# Identifying E-Scooter Hazard Hotspots

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MMoNK


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# Many bikes, more and more e-scooters


Foto: DLR

Foto: Martina Hertel

# Objective: Assessing risk of e-scooters

- Prior studies often analyze patterns and frequency of injuries **after** accidents

- Objective: researching interaction behavior **before** accidents using video recording – differences to bike (UTraCar)

- Crucial to record at “promising” locations
  (e-scooter traffic volume and interactions)

- **How can we identify locations with many interactions for further research *(e-scooter hazard hotspots)*?**
  Focus on interactions bike – e-scooter

Urban Traffic Research Car

# Method: Multi-method approach using various data sources

13 guided expert interviews (cities, research, operators…):

Expert interviews

- Characteristics of potentially dangerous locations
  - Road types, bike infrastructure, crossings, PT, area

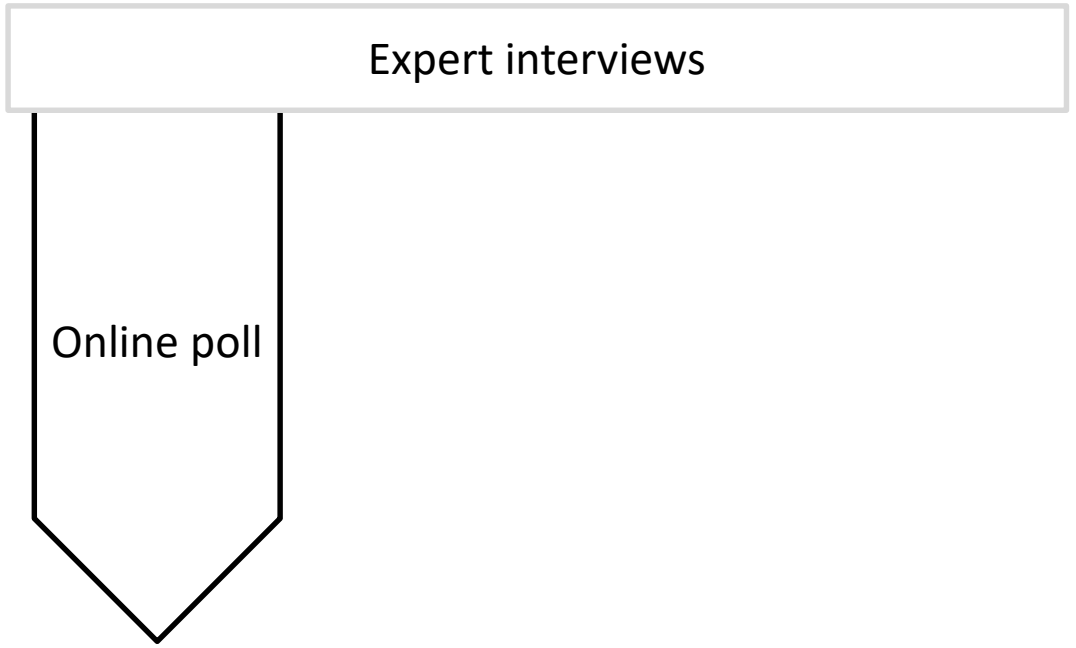
- **“similarities to bicycle“**

# Method: Multi-method approach using various data sources

Online-poll with **3,834 participants,** social media (e-scooter users, cyclists, pedestrians)

Main component: describtion of experienced conflicts
**15,718 conflicts** reported

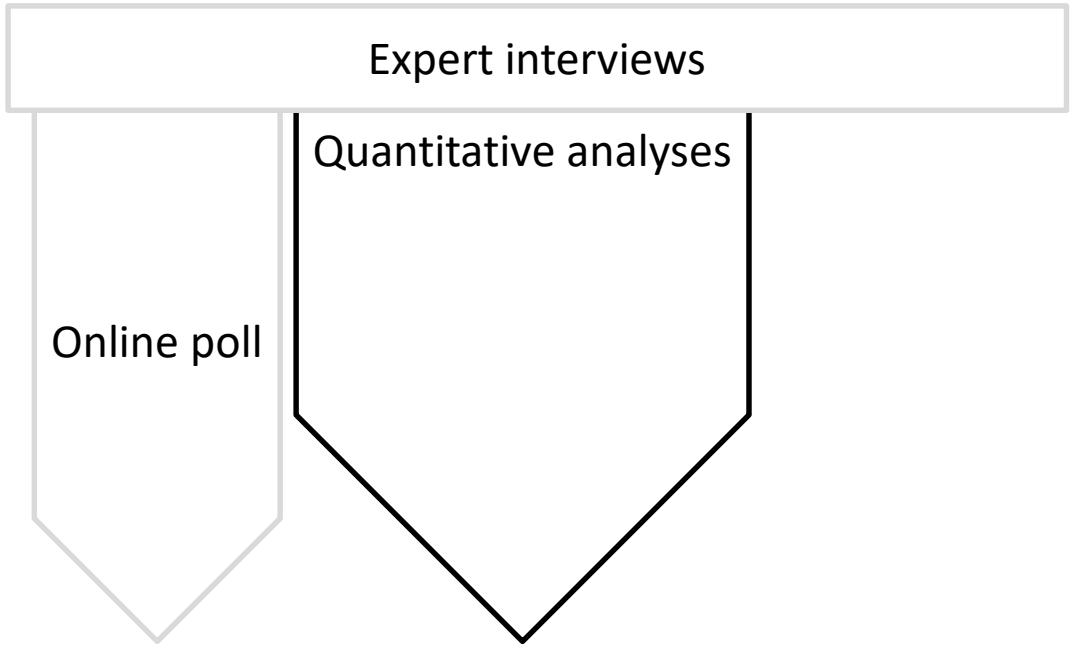
- Type of confllict (severity),
- cause of conflict,
- parties involved,
- **Detailed location characteristics**
  - 24 characteristics



# Method: Multi-method approach using various data sources

4 datasets of secondary quantitative data

- Bike accidents
- Bike near-accidents
- E-scooter trip
- E-scooter accidents



# Quantitative data: Bike accidents

Bike accident data
Geolocations and properties

Source: official police data
Period: 4 years
n=10,196 accidents

Method: spatial clustering DBSCAN

https://unfallatlas.statistikportal.de/


Bike accidents and clusters

# Quantitative data: Bike near-accidents

Bike near-accident data
Geolocations and properties

SimRa citizen science project TU-Berlin
using smarphone App / sensors
Detecting sudden unexpected movements
Validatd and complemented by probands
Period: 2 years
n=13,453 near-accidents

Method: clustering DBSCAN

https://github.com/simra-project


https://www.digital-future.berlin/forschung/projekte/simra/

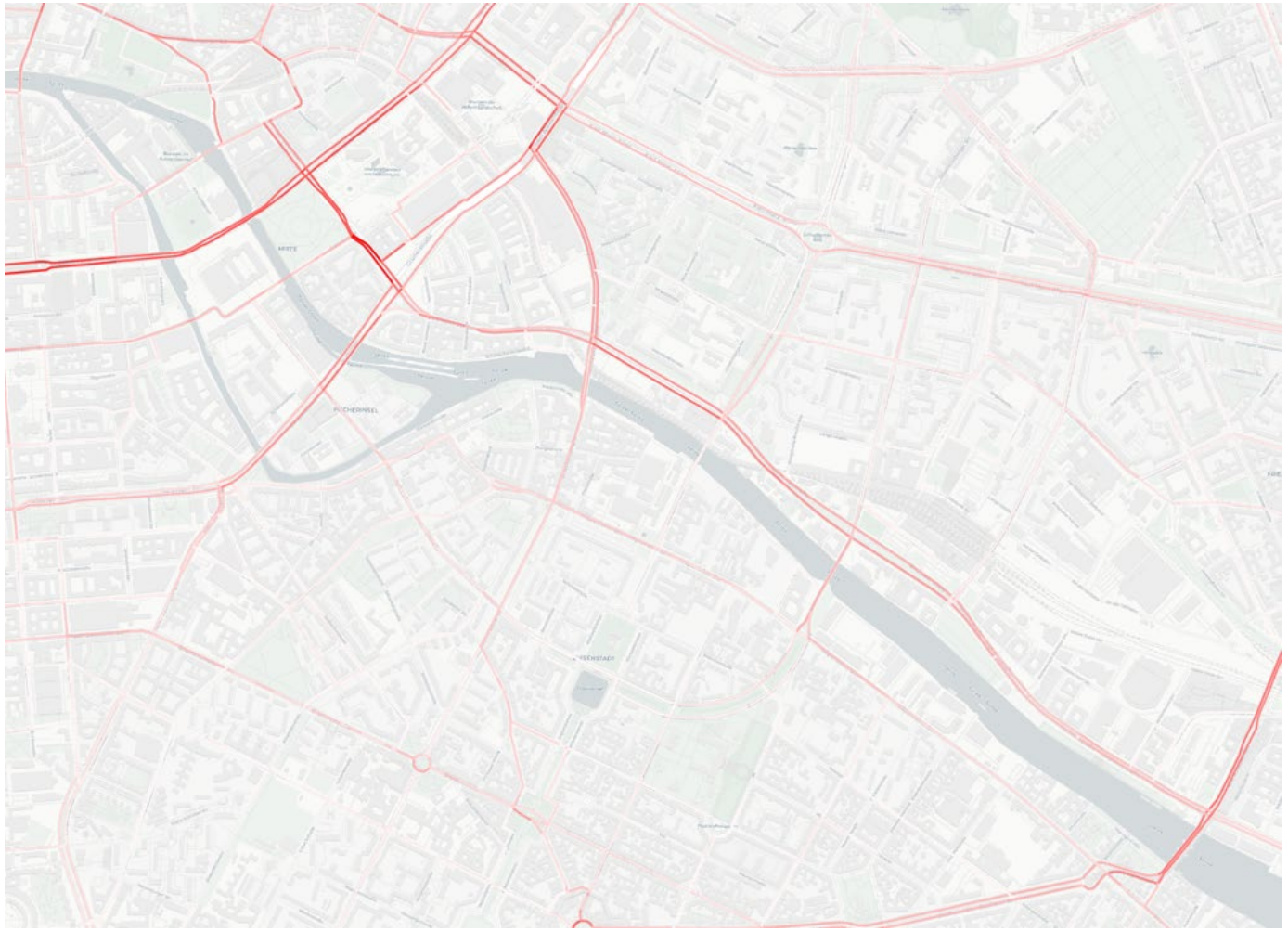
# Quantitative data: e-scooter trips

E-scooter trip data (sharing system)

Source: scraped from operator API
Start and end locations, 2 min interval
Period: 1 year
n=879,191 trips

Method: routing and counting

Not public



Routed e-scooter trips

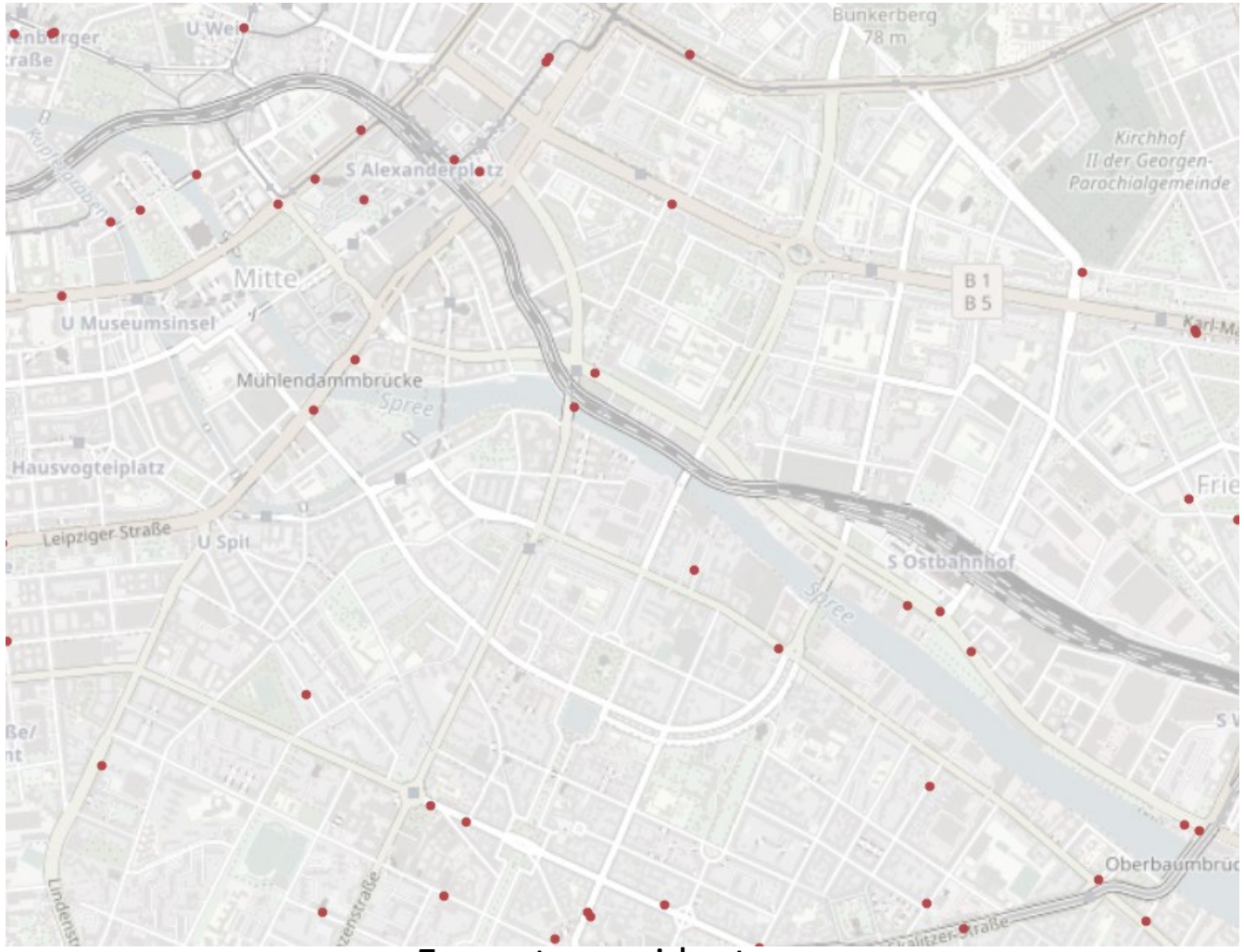
# Quantitative data: e-scooter accident data

E-scooter accidents
Geolocations and properties

Source: official police data
Period: 6 months
n=327 accidents

Method: counting

Not public



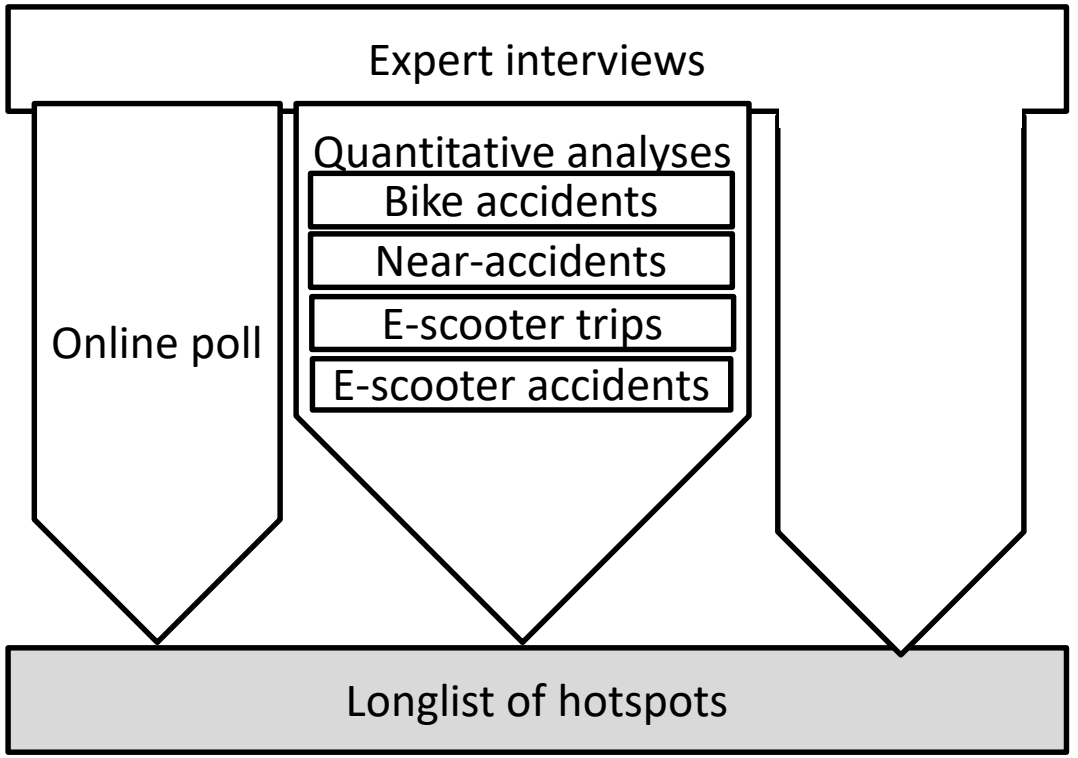

E-scooter accidents

# Method: Multi-method approach using various data sources

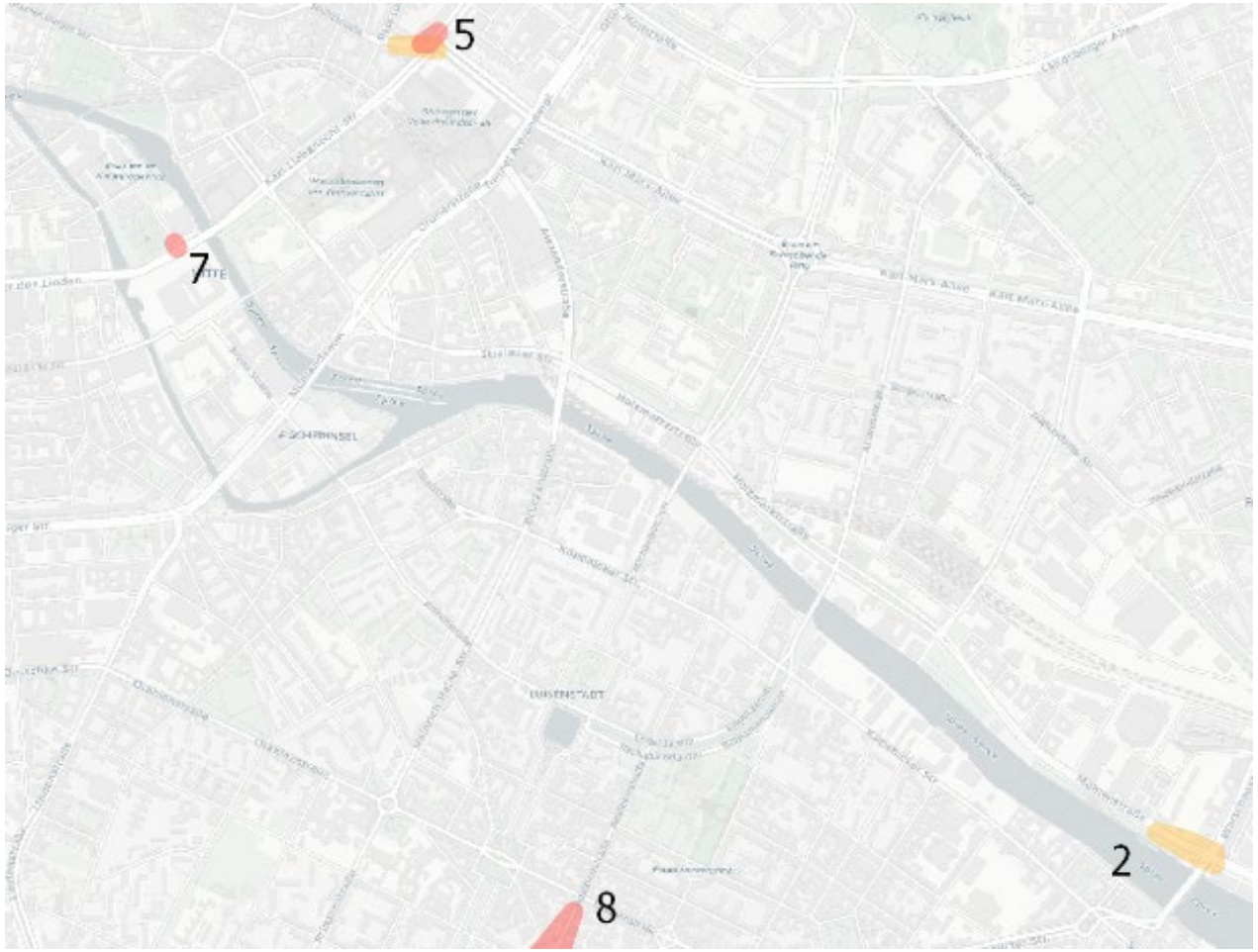
Merge all information

- Accident cluster
- Near accident cluster
- Routed e-scooter trip count
- E-scooter accidents
- **location characteristics (**24 characteristics (osm))
    - Expert statements and poll results

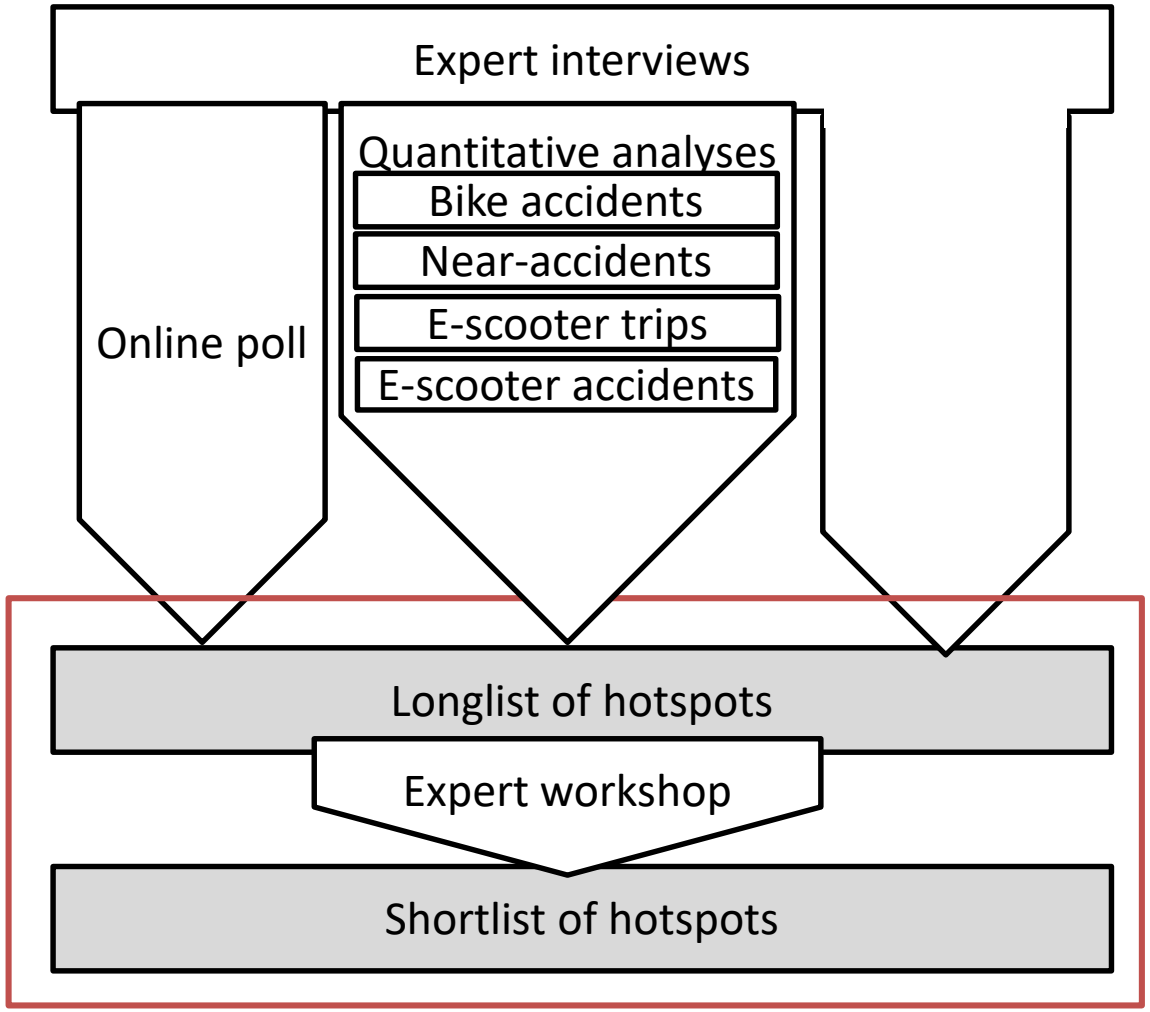
Intermediate result: longlist of 20 hotspots with comprehensive information



# Result: 9 locations identified in a final expert workshop




Identified hazard hotspots



# Sequel: Videoanalyses at identified Hotspots

- Full day recording at 3 locations
- AI identification of all vehicle types
- Analyses of
  - Drivers characteristics (age, gender, helmet, …)
  - Infrastructure used (pavement, roadway, …)
  - Speed
  - Compliance with rules & regulations
  - Distances & Interaction behavior (criticality, TTC, PET)

- Differences between e-scooter and bike?

- -> **several particularities and distinctions; in total limited differences to bicycles**

C. Leschik, M. Zhang, M. **Hardinghaus** (2022): Analysis and comparison of the driving behaviour of e-scooter riders and cyclists using video and trajectory data in Berlin, Germany; Paper to be presented at **ICSC** 8.-10.11.2022 Dresden

# Conclusion: „performing“ locations identified

- Objective: choose locations to assess particularitis of e-scooter usage behavior (especialy risk levels)
- Multi-method approach enables to identify locations of interest
- Subsequent research results in **17,291 cyclists**, **2,460 e-scooter** users, **604** relevant **interactions** recorded
- Spoiler: in summary little differences to bicycle

# Contact

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