Monitoring Driver Behaviour Through Mobile Phones

OSeven

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The development of the OSeven Smartphone application (http://www.oseven.io/) was initiated by the need for **collecting and analysing driving behaviour data**:  
- from naturalistic driving conditions  
- of a large-scale  
- through cost effective solutions  
- and transmit them in real time  

Started in late 2014 and continuously progressing.
Past limitations

Limiting barriers existed so far:

- Mobile phone technology
- High cost of:
  - In-vehicle data recording systems (e.g. OBD)
  - Data plans
  - Cloud computing
- Low penetration rate of smartphones and social networks
- Inability to manage and exploit Big Data

...have now been eliminated.

Current technological advances make it substantially easier for experts to collect and exploit data easier and more accurately through mobile phones.
Data flow

- **A mobile App** recording user’s behaviour using mobile phone sensors (automatic start / stop)

- **A variety of APIs** to read sensor data recorded and temporarily store it to mobile phone

- **Data transmission** from the mobile App to the central database via an appropriate communication channel such as:
  - Wi-Fi network (online)
  - Cellular network such as a 3G/4G network (online)
  - Bluetooth (offline)

*Source: OSeven Telematics*
Data flow

- Data is stored in a sophisticated **database** where managed and processed

- **Indicators** result from the mobile phone data process using machine learning algorithms and data mining techniques

- **Results Visualization**
  - Mobile App
  - Web Portal

Source: OSeven Telematics
- Indicatively, mobile phone integrates **technology sensors:**
  - Accelerometer*
  - Gyroscope*
  - Magnetometer
  - GPS (speed, course, longitude, latitude)

- **Fusion Data** provided by iOS and Android:
  - Yaw, pitch, roll
  - Linear acceleration*
  - Gravity*

*(*x, y, z components)*

- **Recording** at a maximum frequency of 1Hz
Methodological challenges (1/2)

Risk exposure indicators:

- Total distance (mileage).
- Driving duration
- Type(s) of the road network used (given by GPS position and integration with map providers e.g. Google, OSM)
- Time of the day driving (Rush hours, Risky hours)
- Weather conditions
- Trip purpose

combined with other data sources (speed limits and detailed accident maps).
Methodological challenges (2/2)

Driving behaviour indicators:

- **Speeding** (duration of speeding, Speed Limit exceedance etc.)

- Number and severity of **harsh events**
  - Harsh braking (longitudinal acceleration)
  - Harsh acceleration (longitudinal acceleration)
  - Harsh cornering (angular speed, lateral acceleration, course)

- Driving **aggressiveness** (e.g. braking, acceleration)

- **Distraction** from mobile phone use
Main findings

**Speeding behaviour** is found to be correlated with several other driving behaviour parameters:

- Frequency and severity of **harsh events**:  
  - Acceleration  
  - Deceleration  
  - Cornering  
- Driving **aggressiveness** during the trip (e.g. acceleration profile)  
- **Mobile phone** usage  
- Total **Mileage**  
- **Traffic** conditions  
- **Route** frequency
Future challenges (1/2)

Monitoring driver behaviour through mobile phones makes gradually possible the continuous driver assessment, opening a new great potential for traffic and safety behaviour improvement, used either:

- **Independently by the drivers** in order to:
  - raise awareness and engagement on safe and eco-driving
  - receive feedback and support on driving performance and risks

- Through **customized insurance schemes** by correlating driving exposure and behaviour with insurance premiums:
  - pay-as-you-drive (PAYD)
  - pay-how-you-drive (PHYD)
Future challenges (2/2)

**Advanced machine-learning algorithms**

**Big data** analysis – handling - mining

**Correlation** between accidents and driving indicators

Developing **user-friendly Apps** for driving recording

**User engagement**

**Battery** consumption

Personal data **privacy**
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