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CAR DAMAGE DETECTION AND PRICE PREDICTION USING DEEP LEARNING

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Abstract - *Auto insurance processing using images is a critical industry with a lot of room for automation. In this study, we will look at the topic of car damage detection. Vehicle damage detection. Using pictures taken at the scene of an accident can save time and money when filing insurance claims, as well as provide more convenience to drivers. Artificial intelligence (AI) in the sense of machine learning and deep learning algorithms can help solve problems. A transfer learning-based vehicle damage detection technique and a regional convolutional neural network (Mask RCNN) mask are used to quickly solve accident compensation problems. Algorithms identify the damaged part of the car, determine its location, and then estimate the severity of the damage. Very satisfactory results were obtained using transfer learning using available models that were trained for the more general challenge of object identification.*

Key Words: **Car Damage Detection, Machine learning, Prediction, VGG16, Transfer Learning, Deep Learning, Price Prediction**

1. INTRODUCTION

Today, one of the first businesses to invest in innovation, cutting-edge technology, and artificial intelligence (AI) is the insurance industry. Car insurance companies spend millions of dollars each year due to evasion of insurance claims in today's society where the number of car accidents is on the rise.. In the insurance industry, Artificial intelligence (AI) based on machine learning and deep learning can assist with challenges including data analysis and processing, fraud detection, risk reduction, and claim automation. As a result, insurance companies have sought to reduce the time it takes to analyze damage and settle claims. However, developing current applications to solve these problems remains difficult, especially when using deep learning to assess car damage. Deep learning is an effective method for tackling complicated problems, but it necessitates more resources for model building, i.e., deep learning demands a large dataset and takes longer to compute. There are no publicly available datasets for automobile damaged photos because car damage assessment is a specialized topic. The hardest part of training a model is doing it with a small data set. However, in this instance we use a dataset format called COCO format. Using a Mask RCNN algorithm on a small COCO dataset has also shown precise results. Detectron2 which is one of the open-source python library from Facebook provide pre-trained model has been used. The Mask RCNN method is used in the paper to detect and segment damaged areas of cars. It has a lot of research value and a lot of application scenarios in the transportation area. Due to the complexity of automatic damage detection and segmentation, issues such as reduced segmentation and lower detection speed exist. The Mask RCNN is applied to the field of this research, and a model for detecting and segmenting a vehicle's damaged region in an accident is proposed. Insurance companies can also use this model to quickly process insurance claims.

Risk Analysis:

Image size - The security of the application depends upon the size of the image. If we use images of small size then the options for selecting the pixels is less, this reduces the time required to decipher the key from the image. The number of pixels in an image with height h and width w is w*h. The intruder or attacker has to check all the combinations of choosing the pixels from the image to decipher the key from the image. By increasing the size of the image, we can increase the security of the application.

2. LITERATURE REVIEW

A previous study [1] has used pre-trained deep learning models, MobileNet and YOLO, and have been applied on a customized vehicle damage dataset. YOLO algorithm is used for detection but YOLO's full utilization is in classifying multiple objects. In this case, only a single object i.e. car is to be detected where VGG-16 can be used.

Another study by Umer Waqas, Nimra Akram, Soohwa Kim, Donghun Lee, Jihoon Jeon [2] uses algorithm to classifies three types of vehicle damage categories which include medium damage, huge damage or no damage. Also, metadata analysis and moiré effect detection is used to verify the authenticity of the images uploaded by users.

In [3], an insight to further more improvement is suggested. Robust Mask RCNN algorithm is utilized which improves on previous work yet is still lacking in few areas. For example, the detection accuracy is very high, but the mask instance segmentation cannot be completely correct, and some areas in which the damage is not obvious cannot be segmented.

Another paper [4] proposes a deep learning-based solution for car damage classification. Since there was no publicly available dataset, they created a new dataset by collecting

images from web and manually annotating them. Experimented with multiple deep learning-based techniques such as training CNNs from random initialization, Convolution Autoencoder based pre-training followed by supervised fine tuning and transfer learning.

3. PROPOSED SYSTEM ARCHITECTURE

The different steps which will be carried out in order to create and use different classifiers and get most probable results. Out of the different results and accuracies produced by different Machine Learning models, we will utilize the best model with the best accuracy for Car damage detection and price prediction. System Architecture will give us an overview of the working of the system.

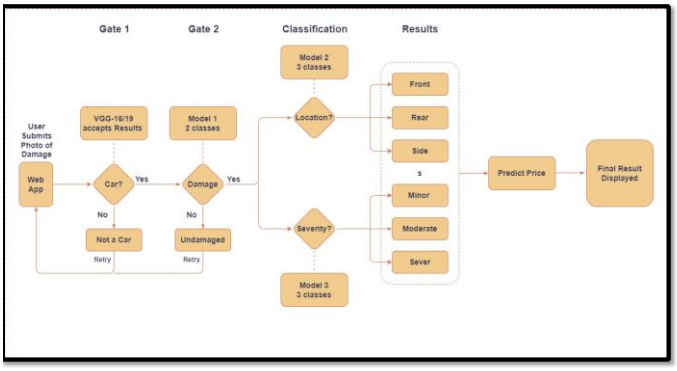

Fig. 1: Car Damage Detection Architecture

Web App:

Here users can upload images of the damaged car or any random images which will be processed by our algorithm using the GUI which is created using HTML, CSS, Bootstrap and integrated by flask.

Module-1:

In this module, VGG-16 is used to detect whether the uploaded image is a car or not..

Module-2:

Here, car damage is detected using VGG-16, VGG-19 and ResNet-50. The model that gives us the most accuracy is considered..

Module-3:

The side of the vehicle where the damaged is incurred i.e. In the rear part, front part or side part is identified using this module.

Module-4:

The damage level is further decided in this module. The level of damage is decided by data visualization using heat maps. A heatmap is a two-dimensional visual representation of data where values are color-coded, providing a convenient and insightful view of information.

Module-5:

Depending on the damage, the location of the damage and the model of the car, the cost of repairing the damage will be predicted.

4. PROJECT DESIGN

The below figure 2, represents the Data Flow Diagram of proposed system. The customer/user uploads the image of car. Then that image is processed and the report of damage is generated and it is sent back to the user.

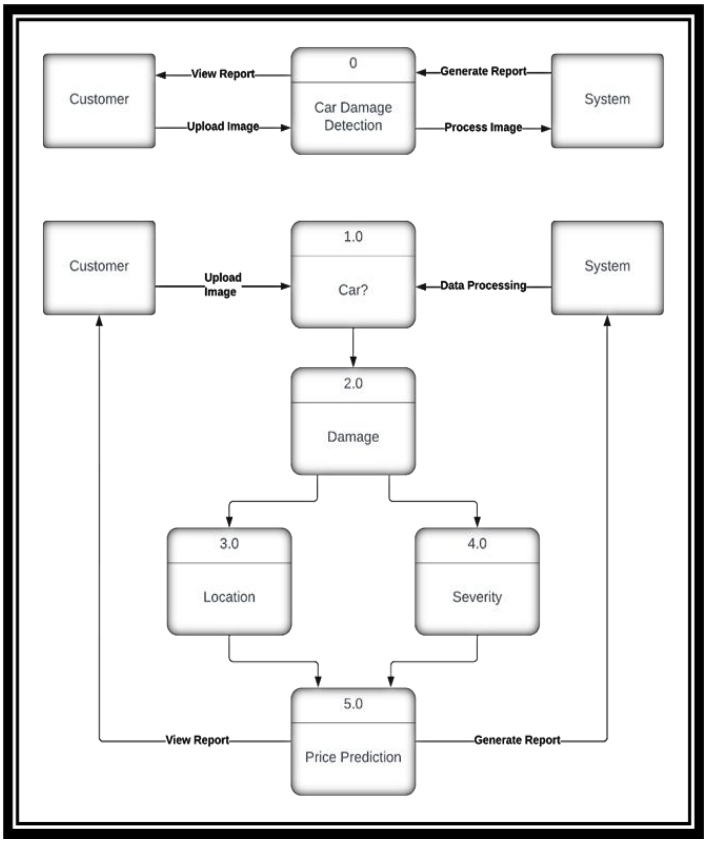

Fig- 2: Data Flow Diagram

Here, the first module detects whether the uploaded image is of car or not. If the car is not detected then it returns back to the initial stage. And if car is detected then further modules take place. The next module detects whether the uploaded image of car has damage or not. If the damage is not detected then it returns back to initial stage. Once the damage is detected, further modules detects location (front, side, back) and severity (minor, moderate, major). Above modules will help in predicting the price.

5. GUI AND EXPERIMENTAL RESULTS

User Interface has been developed.

Also the first module which detects the car has been integrated using flask.

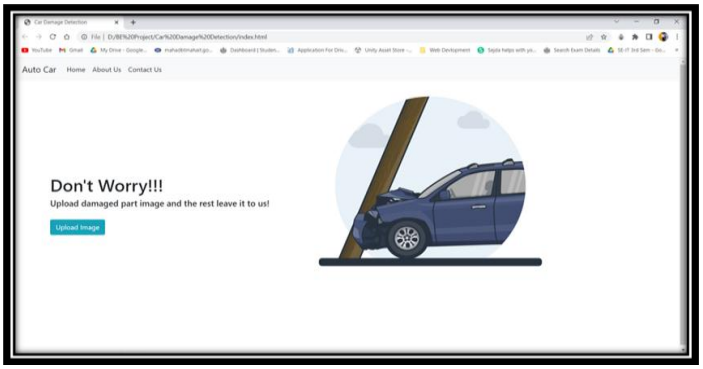

Fig- 3: Home Page

Home page provides basic interface with the option showing Upload Image.

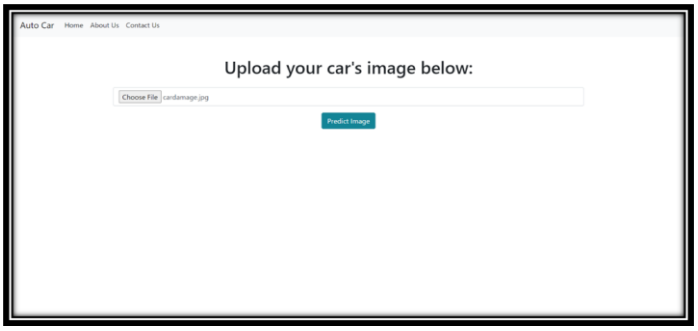

Fig- 4: Interface to upload image

After clicking on Upload Image on Home Page, option is given to upload image and predict that image is of car or not.

Here, the data of the first module which detects whether the uploaded image is of car or not is integrated.

The first module is trained using VGG-16.

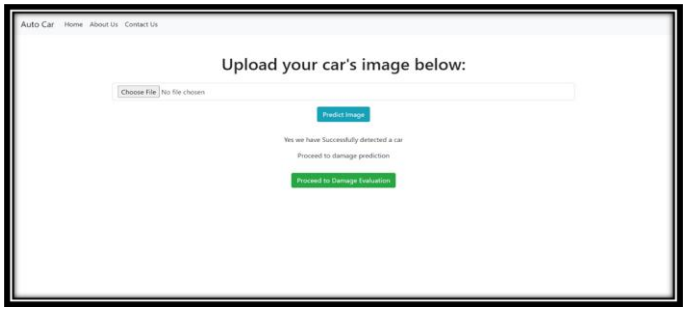

Fig-5: Car Detected

Fig 5 shows that the uploaded image is of car.

Once the car is detected, it will direct user to next step i.e. Damage Evaluation.

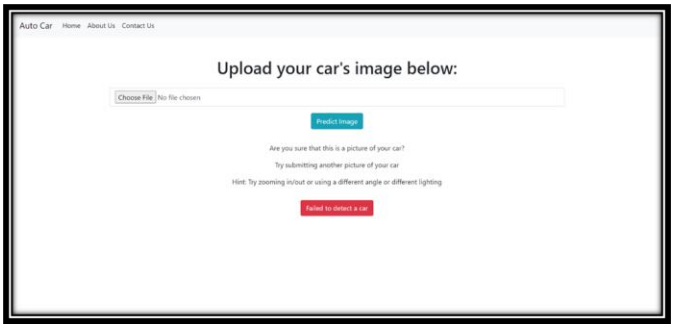

Fig- 6: Car not detected

Above fig 6 shows when the uploaded image is not of car.

If the car is not detected then user is recommended to retake photo and then upload again.

6. IMPORTANT LIBRARIES /PACKAGE

KERAS: A Python interface for artificial neural networks is provided by the open-source software package known as Keras. The TensorFlow library interface is provided by Keras.

TensorFlow: TensorFlow is an open-source, free machine learning and artificial intelligence software library. Although deep neural network training and inference are given specific attention, it can be used for a variety of tasks.

VGG-16 and VGG-19: VGG stands for Visual Geometry Group; it is a standard deep Convolutional Neural Network (CNN) architecture with multiple layers. VGG-16 and VGG-19 consisting of 16 and 19 convolutional layers respectively.

ResNet-50: It is a Convolutional Neural Network (CNN) that is 50 layers deep. Here, we can load a pretrained version of the network trained on more than a million images from the ImageNet database

7. CONCLUSION

To deal with the compensating problem of damaged autos, the model proposed here employs, a deep learning-based detection technique for vehicle-damage identification. The suggested approach of transfer learning-based damage detection of the vehicle is generic after testing, and can also better adapt to the diverse elements of damaged car images. Despite the model's training on a very short dataset, successful outcomes were obtained. Data extension can be done in the future to raise the dataset's size, gather additional automobile damage images under various degrees of illumination and weather conditions, enrich the data, the

edge contour enhancement of images can be improved and the damaged parts of the car can be masked more accurately. Also, the model can be further enhanced to predict the repair price of the damaged area by extracting the predicted part details like the segmented mask area.

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