FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

Lars Skaug

for the degree of Doctor of Philosophy (Ph.D.)

ADVANCING ROAD SAFETY THROUGH DATA INTEGRATION, LOCATION ACCURACY, AND RISK-BASED ROUTE OPTIMIZATION

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DEPARTMENT: Electrical Engineering and Computer Science

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ABSTRACT OF DISSERTATION

This dissertation advances transportation safety through three interconnected contributions that address fundamental challenges in crash data analysis and application. First, we present a comprehensive survey of road crash analysis methodologies, tracing the evolution from traditional statistical approaches to modern machine learning techniques while identifying critical gaps between research sophistication and practical implementation. This survey reveals that while methodological advances have been substantial, ongoing data quality issues, particularly in location accuracy and completeness, limit the effectiveness of even the most sophisticated analytical approaches.

Building on these findings, we develop a novel system to validate and correct crash location data using multi-modal large language models (LLMs) integrated with geospatial analysis. Our credibility-based scoring system evaluates location accuracy by comparing multiple data sources, analyzing crash narratives and diagrams, and applying spatial validation techniques. Empirical testing on 5,000 Ohio crash reports demonstrates that approximately 20\% require location corrections, with our method successfully identifying and correcting these errors through automated post-processing.

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The third contribution introduces a risk-aware navigation solution applicable to both human-driven and autonomous vehicles. By integrating historical crash patterns with predicted traffic volumes, we create standardized risk metrics for individual road segments that can be incorporated into routing algorithms. Validation across 56 high-volume commute routes in Ohio demonstrates that safety-prioritized routing reduces crash risk exposure by an average of 22\% while increasing travel time by only 9\% on average.

Together, these contributions form a cohesive approach to transportation safety from data quality assessment through practical application, demonstrating how advances in data science and analytical methods translate into tangible safety benefits for current transportation systems and emerging navigation technologies.

BIOGRAPHICAL SKETCH

WORK EXPERIENCE

JM Family Enterprises, Inc. – Deerfield Beach, FL
Finance & Data Science Manager (May 2021 - Present)

DataScan. - Alpharetta, GA
Principal Software Developer (Oct 2021 - May 2022)

JM Family Enterprises, Inc. – Deerfield Beach, FL
Data Operations Manager (Aug 2019 - Oct 2021)

Orkla ASA
Solution Architect for Integration (Aug 2018 - Aug 2019) - Oslo, Norway

JM Family Enterprises, Inc. – Deerfield Beach, FL
Manager, Applications and Data (Jan 2006 – Aug 2018)

Florida International University – Miami, FL
Coordinator of Computer Applications (Apr 2004 - Jan 2006)

EDUCATION

Iowa State University
MBA, Information Systems Specialization
2000 - 2002
MBA Student of the Year (2001-2002)

University of Oslo
Bachelor's degree, Language, Logic, and Information Technology
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CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION
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Skaug, Lars, Mehrdad Nojoumian, Nolan Dang, and Amy Yap. 2025. "Road Crash Analysis and Modeling: A Systematic Review of Methods, Data, and Emerging Technologies" Applied Sciences 15, no. 13: 7115. https://doi.org/10.3390/app15137115

Skaug, Lars, and Mehrdad Nojoumian. 2025. "A Multimodal Artificial Intelligence Framework for Intelligent Geospatial Data Validation and Correction" Inventions 10, no. 4: 59. https://doi.org/10.3390/inventions10040059

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