

ABSTRACT PRESENTATION

Title: Geo-spatial traffic behaviour analysis and anomaly detection

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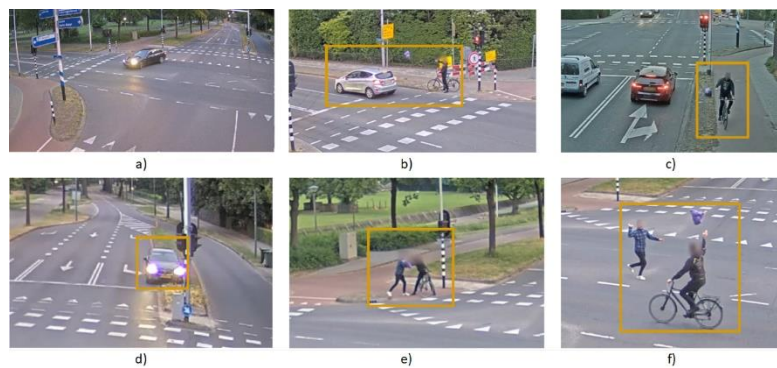
Company name / Institute: TU/e

Project name: SMART Mobility

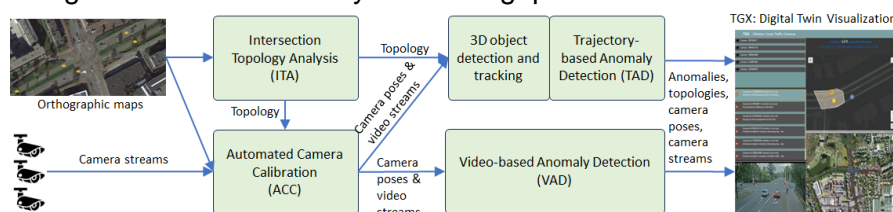
Funding group: ITEA

Abstract can be published on website: YES NO

Understanding the behaviour of traffic participants within the geo-spatial context of road/intersection topology is a vital prerequisite for any smart ITS application. Image-based behavior analysis of traffic agents focuses on early detection of a wide spectrum of situations requiring fast response/mitigation, such as



safety threats and unlawful traffic agent's behaviours. In detail, this situational spectrum includes accidents, illegal use of roads/intersections, dangerous driving, near misses, infrastructure collapse, littering, vandalism, violence, infrastructure attacks, health-related seizures, etc. This list becomes complete if we consider all deviant traffic situations as anomalous events. Anomalies are typical aberrations of traffic agents from the normal behavior. As a result, the AI-based traffic anomaly detection, when integrated with a digital twin reconstruction, can provide full situational awareness to the transportation officers and control room operators. Besides this, a statistical analysis of detected anomalies and their types may lead to concrete ideas and insights on how a specific intersection should be re-designed to increase safety and throughput.



In this talk, we present a video-based traffic analysis and anomaly detection system covering the complete data processing

pipeline, including sensor data acquisition, analysis, and digital twin reconstruction. The system solves the challenge of geo-spatial mapping of captured visual data onto the road/intersection topology by semantic analysis of aerial data. Additionally, the automated camera calibration component enables instant camera pose estimation to map traffic agents onto the road/intersection surface accurately. The main contribution of the system is an innovative AI model for detection of traffic anomalies and a wide range of unlawful, unsafe, and blocking activities of traffic participants. The system includes the whole set of possible traffic agents in this behaviour analysis: pedestrians, bicyclist, and vehicles. The novel aspect is approaching the anomaly detection problem by analysis of both the spatio-temporal visual clues and the geo-spatial trajectories of agents. This enables recognition of anomalies related to traffic rule violations, e.g. jaywalking, improper turns, zig-zag driving, unlawful stops, and behavioural anomalies: littering, accidents, falling, vandalism, violence, infrastructure collapse, etc. The method achieves leading anomaly detection results on benchmark datasets World Cup 2014, UCF-Crime, XD-Violence, and ShanghaiTech. The complete system is deployed and validated on the roads of Helmond town in The Netherlands.