Panel on Information Processing
Topic: Processing Sensing Data

Moderator
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Panelists
Thomas Jell, Siemens Mobility GmbH, Germany
Hamid Menouar, QMIC - Qatar Mobility Innovations Center, Qatar
Paris Kaimakis, University of Central Lancashire Cyprus, Cyprus
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IoT and IoT interoperability

Hamid Menouar, QMIC - Qatar Mobility Innovations Center, Qatar
Connected Vehicles, an enabler of Big Data

Paris Kaimakis, University of Central Lancashire, Cyprus, Cyprus
Computer Vision vs. Privacy
Connected Vehicles, an enabler of Big Data

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Vehicles do already generate business-profitable data
Connected Vehicles, an enabler of big data
Connected Vehicles a Reality

Toyota Has Big Plans To Get Cars Talking To Each Other And Infrastructure In The U.S.

After well over a decade of development a tentative step by General Motors in 2017, vehicle-to-vehicle (V2V) communications might finally get some market momentum with a push from Toyota. The Japanese automaker has announced plans to begin a broad deployment of V2V and vehicle to infrastructure (V2I) technology in the U.S. market from 2021 with the goal of having it across almost its entire lineup by mid-decade.

The combination of V2I, V2V and communication with other road users such as pedestrians and cyclists is known as V2X. Like GM, Toyota is planning to use dedicated short-range communication (DSRC) technology which is based on WiFi. In the U.S. the federal communications commission has set aside spectrum in the 5.9 GHz band for connected transportation.

Connected Vehicles a Reality

With the aim of increasing safety in road traffic, Volkswagen will enable vehicles to communicate with each other as from 2019.

Every Cadillac To Soon Get Hands-Off Super Cruise Automated Driving System For Highways

Cadillac’s Super Cruise partially automated driving system is widely considered to be the best such system currently available in production but it’s only available on a single model, the slow-selling CT6 sedan. That changes in 2020 as it will be rolled out to the entire Cadillac line and then to other GM vehicles as well. Another feature currently limited to a single Cadillac right now is vehicle-to-vehicle (V2V) communications and that will become more available but not until 2023.

Road Side Unit (RSU) collects data from passing vehicles
Road Side Unit (RSU) collects data from passing vehicles
Data Cleaning

Remove Duplicates

Edge Computing

Data Privacy
Thank you

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Computer Vision vs Our Privacy

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July 2, 2019
Consider the application of road-traffic monitoring:

- Visual data $y \in \mathbb{R}^P$ with $P = \mathcal{O}(10^6)$
- Inferred state of cars $x \in \mathbb{R}^S$ with $S = \mathcal{O}(10^2)$
Case Study: A Surveillance Application
The Data

What’s inside $y_k$?

- A huge amount of information — hard to store and transmit
- Mostly useless information
- A tiny amount of useful information
- Some information related to our identity and privacy
Case Study: A Surveillance Application

The Data

Computer Vision vs Our Privacy

Paris Kaimakis, UCLan Cyprus
Case Study: A Surveillance Application

The Inferred State

What’s inside $x_k$?

- Small amount of information — easy to store and to transmit
- No useless information
- No redundancy
- No information related to our privacy
What’s inside $x_k$?

$$\mathbf{x} = \begin{bmatrix} x^{T}_1 & \ldots & x^{T}_n & \ldots & x^{T}_N \end{bmatrix}^T$$

where $N = \mathcal{O}(10)$ is the number of cars detected, and where

$$\mathbf{x}_{(n)} = [x \quad y \quad \theta \quad s \quad \phi]^T$$
Recommendations

Protecting our Privacy in a Computer-Vision Enabled Society

How can we achieve road-traffic monitoring without violating citizens’ privacy?

• We encourage the computer vision community to develop lightweight, decentralised algorithms which can infer car states \( x \) **locally** on surveillance camera chips.

• We call for policy makers to **ban** the transmission of captured images \( y \) to centralised servers – whether for processing or for storing.

• We call for legislation that ensures **low-bandwidth connection** on surveillance camera equipment.

• We call for more **transparency** on the handling of data captured by surveillance cameras.
Advanced Parking Management – a multifunctional lever in effective city management

Thomas Jell
Innovative Mobility Solutions, Siemens-Mobility
City2Share
sozial. urban. mobil

5 Mobilitätstationen in München
- Münchner Freiheit
- Goetheplatz
- Am Glockenbach
- Kidlerplatz
- Zenettiplatz

2 Mobilitätsstationen in Hamburg (switchh)
- Schlump
- Barmbek
Integration Siemens -> DriveNow

Direkt in deiner Nähe befindet sich eine Mobilitätsstation mit Parkmöglichkeiten.

1 freie Parkplätze

Search for point of interest...
Live Demo

APM Prod Cluster
APM Development Cluster

MVG More
Next Use Case: Infrastructure for selfdriving vehicles

Enable level 5 of autonomous driving

Improved safety for complex traffic conditions

Enhanced ease of traffic

Serving first/last mile for public transport
Infrastructure enhances driving abilities of self-driving vehicles in traffic critical situations

- **Roadway junction**: Impossible for SDV to detect vehicle at sufficient range to ensure safe left turn.

- **Hairpin turn**: Impossible for the SDV to detect vehicle at sufficient range to ensure safe avoidance maneuver.

- **Roadway connectivity**: Impossible for SDV to detect vehicle at sufficient range to ensure safe merge.

- **Steep hill scenario**: Impossible for SDV to detect vehicle at sufficient range to ensure safe avoidance maneuver.

- **“Sun blinding” of sensors**: Degraded sensor performance.
Innovation: That’s why …

We ensure safe and fluent traffic (ease of traffic) for self-driving PT vehicles in all weather conditions and complex traffic situations.
We will demonstrate multitude of use cases for self-driving vehicles.

Infrastructure works reliably, even in the case of changing weather and light conditions (rain, snow, fog or glaring sunlight).

Infrastructure identifies risks – even if they are not in the immediate surrounding of the vehicle.

Vehicle reduces its speed to avoid critical situations.
Practical overview of the system

Traffic cell data fusion on TCCC

Operation control center in the cloud

Roadside cognition and localization

Vehicle cognition, localization and control
Occupancy Grid is at the core of our development roadmap
Cloud-based micro services of SDV Suite – Overview

- Mobility System Planning
- Mobility Service Planning
- ITS Traffic Management
- Fleet Management
- Passenger Management
- Intermodal Trip Management
- Shuttle Passenger Information
Our strategy: Be present in the most relevant areas, establish eco-system of partners and implement what we promise

<table>
<thead>
<tr>
<th>Area of application</th>
<th>Pilot Projects</th>
<th>SDV Core Technologies</th>
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</thead>
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<tr>
<td>Urban</td>
<td>HEAT, CETRAN Testbed</td>
<td>OTS 1.0 (Testbed Munich Perlach)</td>
</tr>
<tr>
<td>Campus (e.g., airports)</td>
<td>Airport Munich Siemens Perlach</td>
<td>Intelligent Road (Application Level)</td>
</tr>
<tr>
<td>Interurban</td>
<td>KoRA9</td>
<td>SDV Basic Topics (Basic Technology Level)</td>
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<tr>
<td></td>
<td></td>
<td>C2X (Autonomous parking)</td>
</tr>
</tbody>
</table>
Test beds in relevant environments – Together in an eco-system of strong partners

OTS
Munich

HEAT
Hamburg

Singapore

Airports
Munich

Interurban
KoRa9
Further Information

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Questions?

Seeking partners for 5G-PPP, H2020-ICT calls