



Telematics, Big Data and Road Safety



Together with: all the great nrso team

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Background



Background

- Road transport is responsible for the majority of transport fatalities, with an annual 1,35 million road traffic deaths worldwide.
- Innovative data-driven solutions could contribute to a proactive approach of addressing road safety problem, which is a core principle of the Safe System.
- The rise of smartphones, sensors and connected objects offers more and more transport data.
- The interpretation of these data can be made possible thanks to progress in computing power, data science and artificial intelligence.





Need for New and Big Data

- Alternative data that could lead to new advanced road safety analyses in order to:
 - more efficiently identify key road risk factors
 - address road user behaviour and errors
 - address proactively critical traffic, infrastructure and vehicle risk factors.
- Continuous driver support with aim to improve driver behavior and develop better road safety culture at all road users.
- Great new potential for evidence based public and private road safety decision making at all levels.





Road Safety Big Data



Road Safety Big Data Sources (1/2)

Mobile Phone Data

- Sensor Based Data (e.g. Google Maps, Waze)
- Cellular Network Data (e.g. Cosmote, Vodafone, Wind)
- Vehicle On-Board Diagnostics Data (e.g. OEM industry)
- Data from Cameras
 - On-vehicle (inside and outside)
 - On the road (cities, operators)
- Data from Car Sharing Services (e.g. Uber, Lyft, Bla bla car)
- Data from Bike Sharing Services (e.g. 8D Technologies, Mobike)
- Social Media Data (e.g. Facebook, Twitter)



Road Safety Big Data Sources (2/2)

- Telematics companies (e.g. OSeven, ZenDrive, Octo,)
- Private Agencies' Sensor Data (e.g. INRIX, Waycare)
- Travel Cards Data (e.g. Oyster card, Opal card)
- Public Authorities Sensor Data

 (e.g. Ministries, Public Transport Authorities, Cities, Regions)
- Weather Data
 (e.g. AccuWeather, ClimaCell)
- Census Data

(e.g. Eurostat, National Statistics)



Road Safety Big Data

- GPS traces of the app users are the main core data elements.
- Data coming from connected navigation devices (embedded in cars, applications in smartphones etc.)
- Various sources may be combined by some companies: vehicle sensors, smartphones, PNDs, road sensors, connected cars, fleet management companies etc.
- Data related to road network, traffic parameters and speed are the most available.
- Traffic accidents may be recorded as a subgroup of recorded incidents mainly through:
 - Crowdsourcing,
 - Partnerships,
 - Algorithmically generated flow-based incidents



Crash Data Collection (1/2)

> Automatic data collection is possible through:

- instrumented floating vehicles and/or
- **smartphones** (hard braking, poor road surfaces, speed)
- Active safety systems can also be considered among surrogate safety metrics, such as:
 - ABS for anti-lock braking,
 - ESP for electronic stability control and
 - AEB for autonomous emergency braking



Crash Data Collection (2/2)

- Technologies like automatic crash notification and event data recorders propose datadriven responses to post-crash problems.
- Street imagery, also collected by floating vehicles, supports the assessment of road safety performance (star-rating for roads).
- Drones and satellites started complement the range of data, capturing solutions and play an increasing role.



Telematics for Driver Performance Feedback

Telematics Solutions

- A range of telematics solutions already exist for:
 - fleet management,
 - usage-based insurance,
 - eco-driving and
 - safe driving coaching.
- Driver telematics were initially based on On-Board Diagnostics (OBD), having access to data from the engine control unit.
- Current technological advances make data collection and exploitation substantially easier and more accurate through Smartphones.





Telematics Metrics

Smartphone and OBD driver behaviour telematics metrics:

- Mileage driven
- Road network used (through GPS position)
- Duration and time of the day driving
- Speed
- Harsh braking
- Harsh acceleration
- Harsh cornering
- Mobile phone use (smartphone only)
- Fuel consumption
- Seat belt wearing (OBDs only)
- Drink and drive / fatigue (additional devices)
- Driver state (additional devices)



The Example of OSeven Telematics

- OSeven is a pioneer technology company that is specialized in Driving Behaviour Analysis and Telematics Solutions.
- Business: Insurance (PAYD, PHYD, PAHYD), Fleet management, Rental and Leasing, Ride sharing, Taxi Hailing, Car pooling, Automotive, Banking.

Platform components

- User-friendly smartphone apps
- A state of the art backend infrastructure for big data analysis
- A web app for the visualization of the metrics and scores
- Sophisticated Machine Learning algorithms
- Driving Scoring Model for the evaluation of the driving behaviour

Data flow in OSeven Platform:

- Mobile App detects the start and stop of driving, without any user involvement
- Data from smartphone sensors is recorded and transmitted to OSeven backend (WiFi or 3G/4G)
- Data is analyzed via the OSeven algorithms to produce driving metrics and scores
- Results per trip and overall can be viewed by the driver in the smartphone app and by the corporate clients for their fleets in the web app
- Risk Exposure and Driving Behaviour indicators
- Unique value proposition to drivers, companies and society





Monitoring Driver Behaviour

- New vehicles can include distraction and drowsiness alerts as standard.
- Crash investigators could have access to eye tracking data through event data recorders.
- Smartphone apps developed by insurers should prevent drivers from using the phone.
- Ride-sourcing and delivery platforms sharing data on driving and riding time via the licence number for preventing gig economy sector from breaking the driving hours restrictions.



Driver Performance Telematics Feedback

- Feedback to the driver through the Driver
 Performance Telematics (vehicle or smartphone)
- Real time feedback
 + avoid distraction
 - produce distraction
- Safety performance star rating
 + engage in the long term
 + great motivation to improve driving behaviour
 + identification of need for re-training
 - demotivation in case of non progress
 - demotivation when non favorable comparison with peers
- > The feedback loop should be optimized







Critical Issues (1/2)

- Punishment Vs Positive Feedback (Incentives)
- Regulatory and Voluntary Data
- Secure anonymisation might increase penetration (e.g. blockchain)
- Ownership of data
- Exploitation of data (charging schemes)
- Sharing of safety data (EU legislation)



Critical Issues (2/2)

- Harmonisation and compatibility of:
 - data
 - metrics
 - data collection methodologies
 - data processing methodologies
- Define proper and properly the KPIs
- Clean properly the data
- Linking KPIs with respective interventions
- Control in-vehicle distraction devices
 Define safety policy focus (behavior.)
- Define safety policy focus (behavior, VRUs, infrastructure, traffic)



Technology Weaknesses

- Big Data is not only prone to many of the same errors and biases in smaller data sets, it also creates new ones.
- Big data creates privacy threats, especially with the risk of re-identification of individuals in datasets.
- Hacking is an important risk requiring advanced protection measures.
- Drivers using social driving apps may be distracted by new services (navigation, coaching, C-ITS alerts, infotainment, etc.).





Privacy Protection

- Explicit guidelines should be available to stakeholders concerning the protection of personal data, but also to offer reassurance on the legality of data collection and analysis.
- The use of strong de-identification techniques, data aggregation and encryption techniques are critical.
- Issues concerning video images used for close call analysis should be addressed.



Big Data versus Big Biases

- Every data set should be considered biased towards some user groups, trip purposes or in any other dimension.
- The consequences of using data which isn't representative of the whole population should be assessed.
- There is a high risk for the drivers and the decision makers to be misled by the opportunistic analysis of seemingly low-cost data in absence of qualified data scientists and statisticians.



New Data Sharing Partnerships

- New data ownership frameworks will be developed along the lines of "A New Deal on Data"
- Partnerships enabling both the private and public sector can be created
 - Work is required to define the scope and scale of data collection that is in line with public mandates.
- Open source or commercial solutions are developed to collect, harmonise and aggregate mobility data
- Stakeholders should make road safety data freely available through such platforms





Concluding Remarks



Road Safety Technology Perspectives

- Technology can be the new road safety driver, through:
 - Public private partnerships
 - Clear problem analyses (well defined objectives)
 - Systematic effectiveness monitoring
- ➢ Great need for:
 - more data and knowledge
 - better exploitation of current and future data
 - broader geographical coverage
- Data focus on:
 - more accurate road accident data
 - exposure data and performance indicators
 - measures and policies effectiveness evaluation



Road Safety Digitalization Perspectives

- > **Digitalization** opens great new data possibilities for:
 - road user support and guidance
 - evidence based public and private road safety decision making at all levels
- New great potential for seamless data driven procedures from safety problems identification to selection and implementation of optimal solutions
- New increased net present value of road safety data, available for (real-time) early problem detection and prompt and customized decision support







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