

University of Essex Online

Module: Research Methods and Professional Practice

Unit: 8 – Research Proposal Outline

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Machine Learning Applications in Urban Road Data Mining

Research Proposal

Urban road networks are facing unprecedented challenges due to rapid urbanization and expanding infrastructure. As Casali et al. (2022) discuss, machine learning and artificial intelligence are "promising to revolutionise how we can analyse and plan our urban areas, providing new leads to pursue a sustainable city agenda." Traditional inspection methods, typically manual and periodic, simply cannot cope with the scale and complexity of modern urban environments. We're witnessing an explosion of data from various sources - sensors, cameras, mobile devices, and IoT infrastructure. Wang and Cao (2021) emphasize how this empowers cities to become "smarter, more efficient and more sustainable," yet there remains a significant gap between data collection and generating actionable insights for road maintenance and planning. This research proposes leveraging machine learning to transform how we collect, analyze, and act upon urban road data, creating the foundation for truly smart infrastructure.

The significance of this research extends beyond academic contribution to address critical real-world challenges. The economic implications are substantial: the UK alone spends over £3.2 billion annually on road maintenance, much of it reactive rather than predictive. More critically, inadequate road conditions contribute to over 24,000 road casualties annually. As identified by Alsrehin et al. (2019), machine learning capabilities "to incorporate multiple data sources made it better at predicting future traffic and helped manage it." This research builds on their findings to develop predictive maintenance approaches that could dramatically reduce both financial costs and human suffering. By transforming how urban infrastructure is monitored and maintained, we

can improve mobility, reduce congestion, and enhance quality of life for millions of urban residents while optimizing resource allocation in an era of budget constraints.

Reference List

Alsrehin, N.O., Klaib, A.F. and Magableh, A. (2019). Intelligent Transportation and Control Systems Using Data Mining and Machine Learning Techniques: A Comprehensive Study. IEEE Access, 7, pp.49830-49857.

Casali, Y., Aydin, N.Y. and Comes, T. (2022). Machine learning for spatial analyses in urban areas: a scoping review. Sustainable Cities and Society, 85, p.104050.

Wang, S. and Cao, J. (2021). AI and Deep Learning for Urban Computing. Urban Informatics, pp.815-844.