Braking vs. Flashing Lights – Utilizing a Ground Based LiDAR to Observe Urban Traffic

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Introduction

Assumption:
- Automated Vehicles (AVs) will be introduced onto urban traffic (at some point)
- Even though there is a trend towards shared mobility, conventionally looking, personally owned cars with automation features (SAE3+) will exist
- Human road users have a learned expectation towards traffic – there are human-like elements in current traffic

Understanding current traffic is key for developing automated vehicles with human-like behavior
Braking vs. Flashing Lights

Traffic on priority lane

Traffic on road w/o priority

action, reaction, interaction

Congestion

André Dietrich | Observing Urban Traffic | 29.08.2018 IEA 2018 Florence
Braking vs. Flashing Lights

- V\_green \sim 50 \text{ km/h}

- Normally, yellow cars would turn, once intervehicle gaps become sufficient
Braking vs. Flashing Lights

- If a **congestion** builds up behind the intersection, the **mean velocity** on the main road gets **lower** and drivers start to **cooperate**

Questions:
- What is the **velocity threshold** for drivers yielding their right of way?
- What effect does the **headline flashing** have on the merging process?
Observing Traffic

Understanding current traffic is key for developing automated vehicles with human-like behavior

But how?
- Drive around a lot
- Observe a lot of others driving around
Traffic behavior consists of:

- **Personal** perception and interpretation of **individual** traffic situations

- **Communication and interaction** between road users

- **Kinematic movements** of traffic participants
Observing Traffic – Methods

- **Personal** perception and interpretation of *individual* traffic situations

  - Questionnaires & Interviews
  - Field experiments (e.g. using eye tracking and/or think aloud methods)

- Understanding subjective influences requires **controlled experiments**

  (Portouli et al., 2019)
Observing Traffic – Methods

- Communication and interaction between road users

Currently traffic participants use visual and auditory signals to communicate

- Questionnaires & Interviews (e.g. Merat et al. 2018)
- Manual Observations (e.g. Imbsweiler et al. 2017, Vollrath et al. 2016)
- Videos (e.g. Rasouli et al. 2017)
Observing Traffic – Methods

- **Kinematic movements** of traffic participants

  - Videos
  - LiDAR

Software: Traffic Intelligence (Saunier et al. 2010)
Observing Traffic – Methods

- Kinematic movements of traffic participants
  - Videos
  - LiDAR

Software: Traffic Intelligence (Saunier et al. 2010)
Observing Traffic – Ground Based LiDAR

WebCam
GNSS Receiver
Ibeo Lux Laser Scanner
SSD Drive
Laptop Power Bank
Raspberry Pi
WiFi Access Point

Dietrich (2018)
Observing Traffic – Ground Based LiDAR
Preliminary Results

• Roughly 20% of yielding vehicles flashed their headlights

• Congestion builds up and dissipates in waves

• Evaluating LiDAR data requires powerful algorithms due to obstructed view and
References


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