Modeling and evaluation of a classification of means of transport by means of motion profiles

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Project description (incl. objectives and methodological approach)

The research question was derived from the idea of developing an incentive systembased app that rewards CO2-free mobility and at the same time supports regional as well as sustainable small businesses:

Is it possible to draw conclusions about the means of transportations from the recording of a motion profile (place and time)?



Take Aways

classification of the used means of transport is well possible based on cell phone data

TRANSFER

» an end2end solution from data acquisition up



Results

It could be shown that the detection of motion data can be realized with state-of-the-Art smartphones sensors

- Definition of a proper label ontology and based on that data acquisition campaign **》** using crowdsourcing approach
- » Realization with features such as average velocity, maximum speed, maximal and minimum acceleration, idle time, overall duration, FFT of acceleration signals and additionally standard deviation
- Detection of proper transportation method already with small data set possible (see **>>** Confusion Matrix bottom right)
- Tests around Stuttgart show mostly correct classification. The results can be further **>>**

to processing and evaluation was established

- » Random Forest shows superior performance compared to Decision Trees or Artificial Neural Network and is therefore advised to detect means of transportation
- » Detection of buses versus vehicles is the greatest challenge in this classification. Subsequent filtering improves the result significantly.

Outlook

Potential **further developments**:

- Detection purely on the basis of acceleration sensors
- Extension of the database

Multiple application developments:

- Recommendation of alternative means of transportation

- improved by means of subsequent filtering (see figure below left)
- Used sequence of data processing is graphically illustrated below. **》**





Verkehrsmittel	Label		
	Label	Sublabel	Subsublabel
Gehen	Foot	Walking	-
Joggen	Foot	Running	-
Fahrrad	Bike	Conventional	-
E-Bike	Bike	Electric	-
E-Scooter	$\operatorname{Scooter}$	Electric	-
Auto	Car	Conventional	-
E-Auto	Car	Electric	-
Hybrid	Car	Hybrid	-
Bus	Bus	Conventional	-
Zug	Train	Regional	Regional
S-Bahn	Train	Suburban	S-Bahn
Subway	Train	City	U-Bahn



- Expansion of frequently used means of transportations and their routes
- Customized navigation based on personal motion profile

Literature