

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

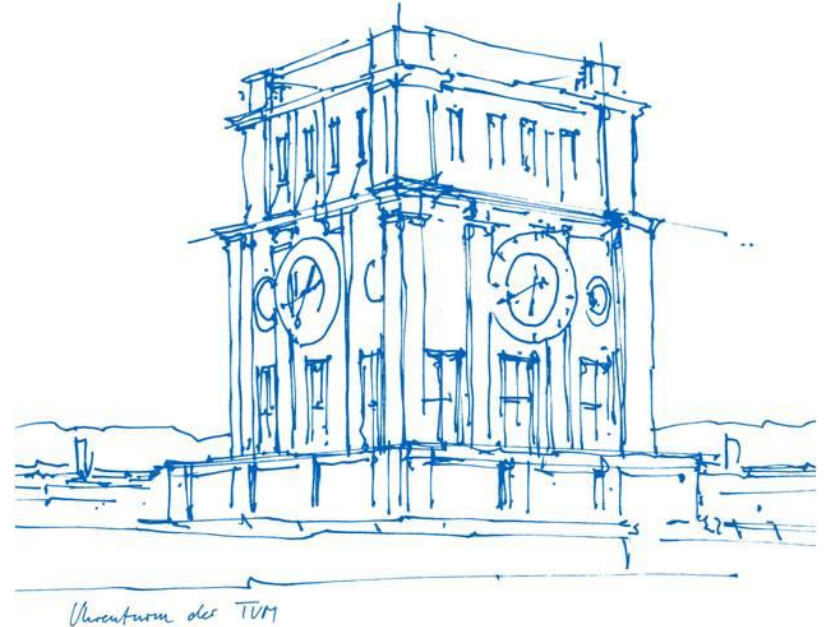
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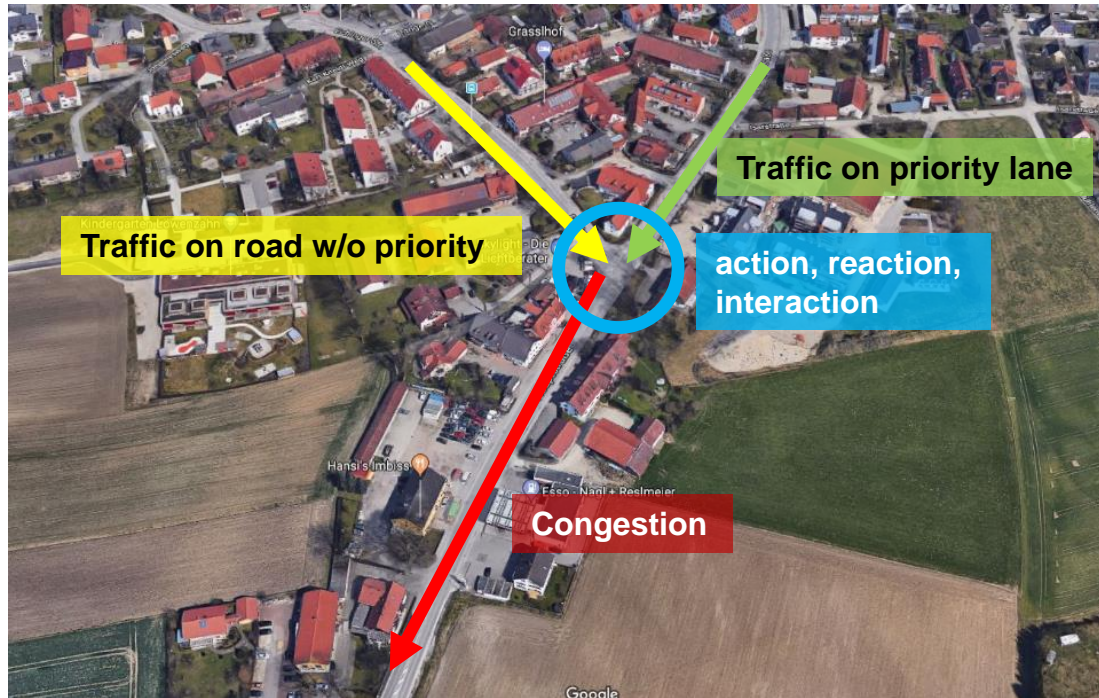
Introduction

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

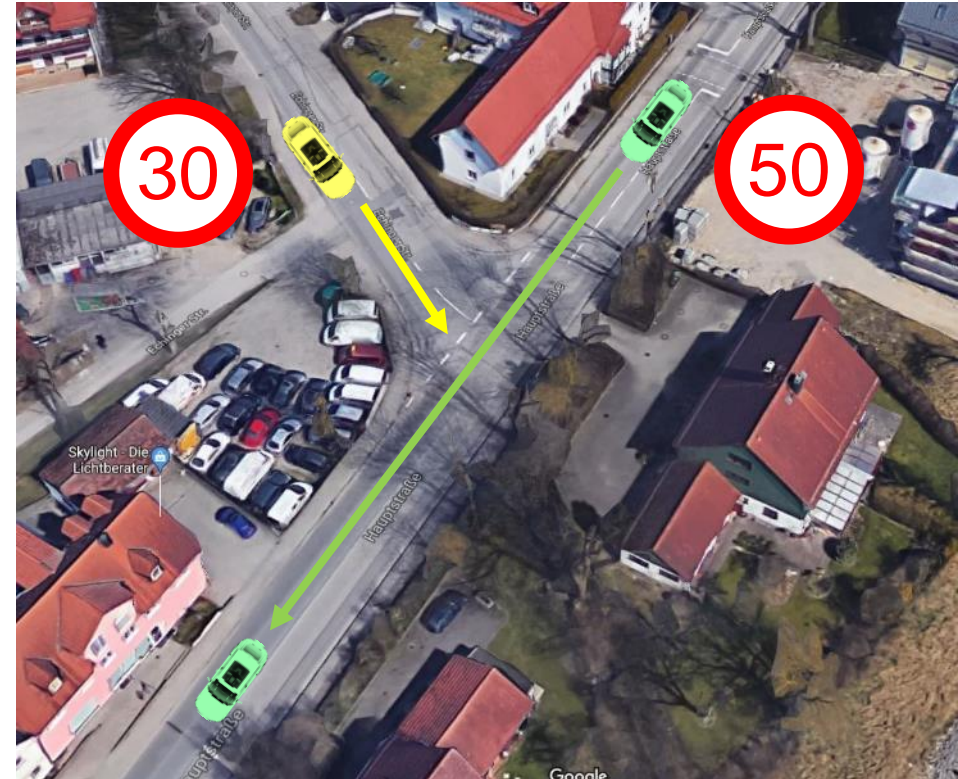
Understanding current traffic is key for developing automated vehicles with human-like behavior

Braking vs. Flashing Lights



Braking vs. Flashing Lights

- $V_{\text{green}} \sim 50 \text{ km/h}$
- 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** has 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

Observing Traffic

„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)

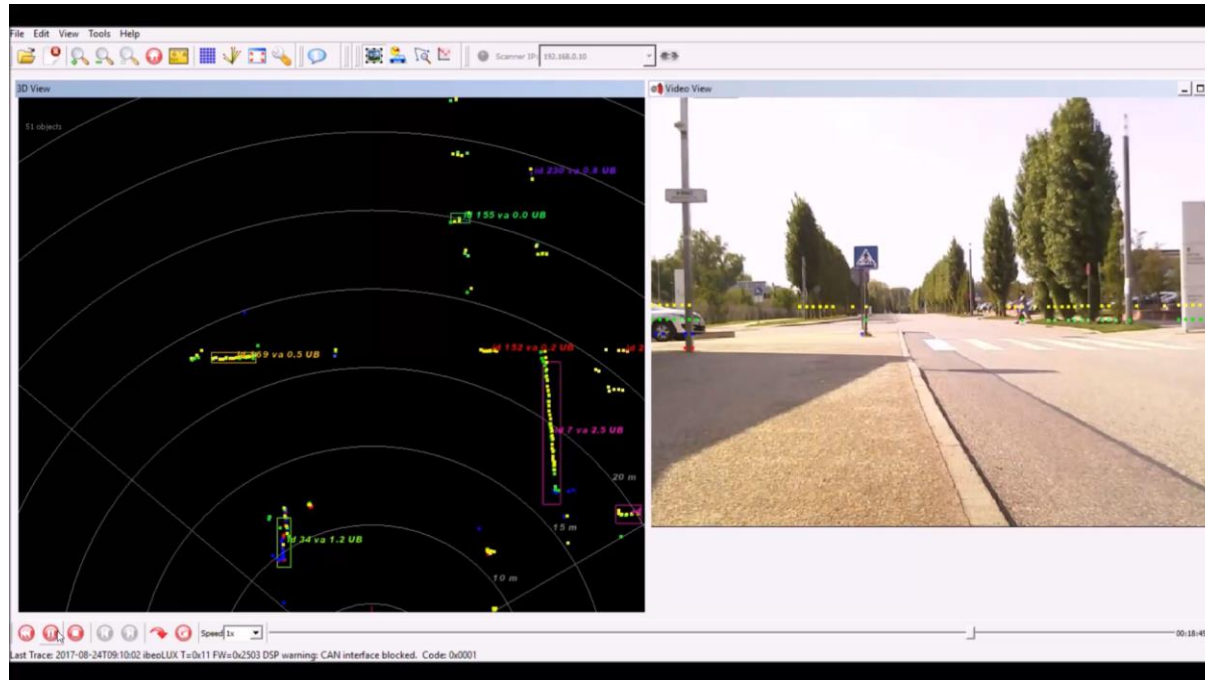
Observing Traffic – Ground Based LiDAR



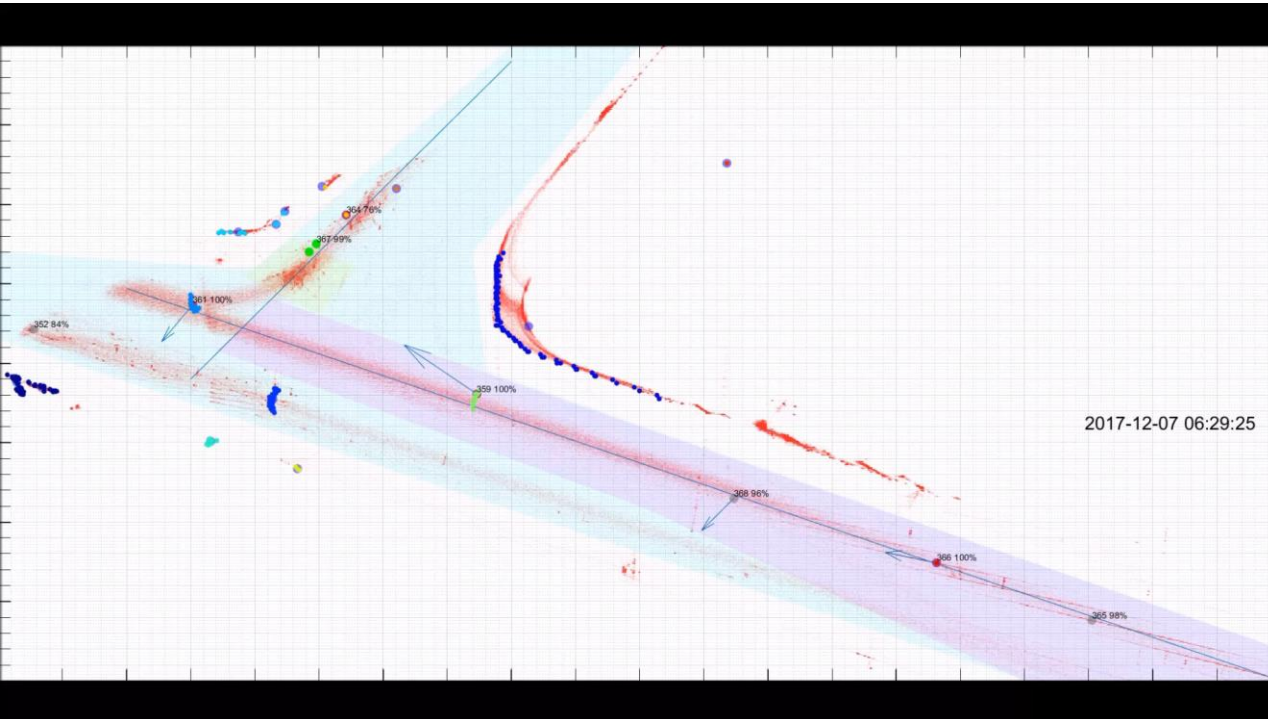
- WebCam
- GNSS Receiver
- Ibeo Lux Laser Scanner
- SSD Drive
- Laptop Power Bank
- Raspberry Pi
- WiFi Access Point

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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Thank you



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