Abstract

The Advanced Road Analysis System is a groundbreaking initiative designed to develop next-generation infrastructure for precise road crack detection and accurate road sign interpretation. The implementation of state-of-the-art technologies offers an immersive and secure user experience that surpasses the capabilities of conventional navigation systems.

One of the key features of this system is its ability to detect road surface cracks and alert users as they approach them, thereby preventing potential damage to vehicles and infrastructure. The system employs advanced algorithms to identify and relay information regarding nearby road signs, enhance situational awareness, and aid in avoiding road violations.

To sum up, an Advanced Road Analysis System is a remarkable example of the convergence of advanced technology and user-centric design. It addresses critical issues related to road safety and infrastructure preservation and sets a new standard for intelligent and comprehensive road analysis systems.

- **Improve road safety:** By automatically detecting cracks, the system can alert authorities about potential road hazards, allowing for timely repairs and preventing accidents.
- **Enhance traffic management:** Automatic traffic sign detection can improve traffic flow and safety by ensuring signs are properly positioned and readable.

- *The methodology*: leverages computer vision with deep learning. YOLOv8, a state-of-the-art object detection algorithm, is used to analyze images and videos captured from real-world roads. The

- detected cracks and signs are then mapped using ArcGIS Pro, a GIS software, allowing for visualization, analysis, and sharing of the data.

- *This project successfully:* demonstrates the feasibility of using computer vision for road infrastructure analysis. By employing YOLOv8, the system achieves high accuracy in crack and traffic sign detection. Mapping the detections with ArcGIS Pro provides valuable insights for infrastructure maintenance and traffic management. While the project builds upon existing research, it offers advancements by utilizing the latest YOLOv8 model, known for its improved speed and accuracy.

Table of content

Keywords

0.1. Main keywords used:
- *Computer Vision (CV)*
- *Deep Learning (dl)*
- *Object Detection*
- *YOLO (You Only Look Once)*
- *ArcGIS Pro: A geographic information system (GIS)*
- *Traffic Sign Detection*

0.2. General:
- *road crack detection*
- *sign recognition*
- *data collection*
- *data augmentation*
- *model architecture*
- *convolutional layers*
- *pooling layers*
- *training parameters*
- *learning rate*
- *batch size*
- *epochs*
- *early stopping*
- *learning rate decay*
- *model evaluation*
- *precision*
- *recall*
- *F1 score*

- *graduation project report*

0.3. Economic and Safety:
- *economic costs*
- *safety costs*
- *road crack problems*

0.4. Economic and Safety:
- *existing solutions (mentioned but not specified)*
- *limitations (mentioned but not specified)*

0.5. Existing Solutions:
- *ethical considerations*
- *user privacy concerns*

0.6. Future Applications:

- *potential future applications*
- *autonomous vehicles*
- *functionalities*