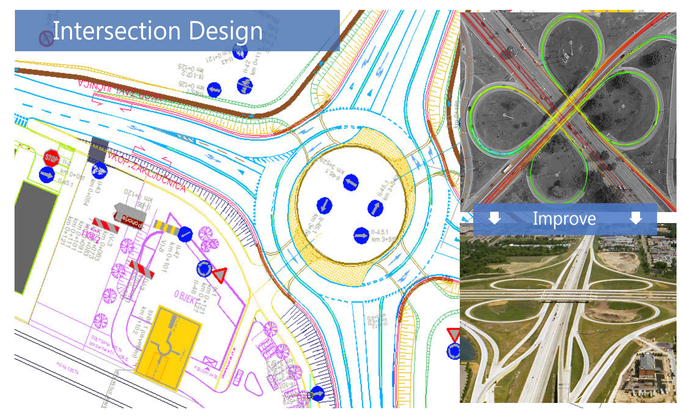


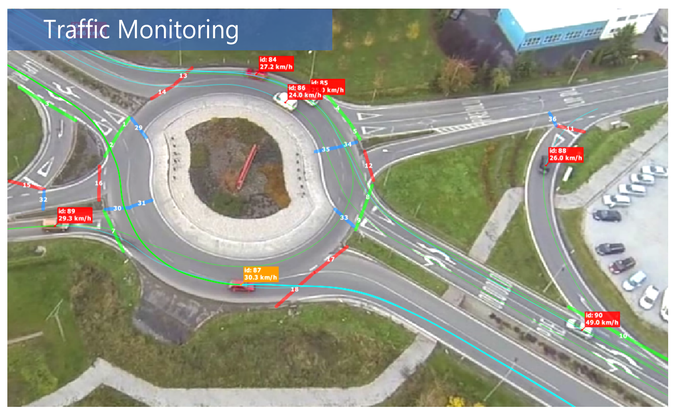


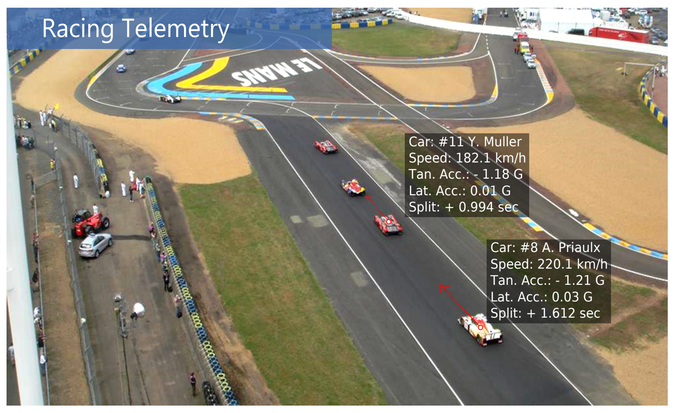
The detection candidates are analyzed by two vehicle classifiers - strong vehicle classifier which produces confident detection cues, and weak vehicle classifier which provides tracking attractors to aid multi-target tracking. The classifiers use Multi-Block Local Binary Pattern features and are constructed by AdaBoost algorithm on dataset of 20,000 hand annotated vehicles and road structures.

The tracking of vehicles is carried out in RGB+Edge image space using a set of independent Bayesian bootstrap particle filters, one for each target. The transition model of the particle filter is simple velocity model considering the vehicle position as integration of its velocity. Target model of the vehicle is represented by 32x32 RGB +Edge template with circular mask, which is extracted from the area initial vehicle detection. The plasticity of the model is achieved by 5% template update in case of overlapping strong detection and/or when the cues from the weak classifier are strong enough in the area of tracked vehicle. To prevent target swaps, the update is disabled when multiple targets overlap.

The evaluation of particle is based on its template distance to the target model and the attractor cues produced by the weak classifier. The initialisation of particle filter for moving object is guided by "falloff" algorithm, which at the beginning of the target tracking causes the position of the particles of given target to be more affected by random noise than their velocity, so the particles can slowly adapt to the target motion while elevating particles' velocity effect on their behaviour.







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