

CSL7360: Computer Vision Major Project

Comparative Analysis of Traditional and Deep Learning Approaches for Road Pothole Detection

Group# 40

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Dataset

- Used Pothole Detection Dataset available in Kaggle
 - <https://www.kaggle.com/datasets/atulyakumar98/pothole-detection-dataset/data>
- Contains two type of images - Normal and Potholes
 - 'Normal'
 - **352** images of smooth roads
 - Captured from various angles
 - 'Potholes'
 - **329** images of roads with potholes
 - Includes different sizes and perspectives

Traditional Computer Vision Based Solution

ORB + SVM

- Uses ORB to extract keypoint-based features from grayscale images
- Builds a visual vocabulary using K-Means clustering on descriptors
- Represents images as histograms of visual words (Bag of Words model)
- Trains an SVM classifier to distinguish between normal and pothole images

SIFT + SVM

- Uses SIFT to extract scale-and rotation-invariant features
- Constructs a Bag of Words representation using K-Means clustering
- Each image is converted into a fixed-size feature vector (histogram)
- An SVM classifier is trained on these vectors for binary classification
- More accurate than ORB in many cases but computationally heavier

Deep Learning Based Solution

Convolutional Neural Network (CNN)


- Learns spatial features using convolutional layers
- Uses 3 conv layers (32→64→128) + max pooling
- Dense layers handle binary classification
- Good at detecting potholes from different angles.
- Robust to lighting, size, and noise variations.

Compact Convolutional Transformer (CCT)

- Combines CNNs (local features) with Transformers (global context)
- Convs reduce input size, making it lighter than Transformers
- Performs well even on small datasets
- More efficient than pure transformers
- Great for complex tasks like pothole detection, capturing both details and context

Steamlit Application

Comparative Analysis of Traditional and Deep Learning Approaches for Road Pothole Detection

 Upload a road image...



Drag and drop file here

Limit 200MB per file • JPG, JPEG, PNG

Browse files



60.jpg 108.8KB



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Uploaded Image



Model Predictions



Traditional Model 1 (SVM
+ ORB)

Prediction: POTHLES

Confidence: 63.73%



Traditional Model 2 (SVM
+ ORB Variant)

Prediction: POTHLES

Confidence: 63.73%



Baseline CNN Model

Prediction: POTHLES

Confidence: 66.60%



Custom CCT Model

Prediction: POTHLES

Confidence: 77.57%

Evaluation Results

Sample Images		ORB + SVM	SIFT + SVM	CNN	CCT
Pothole Img 1	Prediction	POTHLES	POTHLES	POTHLES	POTHLES
	Confidence	89.88%	94.56%	91.64%	88.11%
Pothole Img 2	Prediction	POTHLES	POTHLES	POTHLES	POTHLES
	Confidence	60.80%	98.67%	56.73%	78.01%
Normal Img 1	Prediction	NORMAL	NORMAL	NORMAL	NORMAL
	Confidence	94.65%	75.63%	99.72%	97.95%
Normal Img 2	Prediction	NORMAL	NORMAL	NORMAL	NORMAL
	Confidence	92.93%	75.63%	99.84%	99.90%

Demo

Thank You