

## Driver impairment detection and safety enhancement through comprehensive volatility analysis

This report had three main research objectives:

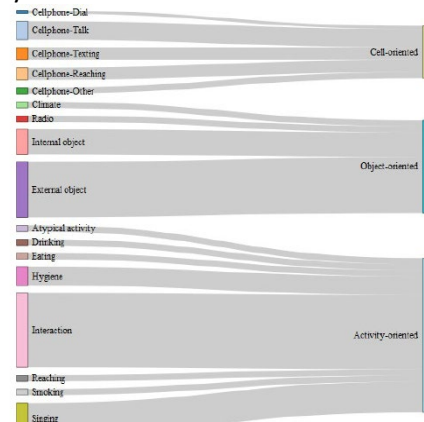
1. Develop a framework for obtaining, processing, and analyzing high-frequency multi-dimensional large-scale data using sensors that monitor the driver, vehicle, and roadways.
2. Analyze the naturalistic driving study data from the SHRP-2 program for in-depth analysis on impairment and distracted driving.
3. Use experimentation in simulated and naturalistic settings, demonstrate collection and processing of driver biometric, vehicle, and roadway surroundings data.

Findings from a literature review showed three gaps: the association of duration of secondary tasks and driving impairment on crash risk, the correlation of distraction and impairment on instability in driving and the overall association with crash risk and severity, and the real-time prediction of crash risk using leading indicators embedded in driver biometrics.

The researchers also developed a framework for obtaining, processing, and analyzing high-frequency multi-dimensional large-scale data using vehicle-based sensors that monitor the driver, vehicle, and roadways. The framework harnesses the data and quantify variations in driver biometrics and behavior, vehicle kinematics, and roadway/environmental conditions utilizing the concept of volatility.

Additionally, this study identified three main groups of distraction and quantified the duration of distraction by different types to study their association with crash risk, including cellphone-oriented, object-oriented, and

activity-oriented distractions. The duration of all types of distracted driving are positively and significantly associated with the probability of the occurrence of a safety critical event (i.e. near-crash and crash events). The results suggest that the association of duration of distraction with crash risk is non-linear and with increased engagement with a secondary task.



*Categorization of secondary tasks*

The analysis presented created foundation for further experimentation in simulated and naturalistic settings. The next phase of the research will provide diverse sets of biometric data that can be analyzed further.

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