



National Technical University of Athens  
Road Safety Observatory

[www.nrso.ntua.gr](http://www.nrso.ntua.gr)



Workshop:

**Digitalisation  
and Road Safety  
Research**

Friday  
**17**  
May  
2019  
at 14:00

**FIFTH UNITED NATIONS GLOBAL ROAD  
SAFETY WEEK**

6-12 May 2019



**Save Lives**

**#SpeakUp**

# Data science techniques for driving behavior evaluation

## – OSeven –

## Dimitrios I. Tselentis

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Together with:  
George Yannis, Eleni I. Vlahogianni

# Scope

## ➤ Develop methodological approach for driving behavior evaluation:

- trip
- driver
- multi-criteria analysis

## ➤ Safety evaluation based on:

- travel characteristics
- driving behaviour metrics
- smartphone devices

## ➤ Smartphone devices:

- large-scale data
- naturalistic driving conditions



- Dimitris Tselentis, Data science techniques for driving behavior evaluation - OSeven



# Research Questions

- How well can **driving behavior** be evaluated? Can **data science** techniques provide sufficient answers?
- What are the most important **characteristics** for driving behavior assessment?
- What is the **required amount** of driving data that should be collected for each driver?





# Driving Behavior Parameters

## ➤ Risk exposure indicators:

- Total distance travelled

## ➤ Driving behaviour indicators:

- Harsh events
  - Number of harsh braking (longitudinal acceleration) (HA)
  - Number of harsh acceleration (longitudinal acceleration) (HB)
- Speeding (SP)
- Mobile phone use distraction (MU)

## ➤ Road types:

- Urban
- Rural
- Highways



# Smartphone Data Collection

- A **mobile application** to record user's driving behaviour (automatic start / stop)
- A variety of APIs is used to read mobile phone **sensor data**
- Data is **transmitted** from the mobile App to the central database
- Data are stored in a **sophisticated database** where they are managed and processed
- **Indicators** are designed using
  - machine learning algorithms
  - big data mining techniques



# Data Preparation

- Data are **anonymized**
  - user-agnostic approach
  - identify driving behaviors and patterns
  - causality between behaviour and other factors
  - large-scale samples
  - no information on demographics or accident record
- **Python** programming language
  - filter aggregate data
  - retain only necessary information
  - aggregate data
  - data analysis



# Main findings

- Required **driving data amount**:
  - 40 trips
  - 400 km
- Speeding behaviour is **correlated** with several other driving behaviour parameters:
  - Frequency and severity of harsh events (acceleration, deceleration, cornering)
  - Driving aggressiveness
  - Mobile phone use
- Total **Mileage**
- **Traffic** conditions
- **Route** frequency





# Scientific and Social Impact

- Significant reduction of individual **driving risk** and subsequent improved road safety level for the society
- Personal and general **feedback** to drivers on
  - their overall driving efficiency and its evolution
  - an inefficient trip is performed
  - driving characteristics that should be improved
  - each road type
- Develop **insurance pricing** schemes
  - charge premiums based on driving efficiency



# Future Challenges

- Application in **larger and diversified groups** of drivers population
- Investigation of more **critical risk factors**
  - headways
  - lane changing
  - eye movement
  - drowsiness
- Type of **analysis approach**
  - macroscopic
  - microscopic
  - combination of micro- and macro-scopic





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