Dr Nicolette Formosa

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Summary: Accomplished Lead Data Scientist with a PhD in Intelligent Transport Systems and over 7 years of experience in developing AI-driven solutions, leading multidisciplinary projects, and publishing high-impact research. Expert in leveraging Databricks, Python, Agile methodologies, DevOps, and MLOps to drive data-driven decision-making and operational efficiency. Proven track record of securing funding, fostering cross-functional collaboration, and delivering innovative solutions that align with strategic business goal

1. KEY ACHIEVEMENTS

• Secured competitive funding grants from reputable institutions, supporting high-impact projects.
• Published 20 peer-reviewed articles in prestigious journals and conferences, contributing to the dissemination of knowledge in the field.
• Led cross-disciplinary teams on innovative projects with significant real-world impact.
• Mentored and supervised junior researchers, fostering a culture of continuous learning and development in the research domain.
• Contributed expertise to organisations and committees, influencing policy discussions and promoting the application of research findings to address real-world challenges.
• Recognised as a subject matter expert, sought after for speaking engagements and guest lectures at academic institutions and industry events.

2. EDUCATION QUALIFICATIONS

PhD in Intelligent Transport Systems (ITS), Loughborough University   2016-2020
Research Project: Developing Vehicle-Based Traffic Conflict Prediction Algorithms Using Deep Learning

MSc in Control Engineering, University of Malta, Distinction, 84%   2012-2014
Research Project: Spatio-Temporal Modelling Applied to Marine Pollution Data

Bachelor of Electrical and Electronics Engineering, University of Malta, 76%   2008-2012
Research Project: Modelling and Analysis of the Interactions between Air Pollution and Traffic Flow

3. EMPLOYMENT

National Highways   Lead Data Scientist   September 2022 – Present
• Designed scalable data pipelines using Databricks and Delta Lake on Azure, optimising big data workflows for high-impact analytics.
• Developed Python scripts and models (Pandas, Scikit-learn) and integrated large language models to enhance predictive analytics, automate data processing, and drive data-driven decision-making.
• Led data science projects using Agile methodologies, ensuring on-time, high-quality delivery through sprints, stand-ups, and retrospectives.
• Implemented MLOps practices and built CI/CD pipelines to automate model deployment, boosting reproducibility and speed.
• Developed computer vision solutions for analysis of road conditions, traffic monitoring, and incident detection using frameworks like OpenCV and TensorFlow, improving infrastructure safety and operational efficiency.
• Collaborated with stakeholders to align data science initiatives with business goals, supporting the Road Investment Strategy (RIS).
• Created interactive dashboards and reports using Power BI, translating complex data into actionable insights for decision-makers, enhancing data accessibility and engagement across teams.

Loughborough University   Doctoral Prize Fellow   January 2022 – September 2022
Project title: **C**ooperative c**O**llision avoida**N**ce in a **C**onnected and **A**utonomous **V**ehicles **E**nvironment (**CONCAVE**)
Funder: Loughborough University
• Led the CONCAVE project focusing on cooperative collision avoidance in connected and autonomous vehicle (CAV) environments.
• Developed ML algorithms and conducted data analysis using big data techniques to support CAV operations with zero fatalities.
• Published research and collaborated with colleagues across academia and industry partners.
• Mentored and inspired undergraduate and postgraduate students through teaching and supervision.

Loughborough University   Research Associate   September 2019 – April 2022
Project title: Connected and Autonomous Vehicles Infrastructure Appraisal Readiness (CAVIAR)
Funder: InnovateUK (Highways England)
Value: £1m
• Team leader of research associates to deliver the work packages in time.
• Instrumented the research vehicle with multiple advanced sensors to gather large amounts of data. This involved working with (1) companies to purchase and order sensors and (2) technicians to implement them onto the vehicle and test data collected is accurate and reliable.
• Developed LiDAR-detection algorithms and worked with big data analytics
• Conducted sub-microscopic simulations to test emerging vehicle safety technologies.
• Presented research findings to industry stakeholders (Highways England and Galliford Try).

4. SKILLS

Languages: Maltese (Native), English (Excellent), Italian (Excellent), French (Intermediate)

Technical: Python, R, Matlab, SPSS, C, C++, Deep Learning, AI Modelling, Big Data Analytics, Simulation

Analytical: Data Analysis, Predictive Modelling, Algorithm Development

Leadership: Experience as a team leader in multiple projects, Project managements, cross-functional collaboration

Communication: Technical Writing, Presentation Skills, Stakeholder Engagement

5. SELECTED AWARDS
• Winner: Top 50 Women in Engineering in Safety and Security (2023) LINK
• Inspiration Women in Loughborough (2023) LINK
• Doctoral Prize Fellowship – Principal Investigator (2022) £250k LINK
• Doctoral Researcher Excellence Award – Loughborough University awards (2021) LINK
• Seed corn research funding (£10k) from Logicalis (2020)
• Global winner – by both judges and audience - for the best PhD idea (Annual Conference of Transportation Research Board, Washington, D.C., USA 2020) LINK
• 1 of 10 Loughborough University women engineers to celebrate 100 years of women engineers at Loughborough (2019) LINK
• Smeed Prize for Best Student Paper at 51st Annual Conference of the Universities' Transport Study Group; a very prestigious award in the transport academic community. (2019) LINK
• Loughborough University Enterprise Award 2019 – Map Matching Algorithms – Impact Winner with Professor Mohammed Quddus & his team (2019) LINK
• PhD Exchange to University of Central Florida for research collaboration with a world leader in Connected and Autonomous Vehicles and AI - Professor Mohamed Abdel-Aty. (2019) LINK
• Santander Mobility Award, (2018) £2.5k
• Winner of Falling Wall UK Qualifier (2018) and participation in Final Falling Walls Labs in Berlin (2018). Falling Walls Lab, invites researchers and entrepreneurs from all academic institutions to present their innovative idea, research project or social initiative. LINK

- Three Minute Thesis Competition Loughborough University – Winner and People's Choice Awards (2018).
- Winner of poster competition at the L'Oréal-UNESCO for Women in Science Awards Ceremony where my research was selected from more than 400 entries. (2018). [LINK]
- LU Research Conference 2017 - Best Poster and best researcher talk (2017)

6. PUBLICATIONS

Peer- reviewed Journal Articles:
1. **Formosa, N.**, et al., 2020. Predicting real-time traffic conflicts using deep learning. Accident Analysis and Prevention. 136, 105429. [DOI]
2. **Formosa N.**, et al., 2022, A New Modelling Approach for Predicting Vehicle-based Safety Threats. IEEE Transactions on Intelligent Transportation Systems. [DOI]
3. **Formosa N.**, et al., 2022, Validation of a Traffic Conflict Technique Using Real-time Data. Sensors 22(2), 566. [DOI]
4. **Formosa N.**, et al., (2023), Appraising Machine and Deep Learning Techniques for Traffic Conflict Prediction with Class Imbalance, Journal of Big Data Analytics in Transportation [DOI]
5. **Formosa, N.,** et al., (2024). An Experiment and Simulation Study on Developing Algorithms for CAVs to Navigate Through Roadworks. IEEE Transactions on Intelligent Transportation Systems, 25(1), 120–132. [DOI]
6. **Formosa, N.,** et al., (2024). Evaluating the Impact of Lane Marking Quality on the Operation of Autonomous Vehicles. Journal of Transportation Engineering, 150(1). [DOI]
7. Ye M., **Formosa N.**, et al., Developing a Vehicle Re-Routing Algorithm Using Connected Vehicle Technology, in: Journal of Intelligent Transportation Systems (Status: under review June 2024).
8. Singh M., **Formosa, N.**, et al., (2024). Assessing temporary traffic management measures on a motorway: Lane closures vs narrow lanes for connected and autonomous vehicles in roadworks. Iet Intelligent Transport Systems. [DOI]
9. Sheng, S., **Formosa, N.**, et al., (2024). Advancements in Lane Marking Detection: An Extensive Evaluation of Current Methods and Future Research Direction. IEEE Transactions on Intelligent Vehicles, 1–12. [DOI]

Conference Contributions - Refereed:
• Developing an Integrated Safety Surrogate Measure for Intelligent Vehicles (TRB 2024)
• Advancements in Lane-Marking Detection (TRB 2024)
• Developing a Vehicle Re-Routing Algorithm Using Connected Vehicle Technology (TRB 2023)
• Lane Closures Verus Narrow Lanes: The Traffic Efficiency and Safety Impacts of Connected and Autonomous Vehicles at Roadworks (TRB 2023)
• Increasing Traffic Safety and Efficiency of CAV Operations at Roadworks (TRB 2022)
• Evaluating Connected and Autonomous Vehicle Infrastructure Readiness Through Vehicle Instrumentation and Traffic Simulation (UTSG 2021)
• Modelling Vehicle-based Safety Threat: Incorporation of New Factors under Uncertainty (TRB 2021)
• Developing a Traffic Conflict Technique for Motorways using Real-Time Data (TRB 2020)
• Vehicle level conflict detection using deep learning (UTSG 2019)
• Predicting real-time traffic conflicts using deep learning (TRB 2019)

7. PROFESSIONAL DEVELOPMENT

I actively engaged in numerous research-related development activities to enhance my skills and knowledge. These activities included participating in workshops and attending short-courses.

TRAINING: Fire Safety, First Aid Training at Work, Mental health training Suicide Prevention Training, Bribery Act, Information Security, Equity and Diversity at Work, Sexual Violence disclosure training, Anti racism training, Respecting Diversity, Unconscious Bias

ACADEMIC SKILLS / OUTREACH / PRESENTATION SKILLS: Presentation Skills, Literature Review Workshops, CV Tailoring