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

Vehicle edges not visible!

+5.1 sec
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

**Step 1 - Preprocessing**
- Video
  - Distortion Correction
  - Stabilization
  - Geo-registration

**Step 2 - Detection & Tracking**
- Background Model
- Weak & Strong Classifier
- Manual Corrections (optional)
- Vehicle Tracking
- Tracks Update
We highlight moving or tall objects and plants that may affect stabilization.

We annotate the area where vehicles or pedestrians are moving.
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?

www.datafromsky.com
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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