

Real-Time Pothole Detection Using Deep Learning

Project Overview

This project presents a deep learning-based approach to detect potholes in real-time using the ResNet50 model with transfer learning. The goal is to improve road safety by integrating the detection system with navigation platforms or autonomous driving features to alert drivers of upcoming potholes.

Motivation

Potholes pose a major threat to road safety and vehicle health. Manual detection is time-consuming and inefficient. This system automates pothole detection using computer vision and deep learning to make real-time road hazard alerts feasible and reliable.

Objectives

Develop a CNN-based model (ResNet50) tailored for pothole detection. - Implement real-time image/video input processing. - Achieve high accuracy, precision, and recall compared to existing methods. - Integrate with smartphone or vehicle systems for real-time alerts.

Technologies Used

Python

TensorFlow / Keras

OpenCV

ResNet50 (pretrained on ImageNet)

Kaggle Dataset for potholes

Google Colab (or Jupyter Notebook)

Model Performance

Training Epochs: 50

Accuracy Achieved: 92.6%

Evaluated on real-world images of potholes and plain roads

Includes graphs for accuracy and loss over epochs

How to Run

1. Clone the repository: `git clone https://github.com/manishankarreddy1/real-time-pothole-detection-using-deep-learning.git` `cd real-time-pothole-detection-using-deep-learning`
2. Install dependencies: `pip install -r requirements.txt`
3. Run the notebook: `jupyter notebook pothole_detection.ipynb`
4. Load the pretrained model and test it using your own images or sample data.

Future Work

Integrate the model into real-time drone footage or vehicle-mounted cameras.

Improve detection under poor lighting or weather conditions

Expand the dataset for better generalization.

Add GPS tagging to pothole locations for smart city integration.

Testing & Evaluation

The model was tested on both pothole and normal road images.

Achieved 92.6% accuracy using ResNet50 pretrained on ImageNet.

Evaluation included both visual inspection and classification metrics.

Conclusion

This project demonstrates a practical application of deep learning in the field of road safety. By leveraging transfer learning and real-time image processing, our system can accurately detect potholes and serve as a valuable component for smart transportation systems.