Enhancing Crash Classification through Attention-based Models: Unveiling Causal Factor Importance and Interactions for Improved Transportation Mobility and Safety

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Center Name: Pacific Northwest Transportation Consortium (PacTrans)

Research Priority: Improving the Mobility of People and Goods

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Project Partners:

Research Project Funding: $40,000 federal; $40,000 non-federal match

Project Start and End Date: 8/16/2023 – 8/15/2025

Project Description: The vehicle crash database faces an ongoing challenge of misclassified crashes, necessitating subsequent adjustments by researchers and traffic engineers based on reported circumstances. However, concerns surrounding security and privacy create significant barriers to releasing officers' accounts, which contain invaluable insights into the conditions and circumstances leading to each crash.

The primary objective of this study is to enhance the classification of crashes by leveraging the potential of artificial intelligence (AI) techniques applied to event accounts and the statewide crash database. The ultimate goal is to develop, calibrate, and validate a robust classification model that can accurately categorize crashes, thereby significantly improving the identification of crash circumstances and causes.

By employing advanced AI and statistical analysis techniques, this research aims to delve into the language used in event accounts, enabling a deeper contextual understanding of crashes. This approach will facilitate precise classification by researchers or consultants, contributing to the identification of trends in crashes occurring on highway facilities. The outcomes of this study will provide valuable insights for enhancing transportation safety, promoting better mobility, and informing decision-making processes in the field.

Furthermore, the findings obtained from analyzing Alaska crash records will serve as a compelling case study, with the potential for application in other police databases within Region 10 and beyond. This broader application will support efforts to improve crash classification and enhance transportation safety measures on a regional scale.

US DOT Priorities:
This project directly supports the U.S. Department of Transportation (USDOT) priorities and RD&T Strategic Plan by leveraging artificial intelligence (AI) to enhance crash classification, thereby advancing transportation safety, a core USDOT goal. By improving the accuracy of crash data analysis, the project addresses the strategic objectives of promoting safety, innovation, and efficiency within the transportation system. It embodies transformative research through the use of advanced AI and

statistical techniques to interpret event accounts, offering a novel approach to overcoming privacy and security challenges associated with crash data. The potential expansion of this methodology beyond Alaska signifies a commitment to economic strength, competitiveness, and organizational excellence by fostering a safer, more reliable transportation network nationwide. This initiative not only aligns with USDOT's emphasis on safety and innovation but also sets a new standard for data analysis and privacy in transportation research, showcasing a pioneering effort in the sector.

Outputs:
The research project is set to produce groundbreaking outputs that will significantly advance transportation safety and data analysis, encompassing the development of an AI-based classification model for accurately categorizing crash events and novel data analysis methods that leverage AI to deepen the understanding of crash contexts. Additionally, it will enrich the crash database with advanced classifications, making it a valuable resource for broader research applications. The project is also expected to yield research publications and software tools that document the methodologies and provide practical resources for analysis, alongside potential intellectual property such as new algorithms or processing techniques.

Outcomes/Impacts: The outputs from this research project, notably the AI-based classification model and advanced data analysis methods, are expected to markedly improve crash data accuracy, influencing safety measures and risk mitigation strategies within the transportation system. Enhanced precision in crash categorization will inform regulatory adjustments and policy developments, potentially leading to reduced road accidents and fatalities. The enriched crash database could drive new safety standards and infrastructure improvements, demonstrating the project's direct impact on transportation safety and policy decisions.

Publications and products stemming from this project, such as novel algorithms and software tools, promise not only advancements in safety but also operational efficiencies, contributing to cost savings for transportation agencies. These efficiencies, in turn, expedite the implementation of safety interventions, optimizing resource allocation and enhancing public health outcomes.

Final Research Report: *will be provided upon completion of the project*