RESEARCH PROPOSAL:

IMPLEMENTING DEEP LEARNING TOOLS AND TECHNIQUES IN TRAFFIC ACCIDENT PREDICTION.

(TRANSCRIPT)

Yassir Ibararh

12693772

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**INTRODUCTION:**

Hello, I am Yassir Ibararh, a software engineer with 5 years of experience in the field. Today, I welcome you to this presentation about implementing deep learning tools and techniques in traffic accident prediction. It is part of the summative assessment of unit 10 in the research methods and professional practice module at Essex University, as part of the master's degree in Artificial Intelligence.

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**SIGNIFICANCE:**
Traffic accidents are a phenomenon that affects public safety worldwide. There has been a total of 3.9 million traffic related accidents between 2015 and 2022 (WHO, 2023). In the United States, traffic collisions were established as the number one reason of death among people aged between 16 and 24 years old. According to research made by the Federal Highway Traffic Safety Administration (2025) that collected data between 2010 and 2025.

Nowadays, with the rapid growth of urbanisation, the safety of road systems has emerged as one of the most important social matters around the world (WHO, 2023). Today, ensuring road safety has become a global concern. Traditional techniques such as historical trend analysis, black spot identification, and conventional regression models have proven insufficient to significantly reduce traffic accidents (Jin et al., 2023).

A study conducted by the World Health Organisation (2020) and enriched by research from the National Highway Traffic Safety Administration (2022) highlights that accident rates remain stubbornly high, and are expected to keep rising, particularly in urban centres.

Although recent years have seen implementations of machine learning systems based on decision trees, support vector machines, and logistic regression, the effect of these models remains limited by their reliance on handcrafted features and shallow representations (Shakil et al., 2023). As urban environments grow more complex, deeper models capable of extracting nuanced patterns are increasingly necessary (Jin et al., 2023).

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Deep Learning, which is also known as deep structured learning, hierarchical learning or deep machine learning, is a subfield of artificial intelligence that gives computers the ability to learn from data patterns without being explicitly programmed by a human (Ongsulee, 2017). It can be defined as the study of artificial neural networks and related machine learning algorithms, which contain more than just one hidden layer. These are called deep nets (Honglei et al., 2018).

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In the traffic accident context, deep learning has emerged as a possible alternative, offering the ability to automatically learn distinct features from large and complex traffic datasets (Theofilatos et al., 2019). Techniques such as convolutional neural networks, recurrent neural networks, and graph neural networks are now being explored to enhance prediction accuracy and support proactive traffic safety interventions (Sameen et al., 2017).

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**RESEARCH QUESTION:**

Given the limited industry adoption and the scarcity of peer-reviewed research on deep learning in traffic accident prediction (Varghese et al., 2020), the central research question is: “How effective are deep learning techniques in improving the accuracy of traffic accident prediction?” This study qualitatively explores these impacts through secondary research from academic sources.

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**AIMS & OBJECTIVES:**

The main aim of the research is to analyse the impact of implementing deep learning techniques in traffic accidents prediction.

The objectives, on the other hand, include reviewing existing literature on deep learning applications and impacts in traffic safety, identifying current and potential use cases in accident prediction systems, and uncovering key trends, challenges, and opportunities in this emerging field.

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**LITERATURE OVERVIEW:**

There is a good number of existing literatures relating to implementing deep learning and AI techniques in traffic systems. However, most of this pertains to the optimization of traffic flow and congestion management instead of traffic accidents predictions (Varghese et al., 2020). According to Al-Dogom et al. (2019) there is a total of less than 100 published papers that address the topic, which highlights a gap in the research. The following literature in this slide provided the main components needed for our study.

Zheng et al. (2021) present a review of the analytical methods currently used for modelling traffic conflicts as an alternative to crash-based safety analysis. The authors discussed some limitations of crash data such as underreporting, rarity, and time lag which can cause an issue when dealing with real-time situations. They claimed that the implementation of deep learning in traffic accidents predictions might offer improved accuracy and real-time analysis if issues such as data inconsistencies and model generalisation are properly addressed.

Jin, C. et al (2023) argued that implementing systems based on deep learning can solve the key limitations of traditional methods. The system proposed by the authors uses convolutional Neural Networks and Deep Neural Networks to improve the prediction accuracy in traffic accidents. The system was tested on more than 3 million data point that was curated from national databases and pre-processed to ensure it is free from any bias or imbalance. The data included historical crashes between 2010 and 2018 and achieved an overall accuracy of over 80%.

On the other hand, both Zhouoning, c. et al (2018) and Zhidan, L. et al (2020) have explored the limitation of implementing deep learning in the field. They have claimed that issues such as data imbalance, dependency on high-quality labelled data, might negatively impact the model’s reliability and real-world deployment.

Dong et al. (2018) looked at another area which is the ethical concerns of the implementation from a legal, fairness and equality perspective. They have argued that improper regulation of deep learning models can reinforce existing biases in the traffic systems. Thus, impacting certain communities and populations. The authors raised concern about the transparency, accountability, and safety of implementing such systems.

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**METHODOLOGY:**

The research-based project is focused on understanding impacts rather than solving an operational problem (Dawson, 2015). It is industry-oriented but independent with no specific problem to address. The study is exploratory rather than explanatory, evaluative or descriptive (Dawson, 2015). The adaptability of exploratory research enables flexibility which is well fitted for such emerging fields with limited existing research (Saunders et al., 2019).

The methodology will be split between two main parts; Starting with the research development and followed by the application development.

The research will be secondary and will follow a sequential approach to gather, analyse then interpret and present (Saunders et al., 2019). Although using secondary data is cost-effective and accessible, there is a risk of bias and data inconsistencies; careful selection and data pre-processing will have to be applied to mitigate these concerns (Zhou et al., 2017). The main source of research will be made using Google scholar to find highly sourced papers, interview, and surveys etc. Although published and peer-reviewed papers are prioritised, but relevant products in the industry and reports will also be considered. This phase is essential to justify the use of deep learning over the traditional methods and frames the scope for the application development.

The application development process then will follow the software development Lifecyle from planning, design, testing, and evaluation. It will be ensured that the system is high quality designed, securely tested and developed using unbiased data (Prabhu, 2019). The main part of focus during this phase will be training the deep learning model using a supervised learning approach and following appropriate testing to attempt achieving the highest possible accuracy.

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**ETHICAL CONSIDERATIONS AND RISK ASSESSMENT:**

While the project is designed to explore the effects of deep learning on traffic accident predictions and preventions, the aim in not only to evaluate the effectiveness of such models, but to also examine their limitations, biases and the implications of a deployment in real-world environments (Prabhu, 2019). All datasets will be sourced from publicly available and approved and licensed repositories. The project will aim to respect the ethical use of data in AI applications (Rhem, 2023).

Similarly, the risk assessment will be necessary due to the legal regulations and confidentiality (Data Protection Impact Assessments, 2025). The main concern involves the storage and handling of sensitive data related to historical crash records, traffic patterns and urban infrastructure (Abduljabbar et al., 2018). Similar datasets such as the UK road safety statistics (Department for Transport, 2024) will be used to curate the training data for the model. The artefact will be built within a local environment to reduce any potential risk related to the used sensitive data.

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**ARTIFACTS:**

This study will examine the impact of deep learning in traffic accidents prediction using an exploratory approach. By following the structure at the University of Essex Online (N.D.A) and Dawson (2015), the artifacts will include a report, an AI trained model and a presentation.

The report will start with an introduction explaining the importance of understanding the impact of implementing deep learning in traffic accidents prediction. Following that the literature review will focus on secondary data from 2020 onwards and address the research gap. The methodology section will explain the decision-making process and the final design. Then, the findings' part will summarise how deep learning can reshape the industry, by identifying any ethical, legal or technical issues and exploring future emerging trends. The final discussion will analyse the findings and discuss the general issues and opportunities. Finally, the conclusion will summarise how effective the implementation really is for traffic accident prediction.

The presentation will include a technical walkthrough of the prediction model that forecasts traffic accidents. It will discuss the data curation as well as the training strategy. At the end, the presentation will showcase how the trained model was tested on real-world data by analysing the accuracy, bias and fairness. The model will be submitted through online platforms such as GitHub or google notebook, and all the necessary instructions will be included in a detailed ReadMe file.

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**TIMELINE:**

By following Dawson’s (2015) recommendations and the University of Essex Online’s research planning guidelines, the proposed research timeline will be of six-month total or the equivalent of around 26 weeks.

Dawson’s approach allows a sufficient time for generating a competent piece of work. Other approaches such as agile-based scheduling were explored but were found less suitable for academic research in a part-time degree (Bayesteh 2024).

Once the research proposal is submitted, there will be ten weeks to complete the literature review and the model design. Thus, giving enough time to find high quality papers and properly understand the problem in hand. Then, 5 weeks to complete the research paper. Following that, there will be ten weeks to develop and test the model. And finally, a week to prepare the presentation and submit all the artifacts.

The process will be iterative and often might require changes as the project progresses over time.

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**CONCLUSION:**

To conclude, the subject chosen for the research is critical due to the concerns about road safety and the limitation of traditional methods. Implementing deep learning is proposed here as a solution. The idea is to define what impact it will have on the prediction accuracy.

After the research submission the following learning outcomes will be achieved such as the ability to do problem solving using deep learning models, developing research and analytical skills, as well as understanding the data management and ethics of fairness, transparency and explainability.

Thank you for watching, I am happy to take any questions.

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