

Naturalistic Aerial Approaches for Monitoring Powered Two Wheelers

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Background

- European registrations of motorcycles and mopeds continued increasing in 2016: +9.1% on a year-on-year basis
- Understanding the way PTW move in traffic is one of the hot topics in Transportation Engineering as a basic step for traffic optimization, improving traffic conditions and tackling safety issues
- Lack of detailed naturalistic PTW driving data
- Fixed cameras have many limitations.
- The use of Unmanned Aerial Systems (UAS) is discussed.



Identifying Limitations to PTW tracking in Urban Environment

- Monitoring PTW movements for an extended arterial section is not possible.
- Complex maneuvers and effect of previous actions can be evaluated.
- Viewing angle of the camera may lead to many “hidden” points.
- Reduced available high points to set the camera.
- Increased angle may lead to reduced accuracy.



Example of hidden PTW with fixed camera



+1.6 sec



Example of hidden vehicle with fixed camera



+5.1 sec

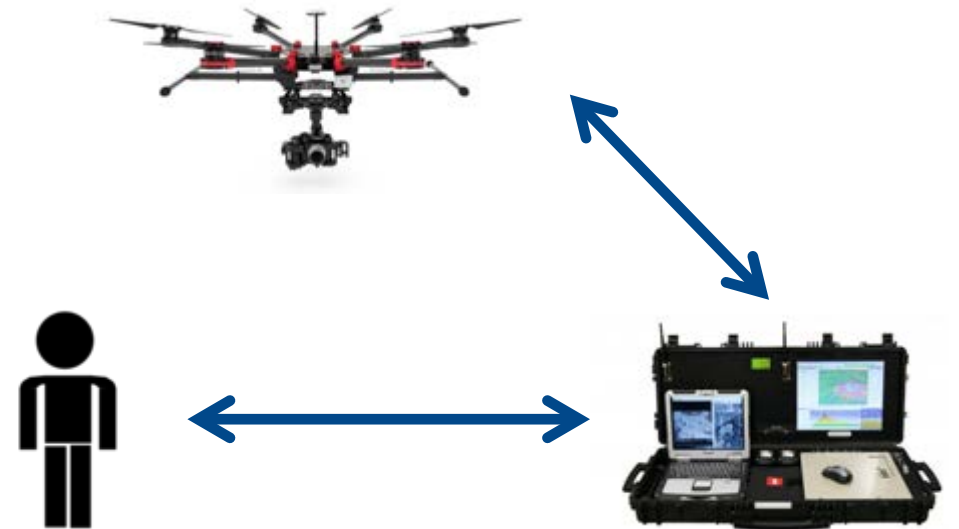


Vehicle edges not visible!



Overcoming limitations with UAS

- Limitations relate either of the length of the arterial or the height of the camera
- Both can be overcome with the use of Unmanned Aerial Systems (UAS)
- A UAS consists of:
 - Operator on the ground
 - Unmanned Aerial Vehicle (UAV)
 - Communication system between the pilot and the UAV(s)



Advantages of UAS

- Record an extended road arterial section
- Do not affect drivers' behavior
- No hidden points
- Hovering capabilities and small size
- Can fly (almost!) anywhere



Limitations & Disadvantages of UAS

- Flying a drone is not allowed overhead people, property, or vehicles.
- Flying over 150m is not allowed (EU regulations)
- Flying beyond visual line of sight is not allowed
- Limited flight time
- Most UAVs are sensitive to adverse weather conditions
- Cybersecurity Issues
- Privacy



What can drones see?



Screenshot from 60m altitude!



What does the pilot (on the ground) see?

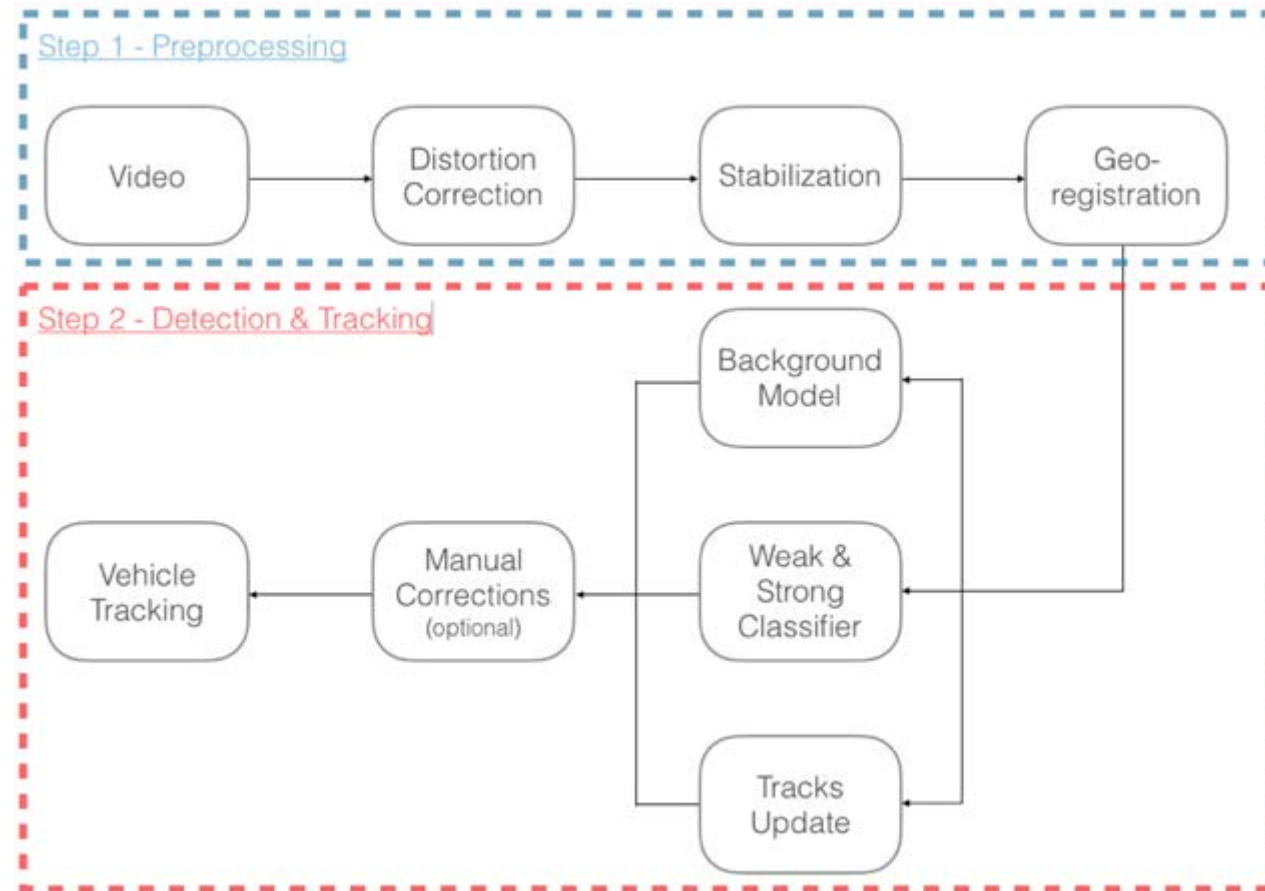
First Person View



Telemetry & GPS



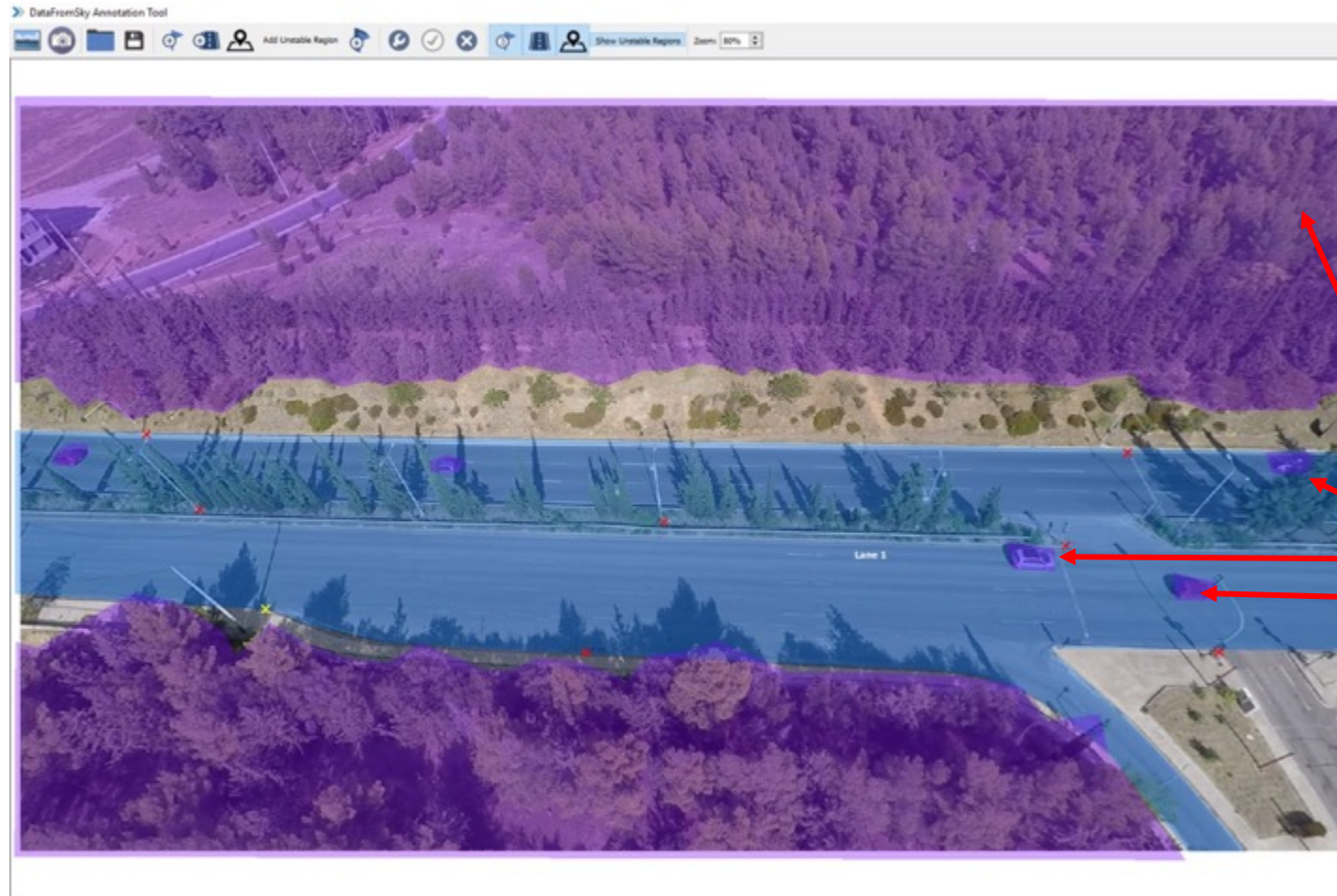
From Video to Vehicle Trajectories



Annotation & Stabilization of Study Area

Blue Color

We annotate the area where vehicles or pedestrians are moving

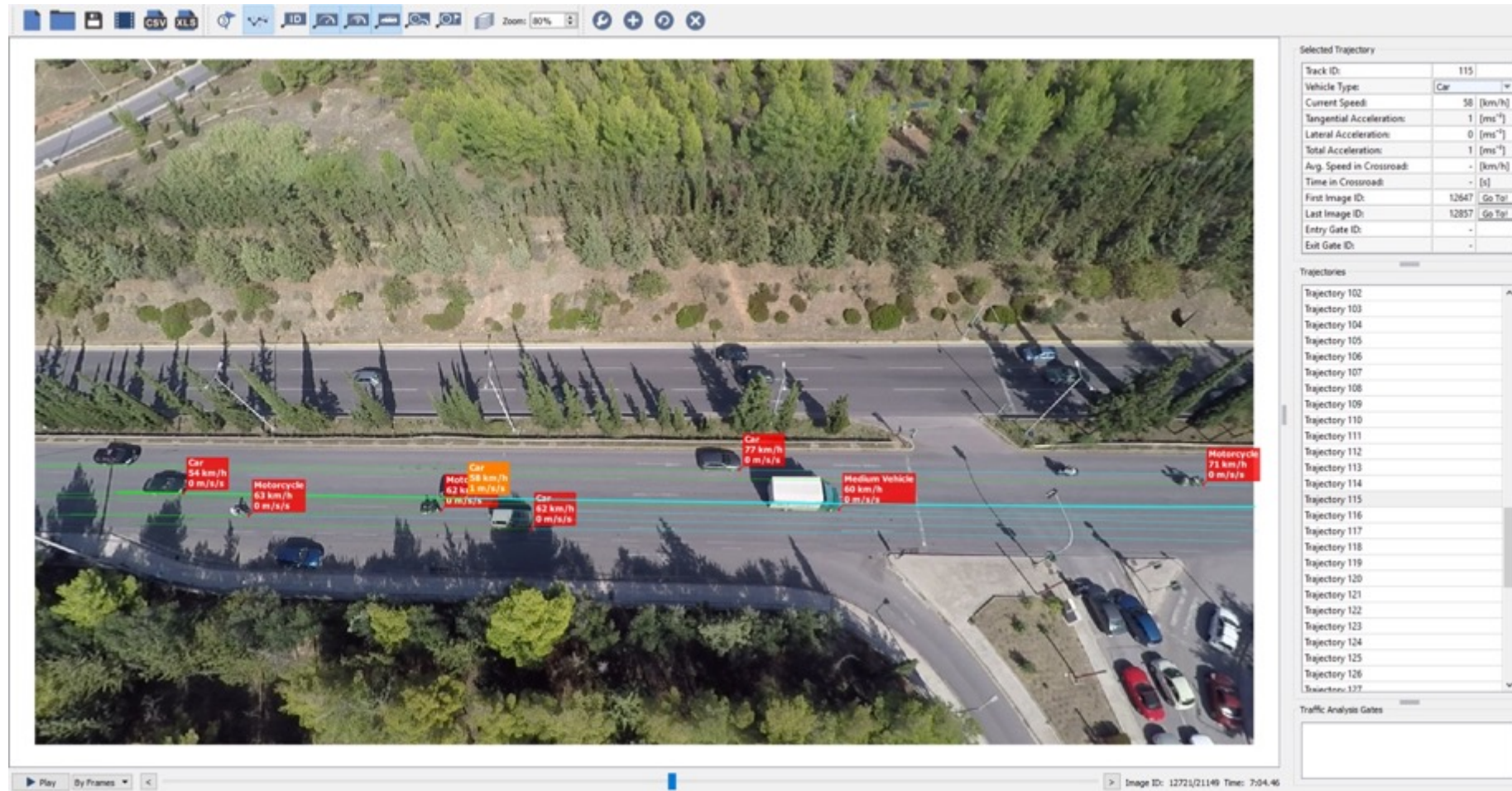


Purple Color

We highlight moving or tall objects and plants that may affect stabilization.



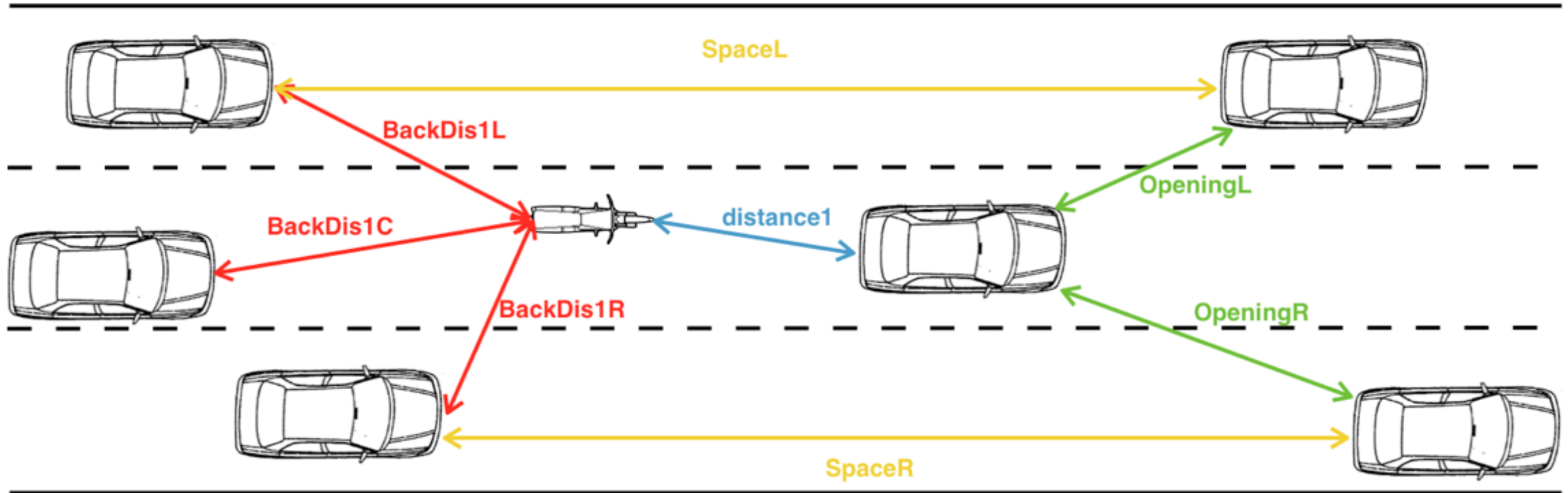
What data can we collect?



- Trajectories
- Speeds
- Accelerations
- Distances
- Volume



What data can we collect?



Variables measured for every overtaking attempt



What data can we collect?



What data can we collect?



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Discussion

- With the latest advances in UAV industry, novel directions for data collection in Traffic Engineering emerge.
- Issues that we need to deal with:
 - Battery life (for increased recording sessions)
 - Stabilization of video (for increased accuracy)
 - Real-time data acquisition
 - Privacy
 - Flying above/in restricted areas



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