1 Group Id

30

2 Project Title

Car Damage Detection Using Computer Vision

3 Project Option

Internal Project

4 Internal Guide

Prof. Priti B. Warungse

5 Sponsorship and External Guide

NA

6 Technical Keywords (As per ACM Keywords)

1. Car Damage Detection
2. Convolutional Neural Networks (CNNs)
3. Supervised Learning
4. Vehicle Damage Assessment
5. Deep Learning
6. Image Processing

7 Problem Statement

In the automotive industry, timely and accurate assessment of vehicle damages is crucial for insurance claims and repair processes. However, the manual inspection of vehicles for damages is time-consuming, subjective, and often prone to errors. The challenge is to develop an automated car damage detection system using machine learning and computer vision techniques.

8 Abstract

- This research paper presents a comprehensive framework for car damage detection using deep learning techniques. The proposed system aims to address the critical need for accurate, efficient, and automated methods for assessing vehicle damage, with potential applications in insurance claims processing, vehicle maintenance, and accident analysis.The project leverages a state-of-the-art convolutional neural network (CNN) architecture, specifically ResNet, for its superior feature extraction capabilities and classification performance. The deep learning model is trained on a carefully curated dataset of vehicle images, annotated with labels indicating the presence and severity of damage. The project undergoes rigorous testing and validation to assess its accuracy, precision, recall, and F1-score. User feedback and user experience evaluations are considered for continuous improvement. The resulting system demonstrates the potential to significantly streamline car damage assessment processes, reduce human error, and expedite insurance claim settlements. The project undergoes rigorous testing and validation to assess its accuracy, precision, recall, and F1-score.

9 Goals and Objectives

- Develop a robust machine learning model for accurate detection of vehicle damages. Gather and annotate a diverse dataset of vehicle images to train and validate the model. Integrate advanced computer vision techniques for efficient image analysis. Optimize the model to enable real-time processing and immediate damage assessment. Enhance model accuracy through continuous fine-tuning and feedback loops. Integrate the system seamlessly with existing processes and workflows. Design an intuitive user interface for easy interaction and result interpretation.

10 Relevant mathematics associated with the Project

System Description:

- Input: Images of damaged vehicles for analysis.
- Output: Detected and classified car damages (e.g., dents, scratches) with their locations and severity.
- Data Structures: Image representation using matrices (pixels and color channels). Lists or arrays to store and manipulate image data. Trees or graphs to represent hierarchical features.
- Functions : PreprocessImage(image): Preprocesses the input image for analysis (e.g., resizing, normalization). DetectDamage(image): Detects damage within the image using computer vision techniques. ClassifyDamage(damage): Classifies the detected damage based on severity and type.
- Mathematical formulation
    1. Let I be the input image, D be the detected damages, C be the classification result, TP be true positives, FP be false positives, and FN be false negatives.
    2. D=DetectDamage(I)
    3. CS=ClassifyDamage(D)
- Success Conditions: Accurate detection and classification of car damages. Efficient parallel processing with minimal time and resource usage. Reliable preprocessing leading to improved damage detection accuracy.
- Failure Conditions: Inaccurate detection or misclassification of car damages. Excessive processing time or resource utilization, causing delays. Preprocessing errors affecting damage detection results.

11 Names of Conferences / Journals where papers can be published

- IEEE/ACM Conference/Journal 1
- Conferences/workshops in IITs
- Central Universities or SPPU Conferences
- IEEE/ACM Conference/Journal 2

12 Review of Conference/Journal Papers supporting Project idea

1. M. Chen, F. Bai and Z. Gerile, "Special Object Detection Based On Mask Rcnn," 2021 17th International Conference on Computational Intelligence and Security (CIS), 2021, pp. 128-132, doi: 10.1109/CIS54983.2021.00035

2. M. Ye et al., "A Lightweight Model of VGG-16 for Remote Sensing Image Classification," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 14, pp. 6916-6922, 2021, doi: 10.1109/JSTARS.2021.3090085.

3. H. Bandi, S. Joshi, S. Bhagat and A. Deshpande, "Assessing Car Damage with Convolutional Neural Networks," 2021 International Conference on Communication information and Computing Technology (ICCICT), 2021, pp. 1-5, doi: 10. 1109/ICCICT50803.2021.9510069.

4. P. M. Kyu and K. Woraratpanya, "Car Damage Detection and Classification," in Proceedings of the 11th International Conference on Advances in Information Technology, Bangkok Thailand, Jul. 2020, pp. 1-6, doi:10.1109

5. H. Patel, "hemilpate1971/Damage-car-detection," GitHub, Aug 13, 2019. https://github.com/hemilpate1971/Damage-car-detection (accessed Feb. 10, 2021).

13 Plan of Project Execution

1. Project Initiation
2. Research and Requirements Analysis
3. Data Collection and Preparation
4. Model Selection and Development
5. Training and Validation
6. Integration with APIs
7. User Interface Development
8. Testing and Quality Assurance
9. Deployment