A method for identifying aggressive driving by using naturalistic driving data

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Agenda

- Aim
- Data
- Method
- Results
- Conclusions
Aim

- Identify metrics that can categorize driver behavior associated with higher crash risk
- Aggressive driving in car-following situations
- Investigate effects of drivers' characteristics on the identified metrics
UDRIVE

EUROPEAN NATURALISTIC DRIVING STUDY

NUMBER OF DRIVERS PER COUNTRY:

- UNITED KINGDOM: 52
- THE NETHERLANDS: 48
- SPAIN: 47
- FRANCE: 43
- POLAND: 31
- GERMANY: 27

87871 HOURS OF DATA COLLECTED

VEHICLE TYPES:
- TRUCK
- CAR
- MOTORCYCLE

NUMBER OF DRIVERS:
- 48
- 186
- 47

HOURS OF DATA COLLECTED PER VEHICLE:
- 41389
- 45591
- 891

NUMBER OF DRIVERS: 281
Questionaries' data

- Driver Behaviour Questionaries’ (DBQ)
  - 19 items assessing the prevalence of errors and violations in the driver’s everyday behaviors
  - High score = more reported aggressive driving violations
- Arnett Inventory of Sensation Seeking (AISS)
  - 20 items assessing the risk-taking and sensation-seeking nature of a driver’s personality
  - High score = drivers seek out highly novel or high intensity experiences

Lajunen et. al (2004); Arnett (1994)
Database
- Vehicle sensor (V, a)
- Mobile eye (range)
- Map data (road type)

Derive measures
- Motorway
- No CC

Select scenario

Compute metrics

Rank drivers

Method

\[
\text{% tailgating} = \frac{THW < 0.4s}{THW < 4s} \times 100
\]

Top 25%

- Longitudinal jerk
- THW

# negative jerk
# positive jerk
Method

Jerk (m/s$^3$)

Brake
Gas
Neither pedal
Thr. Neg. Jerk
Thr. Pos. Jerk

Feng et. al (2017)
Results

- Total segments of car-following: 126098
- Distance: 72705 km
- Duration: 758.2 hours
- 93 drivers
  - 50 males and 43 females
Jerk and tailgating

K-W: \( \chi^2 (1) = 0.1605, \ p = 0.6886 \)

\( \chi^2 (1) = 8.3764, \ p = 0.0038 \)
Jerk and gender

K-W: $\chi^2 (1) = 0.8128, \ p = 0.3673$

$\chi^2 (1) = 6.0431, \ p = 0.0139$
Jerk and country

• Positive jerk
  \[ K-W \chi^2 (4) = 20 \ p = 0.00049 \]

• Negative jerk
  \[ K-W \chi^2 (4) = 19.51 \ p = 0.00062 \]
AISS

- Low AISS group (AISS <= 45)
- High AISS group (AISS > 45)

- Tailgate:
  - Fisher exact $p = 0.0139$

- Positive jerk:
  - K-W: $\chi^2 (1) = 0.2435, p = 0.6216$

- Negative jerk:
  - K-W: $\chi^2 (1) = 1.5286, p = 0.2163$
DBQ

- Low DBQ group (1-3)
- High DBQ group (4-5)

- Tailgate:
  - Fisher exact $p = 0.8604$

- Positive jerk:
  - K-W: $\chi^2 (1) = 2.8062$, $p = 0.0939$

- Negative jerk:
  - K-W: $\chi^2 (1) = 1.6015$, $p = 0.2057$
Conclusion

- **Aggressive** drivers are associated with significantly higher frequency of using large **negative** jerk.

- Drivers from different **countries** have significantly different frequency in using both **positive** and **negative** jerk.

- **Male** drivers have significantly higher frequency of using large **negative** jerk compared to **female** drivers.

- Higher sensation-seeking drivers are more prone to tailgating.
Thank you