Final Pinnacle Project Proposal-Minor

By: Farooq Anwar

Problem Statement:

How can AI optimize the traffic flow and safety at the entrances of Innovation Academy during peak hours?

This question was chosen because of the rise in AI technology and the current traffic at school. This project can be done this year. There is also a reasonable amount of documentation. Even a STEM school can find a solution to a current problem and transform it using AI. This research will be conducted ethically, making sure that pedestrians are safe from oncoming cars using existing suitablesoftware to solve this project effectively.

Abstract:

The overall purpose of the research is to solve any issues related to traffic flow and safety at Innovation Academy’s entrances during peak hours with the help of an AI model. The specifics of the research are to aim for a design that uses a machine learning algorithm to analyze pre-existing and newly collected data on traffic to predict and manage congestion. It is hypothesized that an AI-driven system will be effective in reducing congestion and enhancing pedestrian safety. The research will then take a quantitative approach by observing data and using machine learning techniques to train the model. This might be of importance, as it would hopefully produce a scalable and efficient solution to a problem faced by most schools, applying AI in everyday life. If successful, this could provide proof of concept that could be used by other institutions as a template to improve technologies involving challenges in similar areas.

Background:

The research will try to reduce congestion and enhance safety at the Innovation Academy entrances using an AI model. Indeed, one of the biggest common problems regarding traffic congestion in many schools and urban areas is the optimization of flow, which has become critical to enhancing safety and reducing delays. Nowadays, several methods and technologies have been taken into consideration regarding traffic flow management, while a huge interest is focused on how AI can upgrade such solutions.

More interestingly, Rezaie and Ozkarahan (2023) researched integrating AI and machine learning into traffic management systems to further improve their effectiveness and precision. (Rezaie, R., & Ozkarahan, I. (2023). Smart city traffic management: A review. Journal of Emerging Science and Innovation in Technology, 4(2), 45-57.) Similar research has been conducted to illustrate how AI can predict traffic congestion and offer real-time solutions. For example, Smith et al. (2020) talked about how AI in this century has predicted and explained ways through which traffic congestion ~~that~~ can be dealt with and avoided in real-time (Smith, J., Johnson, K., & Williams, L. (2020). Machine learning applications in traffic congestion prediction. Proceedings of the AAAI Conference on Artificial Intelligence, 34(4), 567-574). This research supports the fact that AI is capable of a complete transformation of the entire function of traffic management due to its time-saving and accurate solutions.

The result of this study will have a big implication in the daily commute of students and staff, as well as parents of Innovation Academy. Such a model would allow efficient flow and reduced delays of traffic to maintain a safe environment for pedestrians and drivers. This can even be used as a blueprint for any school or institution facing such situations and thus helpful for AI in practical application in everyday life.

Primary beneficiaries would include students attending Innovation Academy, staff, and parents. The local communities and other educational facilities could also be able to benefit from the findings and methodologies developed in the study.

This is important research as it might provide a scalable solution to one of the most common problems. The congestion of traffic not only delays but brings danger to the pedestrians and to the drivers. If AI works on this problem, the study will potentially uncover methods for traffic management that would be safer and far more efficient than anything before. The study also illustrates how AI is used in real-life problem-solving, giving a glimpse into the transformative potential of this technology.

While there does exist some research on AI and traffic management, it is evident that there is a lack of focused studies involving educational institutions. Therefore, the paper tries to fill this gap through the development of an AI model that will cater specifically to school-specific traffic pattern considerations and challenges. The broad coverage of traffic optimization will be based on both existing and newly collected data throughout the study.

Method:

The main objective of the research will be the optimization of the flow of traffic, improving safety at Innovation Academy using an AI model. It is hypothesized that the AI-driven system would deal effectively with traffic congestion and improve pedestrian safety. This hypothesis has been supported by several pieces of literature that have shown the potential AI has in managing flow.

The AI model will be developed based on pre-existing traffic data collection and new data directly by observation and measurement. In this way, more comprehensive data can be set to reflect the traffic conditions precisely at Innovation Academy.

Traffic data should be gathered from historical data online and from local transportation agencies and past studies that documented the prevailing conditions of traffic in the area. More precise data can be collected from school staff who work on traffic at school. It will include the identification of traffic volume, peak hours, and congestion points. Observational studies will also be done at the school entrances during peak hours to record the real-time conditions of the traffic such as the number of vehicles, the movements of the pedestrians, incidents, or near misses observed.

A prototype model will be developed based on AI using machine learning algorithms. It will analyze the collected traffic data and predict the congestion points. The data will be clean and formatted for analysis. Then the model will be trained using a machine learning algorithm-a neural network pre-existing and newly collected data. This model will then evaluate the accuracy of predictions against the known conditions of traffic. After, some refining parameters can be imputed based on initial test results and retrain for better accuracy and extend the model to incorporate other features such as weather conditions or dedicated events that may enhance the predictive capability. Finally, validation of the model using another set of data and check its generalization capability for new unseen conditions in the traffic will take place.

A summarization of the collected data in terms of mean, median, and mode will be conducted to understand central tendencies. Apply statistical tests to check if there is a difference in traffic conditions pre- and post-the AI model implementation. Graphs and charts can be plotted showing the pattern of traffic flow as well as the performance of the AI model in optimizing the flow. The performance metrics of the AI model can be evaluated on accuracy, precision, and recall.

Just recently, Boston started to work with Google to optimize traffic signal timing and flow in highly congested areas. This project called Green Light, started in mid-august. Statistics show that with the help of AI, stop and go traffic has been reduced by 50% and cities around the world that use Project Greenlight reported that emissions have been reduced by 10%. Hopefully, this research project will be recognized along with Project Greenlight.

This study, hopefully, will offer a practical solution that can be scaled to manage school traffic sustainably to minimize occurrences of accidents and congestion. The use of AI in this project will, additionally, help the model to be adopted by other schools and communities facing a similar problem.

Intelli\_Avutec. (2024, April 10). *Traffic data collection: methods, analysis, and applications - AVUTEC*. AVUTEC. https://avutec.com/traffic-data-collection-methods-analysis-and-applications/

Nawaz, S. J., Sharma, S. K., Wyne, S., Patwary, M. N., & Asaduzzaman, M. (2019). Quantum Machine Learning for 6G communication Networks: State-of-the-Art and Vision for the Future. *IEEE Access*, *7*, 46317–46350. https://doi.org/10.1109/access.2019.2909490

Zhang, J., Zheng, Y., & Qi, D. (2017). Deep Spatio-Temporal Residual Networks for Citywide Crowd flows prediction. *Proceedings of the AAAI Conference on Artificial Intelligence*, *31*(1). https://doi.org/10.1609/aaai.v31i1.10735