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Intelligent Vehicle Damage Assessment and Cost Estimator for Insurance Companies

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ABSTRACT: The motor insurance sector loses a lot of money as a result of leakage claims. The gap between the amount actually paid for claims and the amount that would have been paid had all of the best that recognize in the industry been followed is known as underwriting leakage. These results have been reached using both testing and visual assessment. However, they do delay the processing of claims. By reducing loss adjustment costs, improvements in the First Notice of Loss and the speed with which claims are examined and evaluated might save a lot of money in the automobile insurance claims process.

Car damage is automatically identified and classified using advanced picture analysis and pattern recognition technology, a method for automatically locating the damaged area by comparing photos of the automobile from before and after an accident. This project proposed a CNN model that can recognize a car's damaged area. If users upload images, the model can evaluate damage (be it a dent or scratch from an object), and it can also estimate the extent of the damage. Insurance firms can handle claims more efficiently as a result. When accepting a car loan, particularly one for a used vehicle, lenders may also consider this model.

KEYWORDS: Leakage, CNN, evaluate damage, pattern recognition technology, Automobile insurance claims process.

I. INTRODUCTION

Claiming Insurance for your damaged vehicle is a hassle not only for the insured but for the insurer too. It involves paperwork and inspection that consumes time, yet it is necessary to avoid fraudulent claims. The whole process takes at least a week to finalize the repair cost, after inspection, from the mechanic.

we estimate the repair cost of damages from pictures of the damaged areas through machine learning using the past claims data for training that the insurance company already has. This will reduce inspection time and consequently claims can be processed faster.

Though it is absolutely necessary to perform thorough inspection for severe damages where internal parts are affected, minor/moderate damages that has only affected the external surface of the vehicle can avoid it by estimating the repair cost and save a lot of time both for the insured and the insurer.

Vehicles are significantly rising in today's globe. Because there are more cars on the road, accidents happen more frequently because individuals are driving them at high speeds. When an accident occurs, the people file a claim with their auto insurance for the necessary funds to repair the car, because of inaccurate claims, the corporation behaves improperly and doesn't make payments now. This occurs due to claims leakage, which is the discrepancy between the sums secured by the firm and the sums it should have secured in accordance with the claims. Even if the car's damage is easily seen, the claim procedure will take longer than usual in accordance with company policy. Despite the company's best efforts, there is a delay in the claims procedure.

Differentiate the suggested approach to perhaps speed up the process of assessing automotive damage. Instead of taking hours to accomplish automotive damage detection if it were visually inspected, a system may perform

it in a minute by just providing a picture of a damaged vehicle. The system can determine the analysis of the damage, the position of the damage, and the degree of the damage using machine learning and computer vision.

II. LITERTURE REVIEW

2.1 Existing Problem

Vehicle damage is becoming an increasing liability for shared mobility providers. The high number of driver handovers necessitates the use of an accurate and quick inspection system capable of detecting minor damage and categorizing it. To address this, a damage detection model is created that locates vehicle damages and categorizes them into twelve groups. Multiple deep learning algorithms are used to improve detection performance, and the effect of various transfer learning and training strategies is evaluated. The final model, trained on over 10,000 damage photos, can detect minor defects in various environments, including water and dirt. A performance evaluation using domain experts reveals that the model performs comparably.

Furthermore, the model is tested in a specially designed light street, demonstrating how strong reflections complicate detection performance.Because it is a manual procedure, resolving a claim in the accident insurance sector takes time, and there is a gap between the ideal and real settlement. We are using deep learning models to not only speed up the process, but also to deliver better customer service and boost insurance company profitability. In this paper, we use multiple pre trained models such as VGG 16,

VGG 19, Resnet50, and DENSENET to choose the top performing models. We first use the Resnet50 model to determine whether or not the automobile is damaged, and if it is, we utilize the WPOD-net model to identify the license plate. The YOLO model is used to detect the affected region. Finally, the damage severity is implemented using the DENSENET model. We discovered that transfer learning outperforms fine-tuning after applying multiple models. Furthermore, we present a framework that incorporates all of this into a single application, assisting in the automation of the insurance sector.

III. PROBLEM STATEMENT DEFINITION

In existing system, the procedure of making an insurance claim for an automobile is laborious, and there is a delay before the first reimbursement is authorized. Insurance firms lose millions of dollars each year due to claim leakage as a result of the expansion of the vehicle sector and the daily rise in the number of accidents. The discrepancy between the company's actual spending and what they should have really spent is known as claim leakage. Ineffective claim processing, erroneous payments, human error such as a lack of quality control or poor customer service or even claim fraud may be to blame for this. Auditing closed claim files is the only way to find claim leakage

3.1 Ideation & Proposed Solution

The empathy map canvas is used for the tools our team use to gain a deeper insight into our customers, an empathy map can represent a group of users, such as a customer segment the empathy map created to gain much popularity within the community. The Following figure represents the empathy map of this project

3.2 Proposed Solution

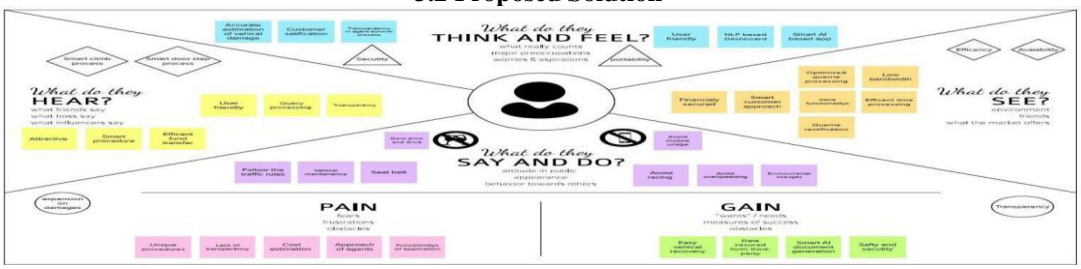

Fig 1 Proposed Solution

The proposed approach collects photographs of a person's damaged automobile, then utilizes those images as input for a deep learning model that uses image processing to recognize the elements of the image and determine the percentage of the vehicle's damage. After then, the images are separated into two groups: replace and repair. When the damage percentage is less than 80, the damaged part must be replaced; however, in the other case, the compensation

amount is set depending on the damage percentage. Finally, it generates a comprehensive analysis report on the vehicle that is used to ask the insurance company for payment.

The Proposed approach of this project involves predicting the major and minor damage cost of the vehicle using artificial intelligence with image processing. A Smart Artificial Intelligence techniques is implemented to claim the damaged vehicle insurance using online. AN Optimized Convolutional Neural Network techniques used to detect the damaged cost of the vehicle using image processing with Cloudant DB.

3.3 Problem Solution Fit

There is no systematic approach to receive a rapid answer from an insurance company. A week of waiting is required. The proposed solution should enable consumers to contact with the insurance provider and receive payments both online and offline. After uploading the damaged image and determining the extent of the damage, the user may obtain insurance only if the company approves the damaged image and the condition more than 80%.

This approach provides a way for evaluating vehicle damage that insurance companies may utilize when processing claims.

This module offered a framework for submitting a vehicle's damaged parts and requesting insurance from an organization. The dataset needed to train the Damage Detection and it has prepared by an admin. In order to make the images useful for training, they were manually annotated; damages were categorized into 7 distinct types such as Door Dent, Bumper Dent, Body Scratch, Broken Windshield, Broken Glass, Broken Lights and Smash By modifying its settings and loading the learned dataset, the model was set up to train on user data.

3.4 Object Detection

Employ a specially trained CNN model utilizing transfer learning on to identify the object. This model takes different forms of damage into account validation sets such as Bumper Dent, Bumper Scratch, Door Dent, Door Scratch, Glass Shattered, Head Lamp, Tail Lamp,

Undamaged, etc. The classification of car damage severity is as follows: Minor Damage which typically involves slight damage to the vehicle that does not impede the vehicle to cause severe injuries. It includes the headlight scratches, dents and digs in the hood or windshield, from gravel or debris, scratches in the paint. Moderate Damage which deals with any kind of damage that impairs the functionality of the vehicle in any way is moderate damage. It involves large dents in hood, fender or door of a car. Even if the airbags are deployed during collision, then it comes under moderate damage. Severe Damage – Structural damages

such as bent or twisted frames, broken/bent axels, and missing pieces of the vehicles and in some cases even the destruction of airbags. These types of damages are a big threat to the human life.

3.5 Damage Detection:

To locate damaged areas in a picture and create a bounding box around each object found, object localization is used which combines object localization and classification to provide a bounding box and a class for each item for object detection. Use CNN to generate a convolutional features map from an image to forecast the class and bounding box of an item. If the car is undamaged then it simply detects it and if it's a damaged one, then there are further localizations made models. The model shows accuracy on the validation set. To automate such a system, the easiest method would be to build a Convolution Neural Network model capable of accepting images from the user and determining the location and severity of the damage. The model is required to pass through multiple checks would first ensure that given image is that of a car and then to ensure that it is in fact damaged. These are the gate checks before the analysis begins. Once all the gate checks have been validated, the damage check will commence. The model will predict the location of the damage as in front, side or rear, and the severity of such damage as in minor, moderate or severe.

3.6 Claim Insurance

The procedure of claiming insurance is done by persons who are in need. For access to the company's insurance, the user must register and authenticate. After that, users may access their insurance information and submit an insurance claim request. The request for an insurance claim can be viewed and approved by the insurance company. Once the damaged image has been uploaded and the degree of the damage has been determined, the user may receive insurance only if the firm accepts the damaged image and the condition is greater than 80%.

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IV. PROJECT DESIGN

4.1 Solution & Technical Architecture

A system architecture or systems architecture is the conceptual model that defines the structure, behavior, and views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. The system architecture can comprise system components, the externally visible properties of those components, and the relationships (e.g. the behavior) between them. It can provide a plan from which products can be procured, and systems developed, that will work together to implement the overall system. There have been efforts to formalize languages to describe system architecture, collectively these are called architecture description languages (ADLs).

The Technical architecture is classified into five stages Authentication and Registration, Analysis, Classification, image preprocessing, and Report Generation

Authentication and Registration with the proposed system by the insurance agents, customers, and admin as shown in the following Figures

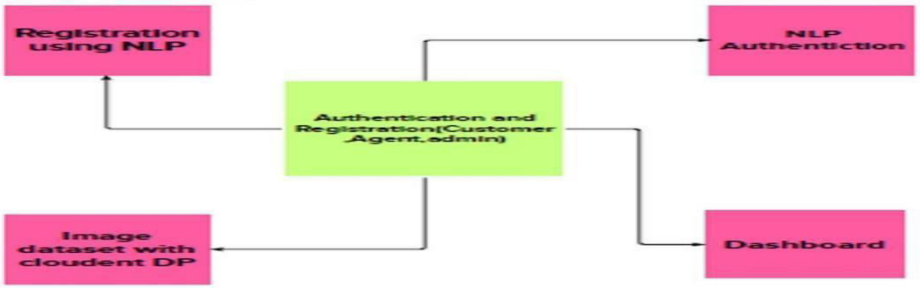

Fig 2 Authentication and Registration

Analyze the process undergone feasibility study of the proposed solution, described as shown in the following Figure.

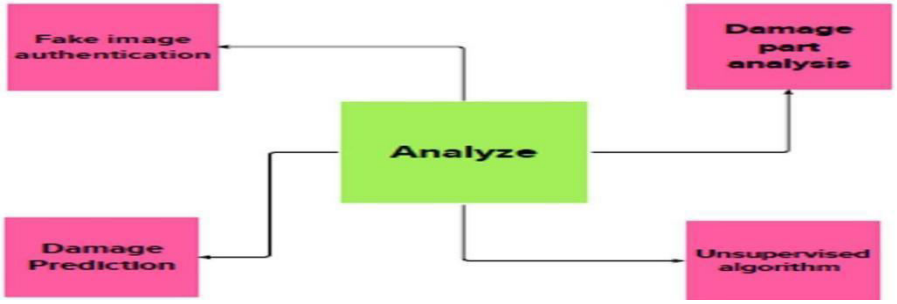

Fig 3 Analyze

The classification is used to differentiate the major and minor damages predicted through image processing as shown in the following figures.

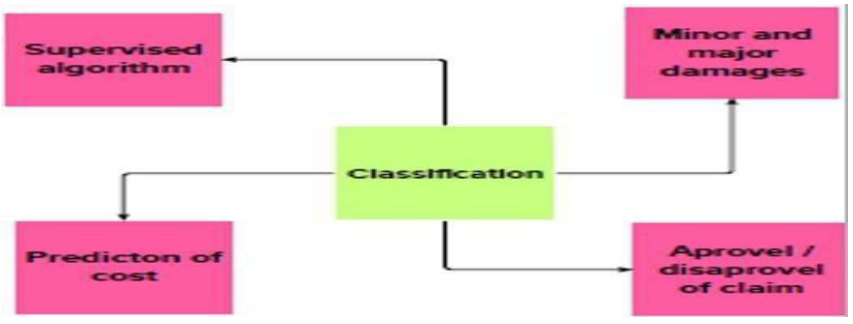

Fig.4 Classification

Image Processing is techniques used predict the major and minor damage of vehicles which upload the customer through online as shown in the following figure.

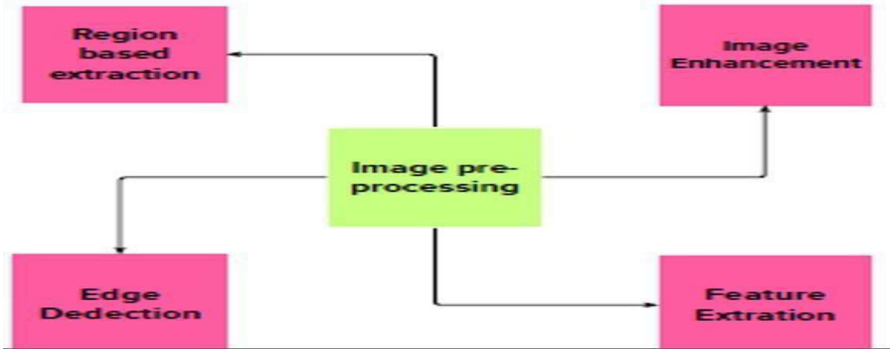

Fig 5 Image Preprocessing

Report Generation which autogenerated report by the proposed system as shown in the figure

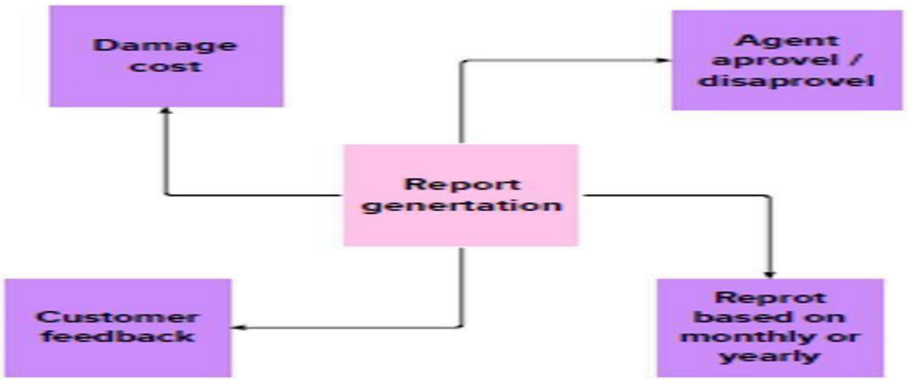

Fig.6 Report Generation

V. PROJECT PLANNING & SCHEDULING

5.1 Sprint Planning & Estimation

Digitalization of the car insurance business accelerates claims and reduces budget loss. Innovative solutions designed for faster claim processing aren't just for customers. They also aim to reduce processing costs for insurers, reduce human error and automatize the process speeding up the service and making it more personalized.

Artificial intelligence (AI) helps insurance companies to evaluate risks, prevent fraud and reduce human mistakes. It gives insurers an advantage in offering customers plans that best fit their needs. Customers benefit from streamlined customer service as well as claim processing provided by AI.

5.2 Sprint Delivery Schedule

The most common approach is to build up a system as a set of layers or gates. On each layer, the users' photos of damaged vehicles will be processed and analyzed with AI-based tools which are the most reliable for a certain goal. Such layered architecture allows to learn and classify data with the best AI model prepared for the exact purpose of the layer. For example, when it is needed to understand at what angle a car was hit, the model specifically trained on a dataset of millions of different cars from different angles was provided, will be used.

5.3 Reports From Cloudant Db

There is a good practice to place AI-based and image recognition systems in clouds, providing customers with Software as a Service and enabling your business to rapidly evolve and grow. It allows you to save costs by running services from time to time (like when you need to retrain your models on a new dataset or run recognition service OnDemand only) unlike your own servers, you have to pay for electricity and support all the time. There are a huge variety of fine-tuned services for specific goals (like AI-training, dataset storage, or providing user interface) on most of the cloud providers, such as Amazon, Microsoft, Google, etc.

5.4 Screenshorts

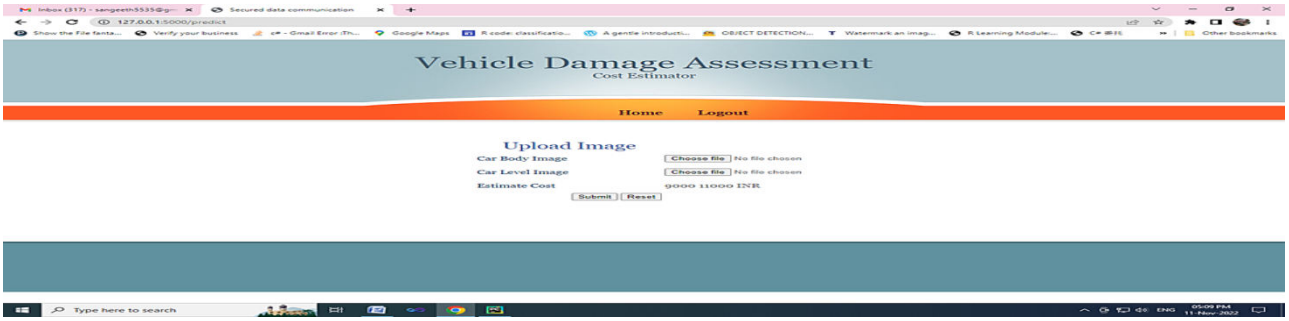

Fig.7 Screenshort

5.5 Performance Metrics

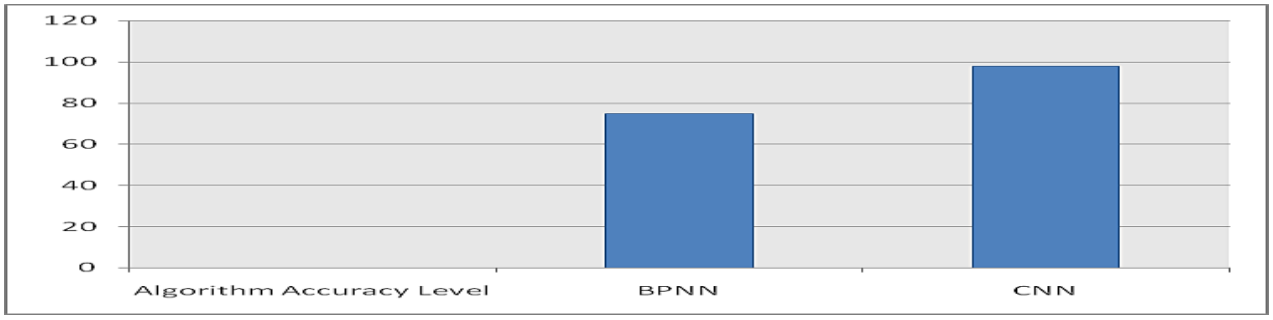

Fig.8 Performance Metrics

VI. CONCLUSION

In this research proposal, a neural network-based solution for automobile detection will be used to address the issues of automotive damage analysis and position and severity prediction. This project does several tasks in one bundle. The method will unquestionably assist the insurance firms in conducting far more thorough and systematic analyses of the vehicle damage. Simply sending the system a photograph of the vehicle, it will evaluate it and determine whether there is damage of any type, where it is located, and how severe it is.

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