9Ο ΔΙΕΘΝΕΣ ΣΥΝΕΔΡΙΟ για την
ΕΡΕΥΝΑ ΣΤΙΣ ΜΕΤΑΦΟΡΕΣ
ΜΕΤΑΦΟΡΕΣ 4.0: Η Ευφυής Εξέλιξη

9th INTERNATIONAL CONGRESS on
TRANSPORTATION RESEARCH
TRANSPORT 4.0: The Smart Evolution

Mapping Risky Driving Behavior in Urban Road Networks

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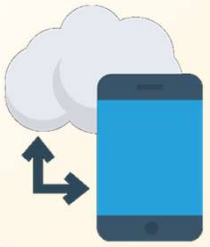
Driving behavior in the era of big data

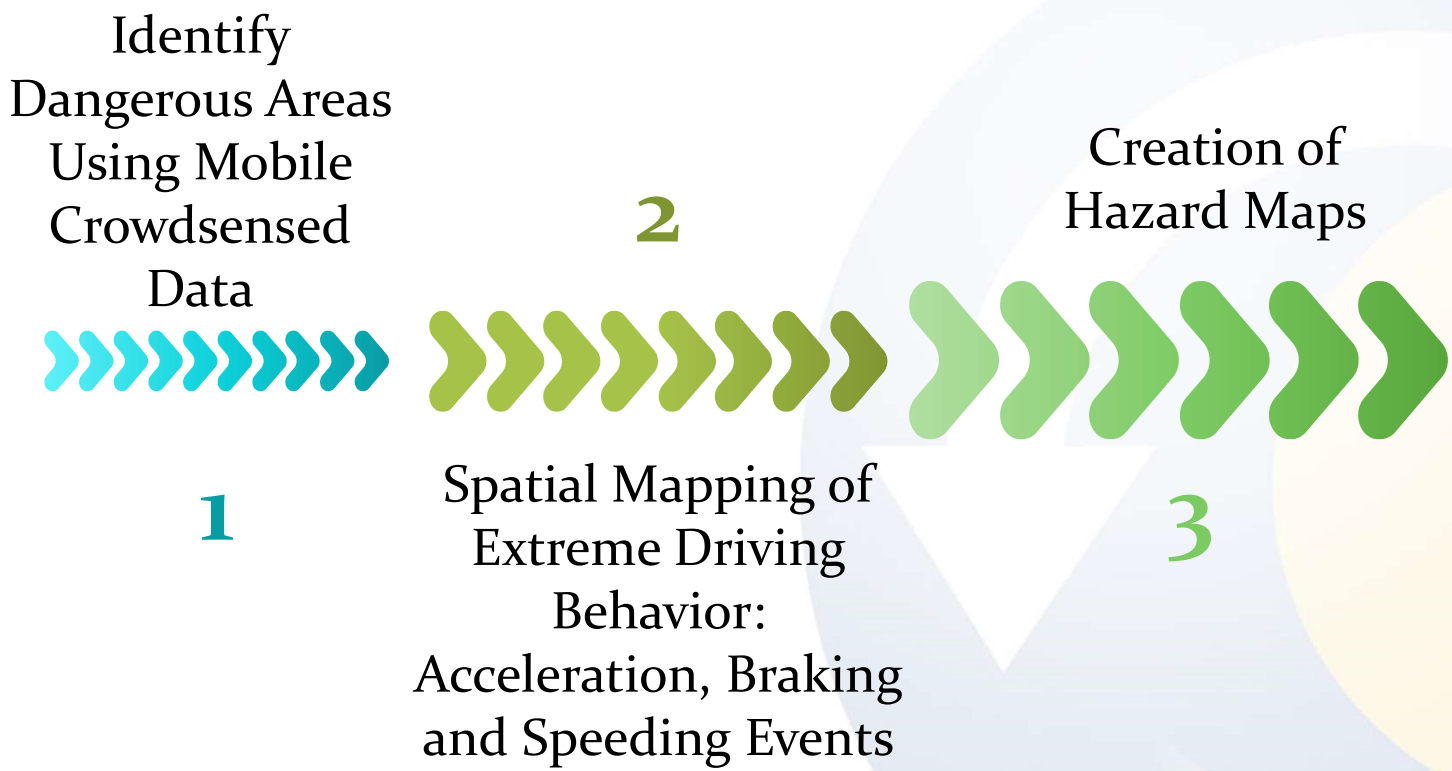
- Improved driving behavior is key for **safe**, **efficient** and **environmentally friendly** road network's conditions.
- The identification of driving hazards relies on police reports and GPS, IMUs and in-vehicle camera data.

SMARTPHONES
as a sensor platform

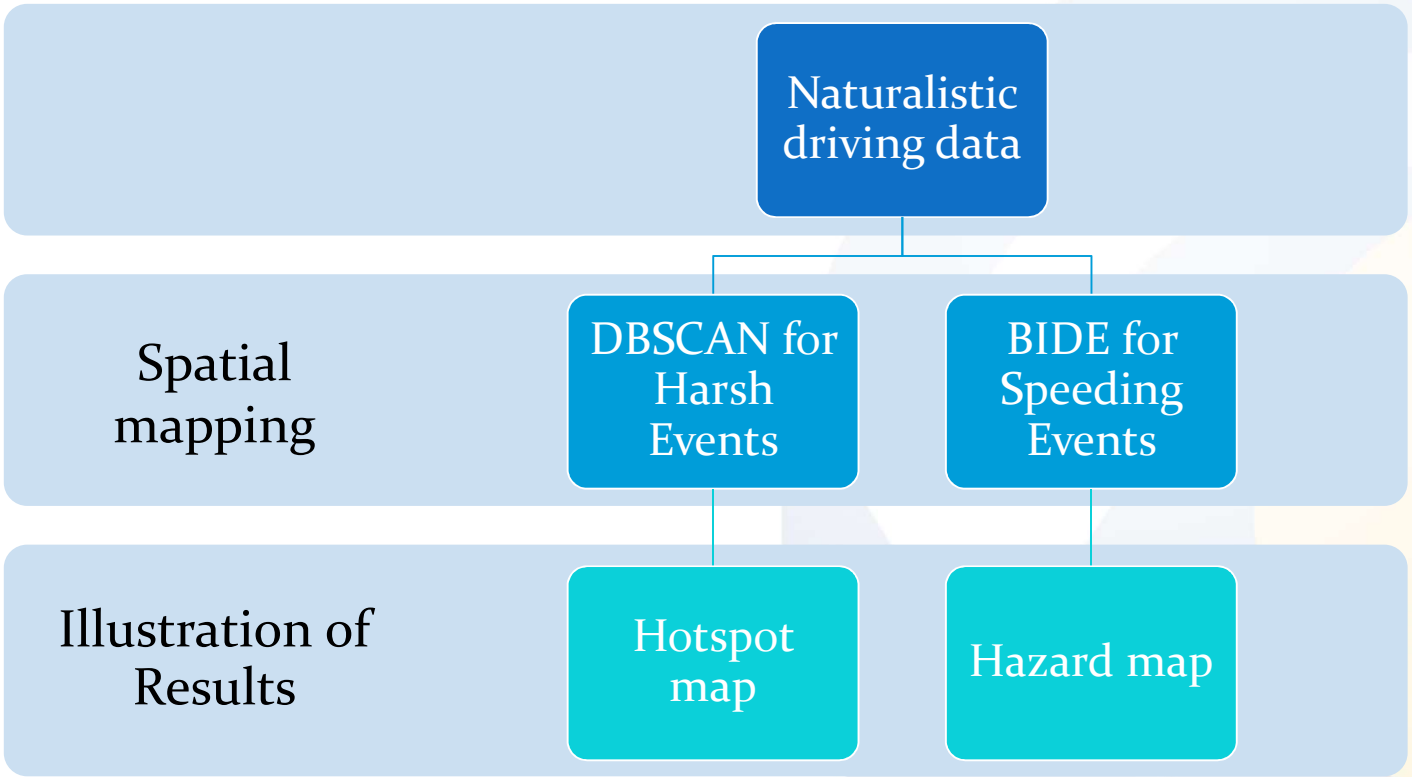
+ Cost-effective
+ Great penetration to user population
+ Transparent data collection mechanism
- Trustworthiness
- Noisy data
- Battery drain



Scope of paper

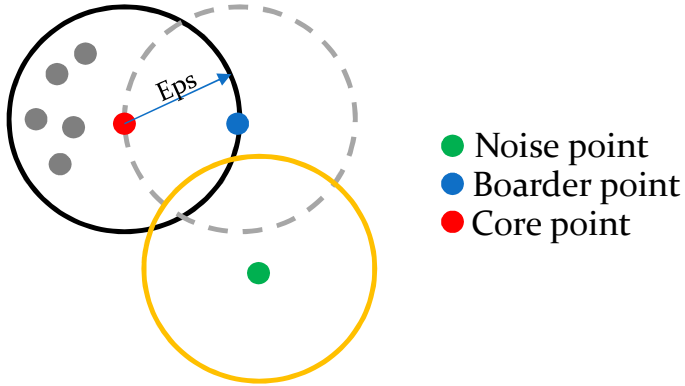


Methodological approach



Methods used

Density-based spatial clustering of applications with noise (**DBSCAN**)



- MinPts → dimensionality of data + 1
- Eps → the knee in the KNN distribution

BI-Directional-Extension-based frequent closed sequence mining algorithm (**BIDE**)

- ❑ Concept of the closed sequential patterns
- ❑ **frequent sequential pattern:** support no less than the *min_support*
- ❑ Consumes less memory
  - *Min_support* → [0,1]

Naturalistic driving data

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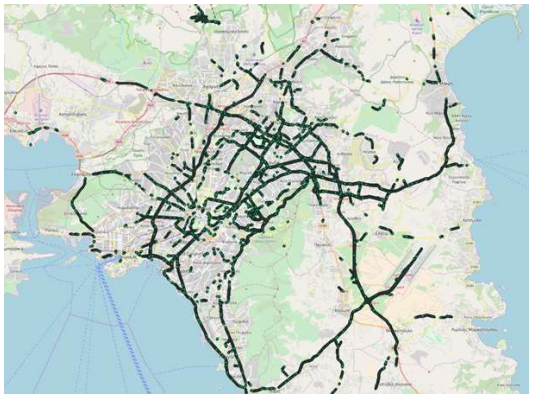
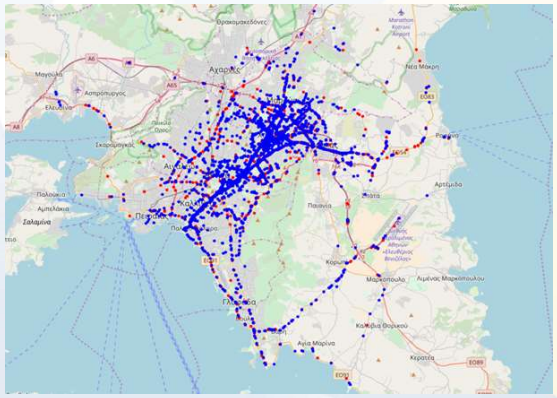
- Data is collected through the OSeven telematics app.
- More than **6000** abnormal driving events from more than **500** drivers in Attica Region were analyzed.
- Frequency of collecting data is set to 1Hz.

Speeding Events

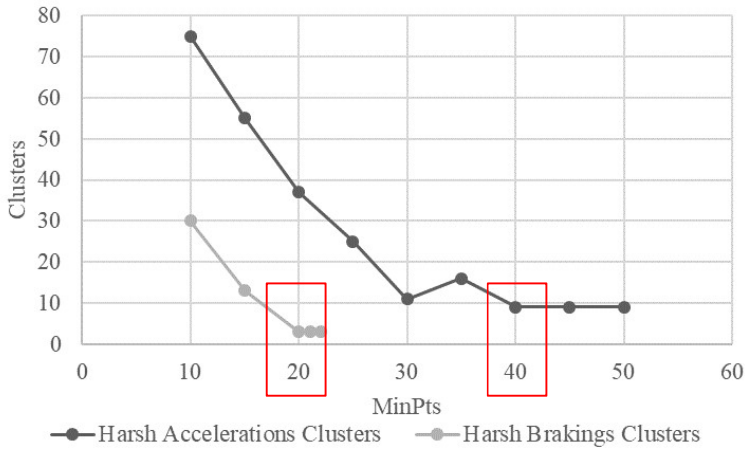


Harsh Events
(acceleration and braking)



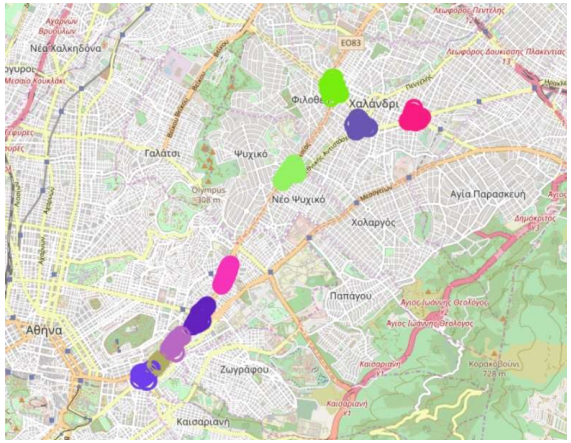
Selection of parameters for DBSCAN

- Harsh acceleration: MinPts = 40 / cluster
- Harsh braking: MinPts = 20 / cluster

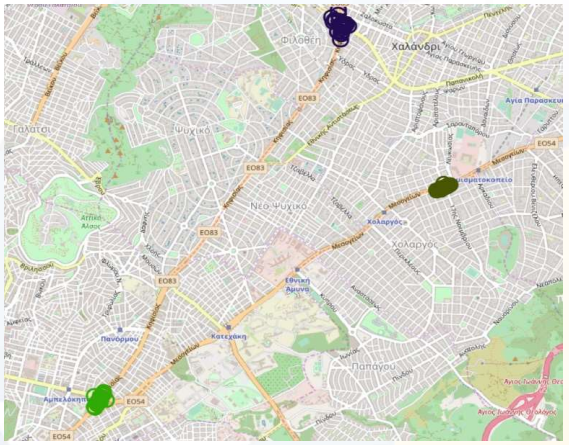


DBSCAN: Results

Hotspot Map for Harsh Acceleration Events



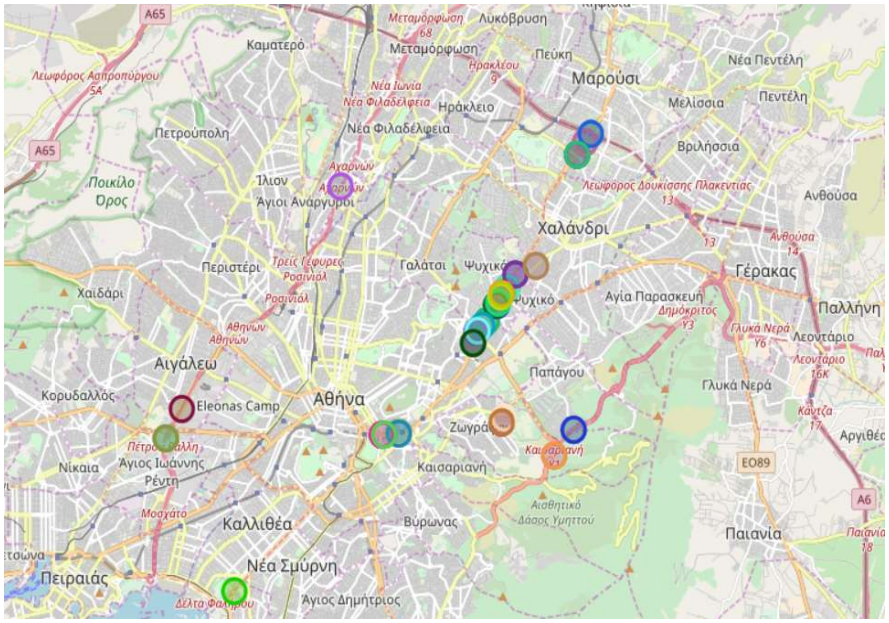
Hotspot Map for Harsh Braking Events



- Most sudden accelerations and braking events are performed at a slower speed indicating that these events were conducted near traffic lights or signals.
- Interestingly, for the most hazardous clusters, no harsh events are documented over the speed limit.

BIDE: Results

Hazard map for speeding events



- Most hazardous speeding locations are found in freeways and urban motorways.
- There are some specific areas in the city center where drivers may exhibit collecting speeding behaviors.

Conclusions

- Drivers react aggressively in the presence of traffic signals and road intersections.
- Most of harsh accelerations occur at lower speeds which relates to the acceleration after a stop.
- Hazardous speeding locations appear mostly in freeways.
- There is a homogeneity of the risky behavior of an individual driver and many random drivers.

Who will benefit?

- Decision-makers
- Authorities
- Road operators

- Improve road infrastructure
- Focus on locations with high risk

- Individual driver
- ADAS
- Real-time recommendation systems

- Drivers can improve their behavior
- Better driving experience
- More accurate and reliable recommendation systems

What's next?

- Introduce the aspects of traffic and road geometry
- Investigate additional parameters such as time of day and weather conditions
- Apply methodology in similar road networks → Comparative results

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Thank you Oseven for providing the data!

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