Improving Methods to Measure Attentiveness Through Driver Monitoring

Eileen Herbers
EHerbers@vtti.vt.edu
https://www.linkedin.com/in/eileen-herbers/

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Distracted driving is a predominant issue in vehicle safety.

Claimed 3,142 lives in 2019*

- How often is a driver inattentive during one trip?
- Will inattention increase with more advanced vehicles (AVs)?
- How do we measure inattentiveness?
- How and when should we notify the driver when they are being inattentive?

A privately funded naturalistic driving database was made available to support this study’s research objectives.

- **Individuals recruited to use the equipped research vehicles in place of their personal vehicle**
- **Collection of DMS output and vehicle parameters, including:**
  - Glance Location
  - Speed
  - Acceleration
  - Steering Wheel Torque
  - Throttle Pressure
  - Brake Pressure
Given context (10 seconds) before the attention rating, we determined the driver’s attention level at the end of the event.

**Not Distracted**
- 1,079 events
  - Driver is clearly engaged in the driving task, characterized by glances off road to locations relevant for safe driving

**Slightly Distracted**
- 157 events
  - Driver is looking around, often to the center console, for longer periods of time

**Moderately Distracted**
- 73 events
  - Driver has more extended glances off road, sometimes with phone use or longer uses of the center console

**Very Distracted**
- 58 events
  - Driver has combined sources of distraction with prolonged glances off road to a cell phone and the center console

**Total Events**: 1,367
At each timepoint, values were calculated within the algorithm to output the suspected attention level of the driver.
The attention status was compared to the ground truth, which was determined during data reduction.

**Algorithm Output:**
Driver Attention Status

- Not Distracted
- Slightly Distracted
- Moderately Distracted
- Very Distracted
1) Calculate error
2) Minimize error
3) Prioritize the correct bin
Adjustments can be made along different parts of the algorithm design process.

What weights do we use to add to the AttentionDuration and InAttentionDuration?

How do we use these calculations to assign the driver’s attention status?

How do we compare the algorithm output to the ground truth?

Driver Assessment
We can compare algorithms against one another to determine the correct algorithm for each application.

- Buffer-based algorithms
- Machine learning algorithms
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In Summary,

- Tools available now make it easier to determine when a driver is inattentive.
- Algorithms used to determine driver attention should be designed with an understanding of their limitations and could be used as a guideline for further development.
- At a minimum, both glance location and speed should be used to assess driver attention.
- DMS could be an important component in reducing distractions.
Thank you!

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What are you looking at? The Importance of Driver Monitoring