Traffic Congestion Solved with AI

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Research Question

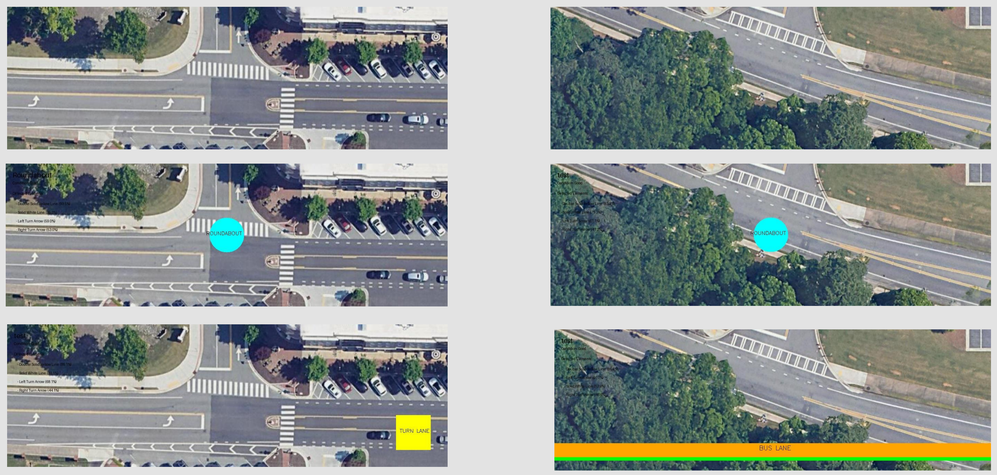
How can AI optimize the traffic flow and safety at the entrances of Innovation Academy during peak hours?

Introduction

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.

Methodology

Artificial intelligence (AI) provides innovative solutions to optimize traffic flow and enhance safety at Innovation Academy's entrances during peak hours. Initially, 76 road images were collected and annotated to highlight key features such as arrows, crosswalks, and road markings. A custom AI model was then coded to recognize these features using tools like TensorFlow and Python, with a convolutional neural network (CNN) architecture optimized for efficiency and precision. The system analyzes user input about road conditions and uses this data to generate actionable solutions for reducing congestion. To visualize these solutions, the AI creates a modified copy of the original image, showcasing potential traffic adjustments. The goal is to transform this model into a user-friendly website or app, providing an accessible interface for traffic management. Though not tested in a virtual physics lab, the AI has been trained and refined using annotated real-world images and observational data, ensuring practical applicability. Leveraging techniques like the Adam optimizer for adaptive learning, dropout layers to prevent overfitting, and multi-metric validation such as AUC and accuracy, the methodology ensures robust performance. Inspired by real-world initiatives like Boston's Project Green Light, which reduced stop-and-go traffic by 50%, this study highlights the transformative potential of AI in addressing traffic congestion and safety concerns. By integrating advanced technologies and observational data, the research aims to create scalable and efficient solutions not just for schools, but for broader applications in urban traffic management. If successful, this project could serve as a blueprint for institutions seeking AI-driven approaches to everyday challenges.



Results

The AI Traffic Optimization System successfully integrates computer vision and machine learning to analyze road conditions and propose targeted solutions for traffic congestion. By detecting road markings with a trained CNN model and considering various constraints, the system provides data-driven recommendations ranging from lane additions to signal optimizations. The visualization component effectively illustrates potential modifications, offering urban planners an intuitive tool for decision-making. While the current implementation focuses on static image analysis, future enhancements could incorporate real-time traffic data and dynamic scenario modeling for more comprehensive urban mobility solutions.

Conclusion