

FIFTH UNITED NATIONS GLOBAL ROAD
SAFETY WEEK
6-12 May 2019



Data science techniques for driving behavior evaluation

- OSeven -

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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





Background

- > Driving data collection
 - naturalistic driving experiments
 - driving simulator experiments
 - in-depth accident investigation
- > Driving metrics adequate amount
 - assessment of each driver
 - deficient amount of data => uncertain or unreasonable results
 - excessive amount of data => significantly increase required processing time
- > Driving behaviour characteristics
 - speeding
 - harsh braking/ acceleration/ cornering
 - seatbelt use
 - mobile phone use





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

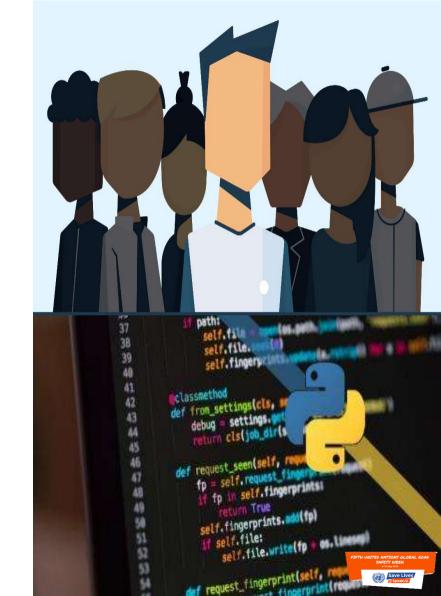


Store / Manage / Analyse



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



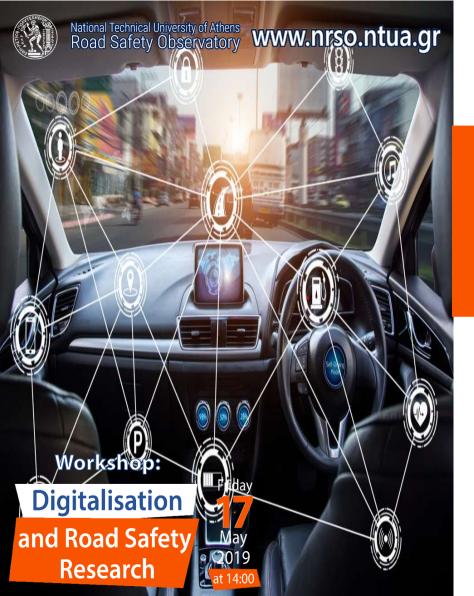


Future Challenges

- ➤ 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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