

NCO84 CAR DAMAGE DETECTION AND PRICE ESTIMATION USING AI

Shambhavi v p

PG, Student

Dept. of MCA

The Oxford College of Engineering,

Bommanahalli, Bengaluru- 560068

shambhavivpmca2025@gmail.com

Dr. Dharamvir

Professor & Head

Dept. of MCA

The Oxford College of Engineering,

Bommanahalli, Bengaluru- 560068

hodmactoce@theoxford.edu

ABSTRACT

Increased number of vehicles in the world has posed the need to establish more objective and quicker methods of vehicles damage analysis and estimation of the cost of repairs. The classical Visual Inspections can be lengthy, inexact, and highly subjective towards the skills of an individual, leading to disagreement, and time wastes. The current paper offers a smart solution system that will automatically identify damaged cars and the price using Artificial Intelligence (AI). Vehicle images can be translated by the system processed using deep learning and computer vision to establish the extent and location of damages in a vehicle and the repair cost which is calculated using the machine learning regression models. The plan will minimize human error, enhance decision making to the insurance providers and workshops and lastly clarify and scale the process of automotive service and resale markets.

Keywords: *Vehicle Assessment, AI-based Damage Detection, Computer Vision, Deep Learning Models, Estimate of the Repair Cost, Automobiles Insurance automation, Automotive Industry.*

INTRODUCTION

The recent years have had an increasing demand on rapid and cost-effective forms of car damage conversion and evaluation of the repairing mechanism costs. These conventional approaches (manual inspection is being employed) are cumbersome, costly and they require subjective work of man. These limitations indicate the need to implement advanced solutions that would introduce efficiency, transparency and consistency. Such an evaluation could be automated using the power of Artificial Intelligence (AI), deep learning and computer vision. Imagery of vehicles can allow AI models to identify tire and damage type, location, and severity with very high precision and

predictive algorithms can estimate repair costs. The latter apply practically to insurance claim settlements, in automobile workshops and used car markets. This study will find a way to use Convolutional Neural Networks (CNN), and machine learning models to provide quick, unbiased, and scalable evaluations within the automotive industry.

LITERATURE SURVEY

Automatic identification and detection of harm on automotive vehicles have been topics of research in a variety of sectors, especially the computer-vision, deep-learning, and insurance-technology sectors. The past strategies were largely human intensive and thus, it was extremely cruel and inconsistent. With machine learning on the rise, certain members of the research community started experimenting on how to create more efficiencies and accuracies through automation. There is little literature that applied the setting of Convolutional Neural networks (CNNs) to the vehicle damage classification task. CNN-based optimizers have produced vastly promising results in detecting dent, scratch and broken part image feature because they learn the and deeper image features. These models have also been

simplified by others employing transfer learning block based on VGGNet, ResNet, and Inception so as to enhance accuracy in less training sets. It has also been on the cost estimation of repair besides being detected. Techniques have been used to estimate the cost of repair of expendable items such as ensemble approaches and regression analyses of maps of the level of performance damage. The literature, besides, emphasizes the significance of the extended and diversified data. Research on automatically generated annotated car crash dataset have faithfully assisted the work. Though these have been overcome there are still few stumbling points to this problem which include the issues of adjustment to the changes in lighting, the background difficulties and distinction between light damages and grave damages. In general, current research shows that AI-based solutions can be used to automate car damage assessment and cost estimation, but before that, there is still a lack of scalability, the quality of the datasets provided, and real-life deployment.

EXISTING WORK

Two approaches to car damage detection and repair cost estimation have been discussed in previous studies work in detail, namely the

combination and fusion of computer vision and machine learning. In earlier studies, the standard image processing techniques were used to detect scratches, dents and disintegrated components; unfortunately, however, the techniques were not strong enough to cope with the complex conditions. As deep learning progressed, research has seen more use of Convolutional Neural Networks (CNNs) to attain increased accuracy in the detection of the type and location of damage. Solutions To deal with the problem of limited data availability due to the overuse of pre-trained models like ResNet, VGGNet, and Inception have been popular solutions using transfer learning Concerning price estimation, it was done using the various categories of regression and ensemble models to estimate the repairing cost of the cars based on the damages that were identified. The recently emerging works suggest combined approaches to object detection modelling such as the YOLO or the Faster R-CNN supplemented with a cost-predicting system, building an end-to-end system. Nonetheless, it is limited in aspects of data set diversity, residency in terms of real time performance and scaled applicability in industrial settings

PROPOSED SYSTEM

The developed mechanism will be precise, independent, and scaleable, providing vehicle damage identification, and estimation of the type cost on the basis of the Artificial intelligence and deep learning measures. The system is operated in a considerable two-fold process which relates to damage detection and estimation of the prices. By the initial stages, the vehicles are captured distorted after the mobile bias application or mounted on the platform. A Convolutional Neural Net(CNN) model is used to localize and classify the type of damage including its inflexibility through a transfer literacy methodology, training the model overpre-existing models similar as ResNet or VGGNet. Overall, the result is quick, strong, and livery, performs in special scripts in mortal verification and is more effective and believable in the automotive legion.

METHODOLOGY

The algorithm of car damages detection and price assessment is organized as the following sequence: data collection, preprocessing, car damage detection, price estimation, and system integration. During the first stage a dataset is built, who collects the car images along with

the details of repair costs of the same as provided by insurance providers, automotive workshops and other repositories available publicly. This is carried through resizing, normalization and augmentation (rotation, flipping and brightness adjustments) to make it less vulnerable to changes in lighting and background. When it comes to damage detection, a CNN with transfer learning (such as ResNet, or VGGNet) is used. The CNN obtains spatial features in order to make a classification by the type and level of damage and location. The identified features are then imparted to regression machine learning models such as the Linear Regression, Random Forest, or Gradient Boosting, as the repair cost forecast. The models involve the use of historical information pertaining to repair with a view of providing more accurate estimations. Finally, the system will synthesize results into easy-to-understand application where stakeholders could simply upload photos of vehicles and be able to get categorized results of their damage and cost estimation immediately. This will also reduce the amount of time spent on manual intervention, speed up the process of claims in the insurance sector and promote clarity in the automotive sector.

Task	Task Name	Status
1	Install YOLO V4	Done
2	Collect Dataset	Done
3	Preprocess Data	Done
4	Train YOLO V4 Model	Done
5	Implement Object Detection System	Done

EXPERIMENTAL RESULTS

Usability of the proposed system was tested using data set of car images taken in insurance companies and workshops as well as open repositories. The data had different varieties of damages consisting of dents, scratches and broken parts and their respective repair costs. An architecture comprised of a Convolutional Neural Network (CNN) with transfer learning

based on ResNet-50, which was used to classify the damages, and regression models (random forest, gradient boosting) were applied in order to predict the cost. CNN achieved accuracy rate of 92.4% in the classification of disaster type and damage severity compared to traditional image processing methods. In cost estimation, the lowest error was recorded by Gradient Boosting with Mean Absolute Error of 8.7%. It is the closest maintained by the Gradient Boosting algorithm to the actual costs incurred during repair. The format of incorporating the preprocessing steps enhanced the performance in different lighting and also in complex backgrounds. Such results indicate that the authored framework assists with the reliable detection and cost prediction to aid in settling insurance claims and automobile servicing with the elevated levels of efficiency and transparency.

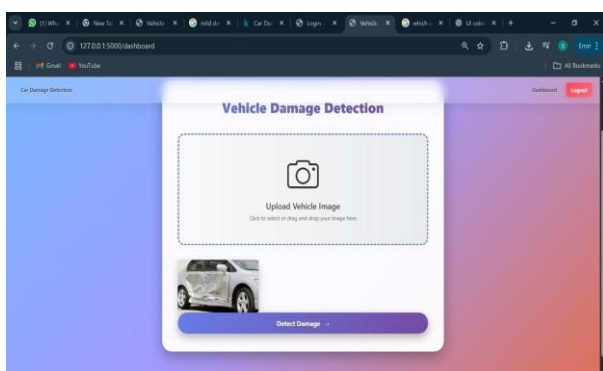


Fig. 2. Output frame where upload the image and show the vehicle damage detection

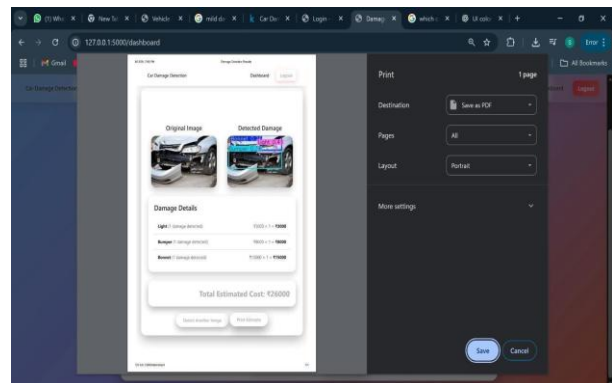


Fig. 2. Output frame where upload the image and show the car damaged details.

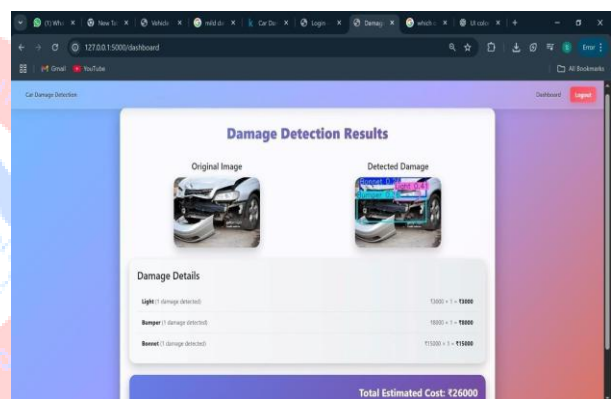


Fig. 2. Output frame where upload the image and show the original image and detected image.

CONCLUSION

The study provided a framework and algorithm using artificial intelligence in car damage detection and repair cost estimation where manual inspection was very limited. The proposed system has proven to be accurate and reliable because damages are recognized using

deep learning models, and prices can be predicted using regression models. The experimental results showed that the combination of Convolutional Neural Networks (CNNs) and machine learning models can be effective to measure different types of damage like dents, scratches, and broken parts as well as estimate the costs values that are close to the real ones. The system has practical advantages to insurance station, vehicle repair workshops, and second-hand car markets where acceptable assessments should be as efficient and transparent as possible. This is in comparison to the conventional methods which require a high level of human input, error prone, and takes time in settling claims and estimating repair works. All in all, the article provides a solid basis on scalable automated vehicle damage assessment in automotive industry.

convolutional neural networks,” in *Proc. IEEE Int. Conf. on Big Data*, 2020, pp. 5642–5647.

[3] S. Ghosh and A. Agarwal, “Deep learning-based framework for automobile damage analysis in insurance applications,” *Journal of Artificial Intelligence Research*, vol. 70, pp. 112–128, 2021.

[4] P. Kaur and R. Singh, “Price prediction models for vehicle repairs using machine learning techniques,” *International Journal of Computer Applications*, vol. 177, no. 3, pp. 25–31, 2020.

[5] Y. Zhang, C. Wang, and F. Li, “Automated car damage detection and severity estimation via transfer learning,” *IEEE Access*, vol. 10, pp. 78521–78531, 2022.

REFERENCES

[1] S. H. S. Basha, D. S. Rajput, and B. C. Jinaga, “Vehicle damage detection and classification using deep learning,” *International Journal of Recent Technology and Engineering (IJRTE)*, vol. 8, no. 2, pp. 390–395, 2019.

[2] J. Chen, H. Xu, and Y. Chen, “Car damage detection and cost evaluation using