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Car Damage Detection and Analysis Using Deep Learning Algorithm For Automotive

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Abstract **- Images and its processing form a vital part of understanding of the world around us. Therefore incomplete images make it unable for us to detect and analyze the premise of the picture. This is of no use to us, but today's machine learning platforms are capable of restoring the lost or corrupted parts of such images, making it easier to understand the context behind the scenes and efficiently analyze the pictures taken. In painting Extrapolation can be done by propagation of local structures into the unknown parts, in order to construct the missing part's one pixel (or patch) at a time, while maintaining consistency with the neighborhood pixels. This application of deep learning is used in the car damage detection and extraction of original features before the incident for timely insurance claims.**

Keywords **- Car damage, Extrapolation, Deep Learning, RCNN, Object detection.**

I. INTRODUCTION

In this paper we are suggesting an automated system that can classify the damaged vehicle and predict how the damage has occurred. Convolution Neural Network (CNN) can be used for understanding, detecting and analyzing various classes of damage in the minor and major parts of car. The damages can be of any types like bumper dent, door dent, glass shatter, head lamp broken, tail lamp broken, scratch and smash. CNN is used for object recognition task, in the proposed system it is being applied in the specific context of car damage recognition. Classification task is done on Damaged Vehicle dataset.

This dataset consists of images of different types of damaged vehicle. Mask RCNN is used for segmenting, decomposing and sub- dividing the various instances of Machine Learning. This allows us to separate different objects and give bounding boxes, classes and masks. Once after locating bounding boxes, it can be colored and individually extract the features. Custom Mask RCNN enables to detect the exact area of care damage for better claims from insurance companies.

II. LITERATURE REVIEW

Vehicle damage recognition and feature extraction of the damaged parts of the vehicle due to various obstructions and other oncoming vehicles is an important domain of object recognition and computer vision combined with deep learning techniques. Feature detection and description searches the digital image for interesting features. Scale Invariant Feature Transform is a feature is a feature detector and descriptor algorithm which ensures proper image irrespective of scale and rotation. Specific interest points are chosen and converted to a vector based values. These high-dimensional vectors are converted to single valued words to deal with the extracted content easily. Car recognition is a challenging problem, but one with many potential solutions. The non-deformable physical structure and unique local features are exploited for recognition. [1]

To accurately predict whether the given vehicle is damaged or not and thereby attracting the client such as insurance company to automate the process of insurance claiming for damaged vehicle we must show the potential of Convolution Network in the context of car damage detection. A predefined 3D computer-aided design model of damaged vehicle is registered over the photograph to check how the car would look like if it wasn't damaged. ConvNet is implemented to perform the task of car damage detection. ConvNets trained on the Image Net dataset using transfer learning. The result is the application of ConvNet with respect to car damage detection. This model can recognize the car and detect the damage. This system is successful in showing the potential of ConvNets in the context of Car Damage Recognition. ConvNets are good at fitting the training data but they often do not generalize well when the

image dataset of car damage is limited in size. When the labeling of the image is wrong then damage prediction also goes wrong. This model not only recognize the damaged car but it also detect the location, size and type of damage occurred. [2].

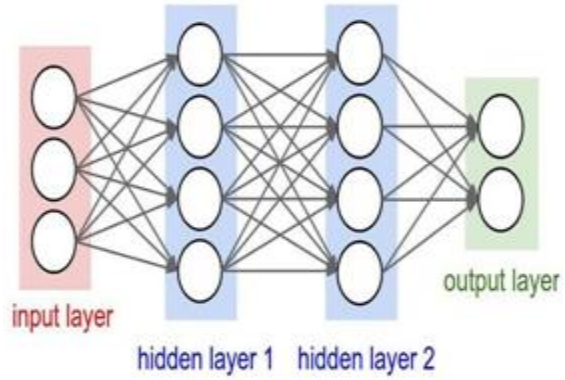

Fig.1. A three-layer neural network with three inputs, two hidden layers of four nodes each, and two.

To develop a system for accurate, quick and correct car insurance claim processing, and to classify the car damage types so that the actual claim payment can be calculated and thereby reducing the Claim Leakage. To perform the task of classifying car damage type, Convolution Neural Network based methods are used. CNN is pre-trained using auto-encoder followed by fine-tuning using transfer learning from large CNNs trained on ImageNet dataset.

Further to improve the accuracy Ensemble Method is built on pre- trained classifier. Successful in developing a Deep Learning based solution for car damage classification. It is observed that Transfer learning performs the best among all the other deep learning techniques used to train CNN. Since there are no publicly available dataset, it is manually annotated by collecting images from web. Car specific may not be effective for car damage classification. Damaged portion can be localized using the same approach. [3]

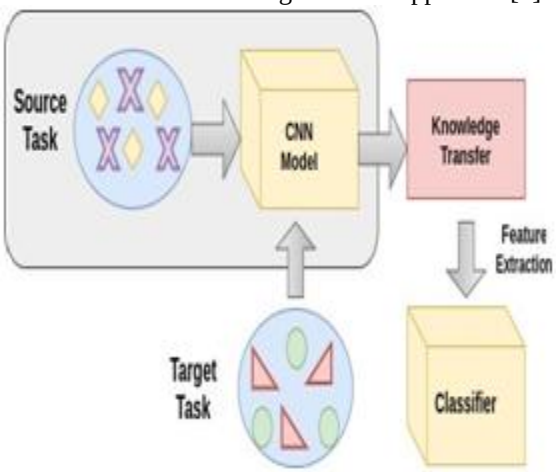

Fig.2. Transfer learning setup.

Now days claiming and settlement of vehicle insurance is done through online, where customers are allowed to upload the image of damaged vehicle taken using their mobile phones and request for claim. However there can be chance of repeated claim for same case which can be loss for insurance company. So the main objective is to develop an Anti-Fraud checking system to process the request and speed up the insurance claim process. YOLO detector is used as object detection framework. YOLO detects the damage on vehicle by learning features though regression in 4 coordinates. To extract local features, pre-trained VGG16 object recognition model is employed as a feature extractor. Global deep features and color histogram are present in Global feature. [4]

For damage parts detection advanced technologies in image analysis and pattern recognition is used. The first method is constrained object detection, where image processing techniques to detect the region of interest. The second method is region based image comparison, this method compares the images of the vehicle before and after the accident for identifying the areas which are damaged. The third method is shape based image comparison, where comparison of the images of the automobile happens in terms of their shape, in particular, their profiles or outer boundaries. This is done in the following three steps. Step1: object boundary extraction and coding. Step2: object boundary matching. Step3: damaged area identification. The fourth method is joint region and shape based image comparison we get the detection results from both region and shape based approaches, we add them together on the basis of an intersection and union criterion.[10]

Here novel application is applied. It uses technologies like advanced image analysis and pattern recognition to automatically identify and determine the class of damage. This application helps the auto insurance companies to speed up their claim process and to efficiently use the resources. The auto shops get the images during the regular maintenance services. The disadvantage is that the customers likes the idea of using the image analysis technique to detect the damaged parts of vehicle as they think it is neat and interesting but there are many challenges which needs to be addressed before its real world deployment. [5]

Objective is to investigate the vehicle frontal body damage detection using roadway surveillance camera images. It implements the deep learning technique and image classification methods to identify the vehicle status. First need to detect the vehicles within the raw images, secondly by using the cropped images it represents the deep features of the vehicle, finally by applying the classification operations to the damaged

vehicle. Average accuracy results of damaged and non-damaged class through SVM classifiers using reported features on test images. Here there is a distinct accuracy can be established between damaged and non-damaged class, so that it would not mislead overall performance results. It requires larger dataset for getting minimum accuracy results, many models need to encounter. [6]
System recognizes scratches in cars, by using Convolution neural networking. In order to achieve this we need to go for transfer learning technique. Implementing the Convolution neural networks, three things are required: Network architecture, Database and Training parameters. Based on the network, database and training parameters we can achieve the accuracy of the images, validations and precision of the images. By implementing the CNN architecture, it reduces the complexity in the development of quality of the physical damages in the vehicles. It analyses the area that did not correspond to the cars or the presence of dirt in the car will be confused with the scratches. [7]

Faster R-CNN is used to efficiently predict the object and object score at each position. Region proposal Networks method is used takes images as the input and produced the output as rectangular object, with an object score. This is based on the fully convolution network, and to compute with a Fast R-CNN object detection network. Optimization method is used to implement the fully convolution network, which can be trained in end-to- end by back propagation and stochastic gradient descent. Result is object detector which uses convolution layers in an efficient manner and primarily focuses on the exact detection mean Average Precision. It is an efficient object detector with high accuracy. But when testing boundary-crossing is not ignored it causes large error which is difficult to correct. [11]

Best Approach

1. **Extracting Region Of Interest (ROI)-** Image is passed to a ConvNet that returns the region of interest supported strategies like selective search(RCNN) then ROI pooling layer on the extracted ROI to makesure all the regions are of the same size
2. **Classification Task-** Regions are passed into a fully connected network which classifies them into different image classes. In our case, it'll be scratch ("damage") or background (car body without damage)
3. **Regression Task-** At last, a Bounding Box (BB) regression is used to predict the bounding boxes for each identified region for lightening the bounding boxes that is getting exact Bounding Box relative coordinate.

III. CONCLUSION

Automated detection of car exterior damages and subsequent quantification (damage severity) of those would help used car dealers (Marketplace) to price cars accurately and fast by eliminating the manual process of damage assessment. The concept is equally beneficial for property and casualty (P&C) insurers, in terms of faster claim settlement and hence greater customer satisfaction. Further after detection and masking of car damage, the process can help the car evaluators/claim settlement personnel in quantifying the damage severity, in terms of dimensions and approximate relative area of damage.[8] Convolution neural networks (CNN), the driver behind computer vision applications, are fast evolving with advanced and innovative architectures to solve almost any problem under the sun related to the visual system and Mask- RCNN is the next evolution of object detection models which allow detection with better precision and accuracy.[9]

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