Intelligent Vehicle Damage Assessment & Cost Estimator For Insurance Companies

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INTELLIGENT VEHICLE DAMAGE ASSESSMENT &
COST ESTIMATOR FOR INSURANCE
COMPANIES

ABSTRACT

The motor insurance sector loses a lot of money as a result of leakage claims. The gap between the amount actuallypaid for claims and the amount that would have been paid hadall of the best practises 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 methodfor automatically locating the damaged area by comparing photos of the automobile from before and after an accident. This project's proposed a CNN model that can recognise a car's damage 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 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.

1. INTRODUCTION

1.1 PROJECT OVERVIEW

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 to inaccurate claims, the corporation behaves improperly and doesn'tmake payments now. This occurs as a result of claims leakage,which is the discrepancy between the sums secured by the firm and the sums that it should have secured inaccordance 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 machinelearning and computer vision.

1.2 PURPOSE

Today's world is seeing a substantial increase in automobiles. Because there are more automobiles on the road and more people are driving them at high speeds, accidents happen more frequently. When an accident happens, the parties involved submit a claim with their auto insurance to obtain the money needed to repair the vehicle since, according to false claims, the company acts inappropriately and withholds payments.

2. LITERATURE REVIEW

2.1 EXISTING SYSTEM

TITLE:Convolutional Neural Networks for vehicle damage detection, 2021

AUTHOR NAME: R.E. Ruitenbeek

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 categorising it. To address this, a damage detection model is created that locates vehicle damages and categorises them into twelve groups. To improve detection performance, multiple deep learning algorithms are used, and the effect of various transfer learning and training strategies is evaluated. The final model, which was trained on over 10,000 damage photos, can detect minor defects in a variety of 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 designedlight street, demonstrating how strong reflections complicate detection performance.

TITLE: Deep Learning Based Car DamageDetection, Classification and Severity

AUTHORNAME: Ritik Gandhi1, 2021

Because it is a manual procedure, resolving a claim in the accident insurance sector takestime, 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 firstuse the Resnet50 model to determine whether or not the automobile is damaged, and if it is, we utilise the WPOD-net model to identify the licence plate. The YOLO model is used to detect the affectedregion. Finally, the damage severityis implemented using the DENSENETmodel. We discovered that transfer learningoutperforms 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.

TITLE: Car Damage Assessment to Automate Insurance Claim, 2022

AUTHORNAME: Siddhant Gole

Car damage inspection is an essential stage in claim sanctioning, and the procedure is frequently delayed and erroneous, resulting in claim leakages. Our task is to create a web application connected with a deep learning model that receives user input in the form of photographs of damaged automobiles and assesses the damage to provide a cost reportthatthe firm can use to approve the first reimbursement. To detect and localise the damaged regions, the model employs the MASK R-CNN algorithm in conjunction with Faster RCNN. The device also includes a security module that detects and stores the vehicle's licence plate, body type, and logo data for verification. Our goal is to develop a system that can detect damaged parts of a car using images and generate a cost analysis report that the company can use to sanction the insurance amount. The task would be to develop an end-to-end system for detecting and classifying types of damage via images, as well as to implement a car number plate, body type, and logo detection system to verify car details.

TITLE: Using Machine Learning Models To Compare Various ResamplingMethods In Predicting Insurance Fraud, 2021

AUTHOR NAME:Ruixing Ming

Insurance fraud is one of the most prevalent kinds of fraud. In particular, the cost of automotive insurance fraud is significant for property insurance companies and has a long- term influence on insurance businesses' pricing tactics. And Car insurance fraud detection hasbecome requiredin order to reduce insuranceprices. Although predictive models for detecting insurance fraud are widely used in practise, there are few published research on the use of machine learning algorithms to identify insurance fraud, most likely due to a lack of available data. Evaluate 13 machine learning approaches in this paper using real-world data. Predicting insurance fraud has become a big difficulty due to the uneven datasets in this domain. Because our data consists primarily of "non-fraud claims" with a minor number of "fraud claims." As a result, classification models predict fraud poorly; thus, the current study seeks to propose an approach that improves machine learning algorithms' results by using re- sampling techniques, such as Random over Sampler, Random under Sampler, and hybrid methods, to address the issue of unbalanced data.

'

TITLE: Evaluation of deep learning algorithms for semantic segmentation of carparts, 2021

AUTHOR NAME:Kitsuchart Pasupa

One of the most significant operations in the auto insurance industry is the evaluation of accident-damaged vehicles. Currently, each fundamental component must be manually examined. It is believed that in the future, a smart device will be able to do this evaluation more effectively. We analysed and compared five deep learning algorithms for semantic segmentation of automobile parts in this work. Mask R-CNN served as the baseline reference method, while the other algorithms were HTC,CBNet, PANet, and GCNet. These five algorithms were used to do instance segmentation runs. HTC's ResNet-50 algorithm was the best for segmentation on various types of cars such as sedans, trucks, and SUVs. On our initialdata set, it attained a mean averageaccuracy of 55.2 when distinctlabels were allocated to the left and right sides,and 59.1 when a single label was assigned to both sides. Furthermore, the models fromeach method were verified for robustness by running them on photos of components ina real-world setting with varying weather conditions such as snow, frost, fog, and different lighting situations. When left and right sides were assigned different labels, GCNet achieved a mean performance under corruption, mPC = 35.2, and a relativedegradation of performance on corrupted data, compared to clean data (rPC), of 64.4%, and mPC = 38.1 and rPC = 69.6% when left and right sides were consideredthe samepa

2.2 REFERENCES

[1]. R.E. Ruitenbeek, Convolutional Neural Networks for vehicle damage detection, 2021 [2]. Ritik Gandhi1Deep LearningBased Car Damage Detection, Classification and Severity,2021

[3]. SiddhantGole, Car DamageAssessment to Automate Insurance Claim, 2022

[4]. Ruixing Ming, Using Machine Learning Models To Compare Various ResamplingMethods In Predicting InsuranceFraud, 2021

[5]. Kitsuchart Pasupa,Evaluation of deep learning algorithmsfor semantic segmentation ofcar parts, 2021

2.3 PROBLEM STATEMENT DEFINITION

In existing system, the procedure of making an insurance claim for an automobile islaborious, and there is a delay before the first reimbursement is authorised. 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 closedclaim files is the only way to find claim leakage.

3.   IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple,easy-to-digest visual that captures knowledgeabout a user's behaviours and attitudes.It is a useful tool to helps teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

3.2 IDEATION & BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Brainstorm, Idea Listing and Grouping
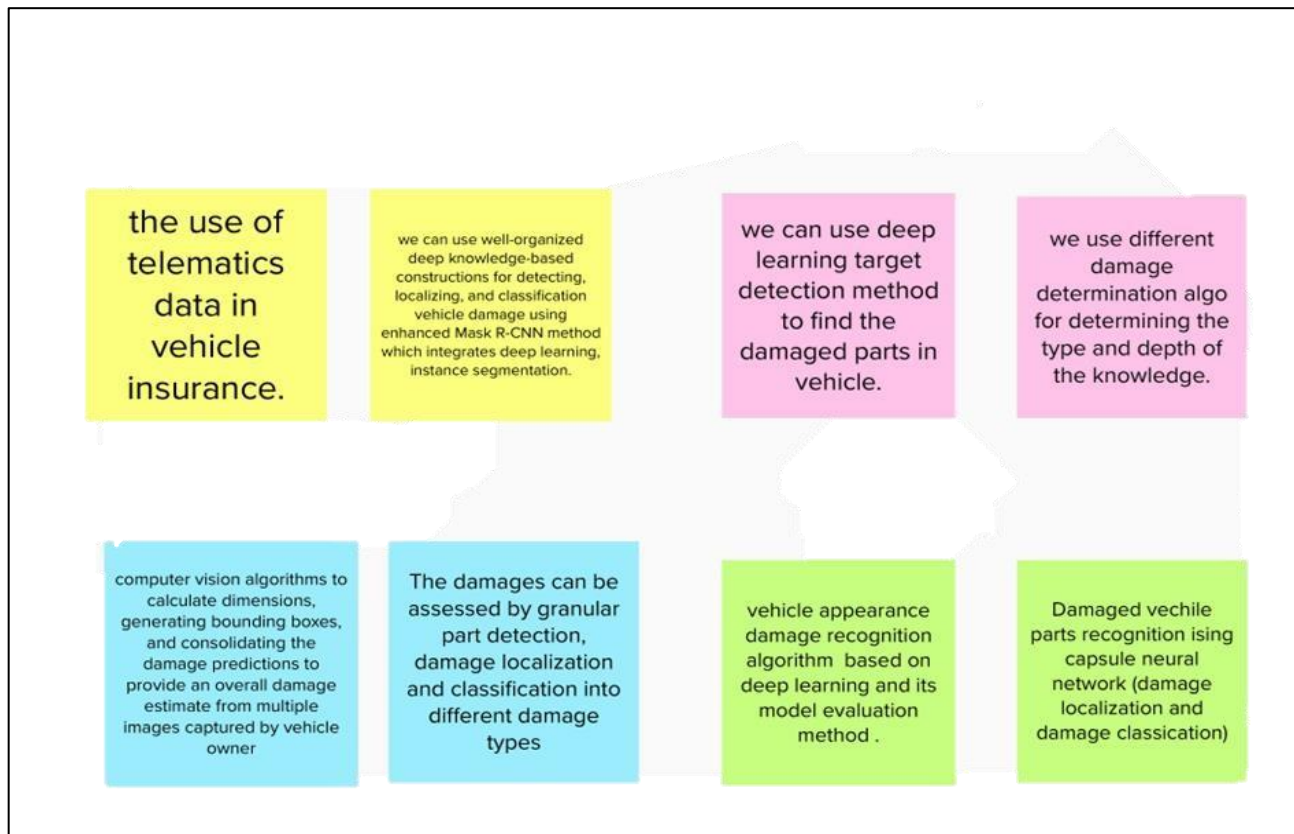
3.3 PROPOSED SOLUTION

The proposed approach collects photographs of a person's damaged automobile, then utilises those images as input for a deep learningmodel that use image processing to recognise the elements of the image and determine the percentage of the vehicles'' 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.

3.4 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 insuranceonly if the companyapproves the damaged image and the condition is more than 80%.

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL

REQUIREMENTFRAMEWORK

CREATION

This approach provides a way for evaluating vehicle damage that insurance companies may utilise when processing claims. This module offered a framework for submitting a vehicle's damaged parts and requesting insurance from an organisation. The dataset needed to train the Damage Detection and it has prepared by an admin. In order to make the images useful fortraining, they were manually annotated; damages were categorised 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 wasset up to train on user data.

OBJECT DETECTION

Employ a specially trained CNN model utilising transfer learning on to identify the object. This model takes different forms of damageinto account validation sets such as BumperDent, 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 withany 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 moderatedamage. 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.

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 localisation 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.

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 imageand the condition is greaterthan 80%.

4.2 NON - FUNCTIONAL REQUIREMENT

USABILITY

The system shall allow the users to access the system with pc using web application. The system uses a web application as an interface. The system is user friendly which makes the system easy

AVAILABILITY

The system is available 100% for the user and is used 24 hrs a day and 365 days ayear. The system shall be operational 24 hours a day and 7 days a week.

SCALABILITY

Scalability is the measure of a system'sability to increaseor decrease in performanceand cost in response to changes in application and system processing demands.

SECURITY

A security requirement is a statement of needed securityfunctionality that ensuresone of many different security properties of software is beingsatisfied.

PERFORMANCE

The information is refreshed depending upon whether some updates have occurred or not in the application. The system shall respond to the member in not less than two seconds from the time of the request submittal. The system shall be allowed to take more time when doing large processing jobs. Responses to view information shall take no longer than 5 secondsto appear on the screen.

RELIABILITY

The system has to be 100% reliable due to the importance of data and the damages that can be caused by incorrect or incomplete data. The system will run 7 days a week. 24 hours a day.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

      A two-dimensional diagram explainshow data is processed and transferred in asystem. The graphical depiction identifies each source of data and how it interacts with other data sources to reach a common output. Individuals seeking to draft a data flow diagram mustidentify external inputs and outputs, determine how the inputs and outputs relate to each other, and explain with graphics how these connections relate and what they result in. This type of diagram helps business development and design teams visualize how data is processed and identify or improvecertain aspect

FLOW CHART
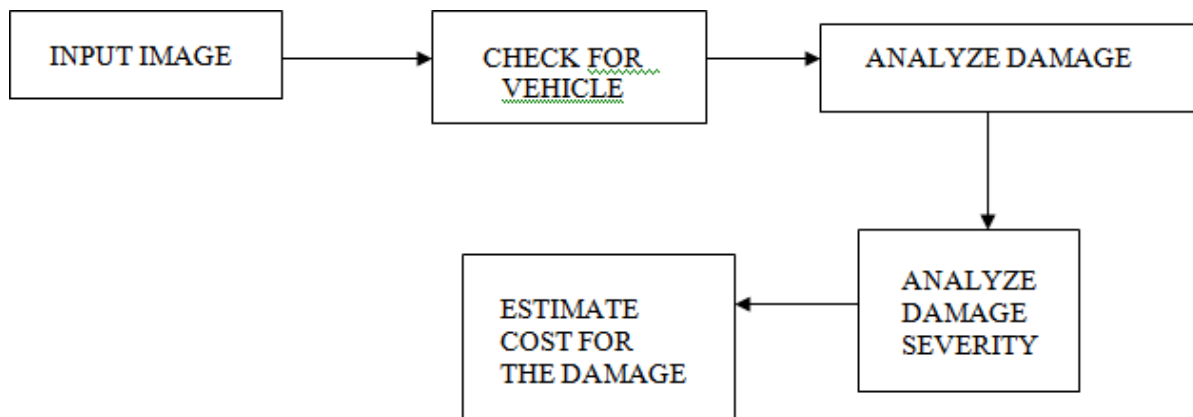
LEVEL 0

The Level 0 DFD shows how the systemis divided into 'sub-systems' (processes),each of which deals with one or more of the data flows to or from an external agent, and which together provide all of the functionality of the system as a whole. It also identifies internal data stores that must be present in order for the system to do its job, and shows the flow of data between the various parts of the system.
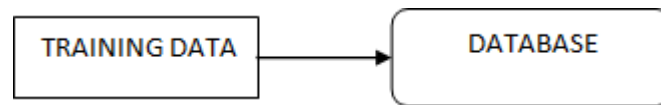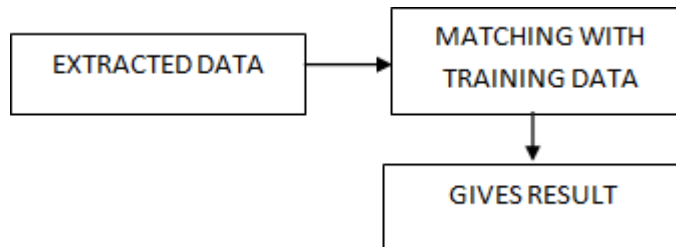

LEVEL 1

The next stage is to create the Level 1 Data Flow Diagram. This highlights the main functions carried out by the system. As a rule, to describe the system was using between two and seven functions - two being a simple system and seven being a complicated system. This enables us to keep the model manageable on screen or paper.
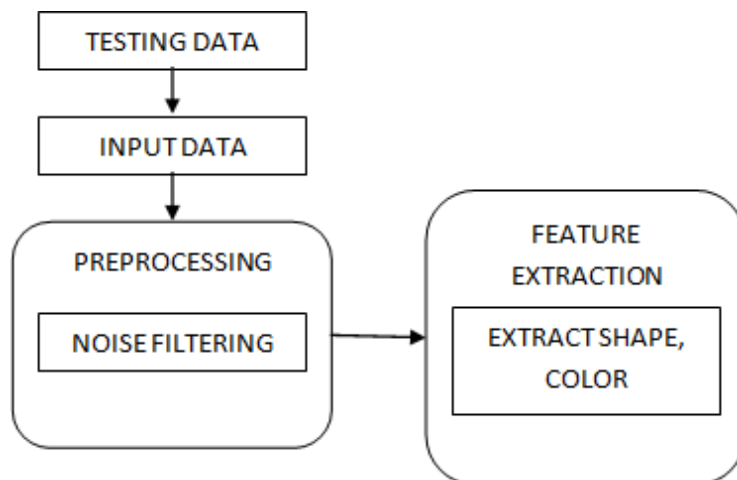
LEVEL 2

A Data Flow Diagram (DFD) tracks processes and their data paths within the business or system boundaryunder investigation. A DFD defineseach domain boundaryand illustrates the logical movement and transformation of data within the defined boundary. The diagramshows 'what' input data enters the domain, 'what' logical processes the domain applies to that data, and 'what' output data leaves the domain. Essentially, a DFD is a tool for process modelling and one of the oldest.

```
┌──────────────────┐      ┌──────────────────┐
│  EXTRACTED DATA  │ ───► │   MATCHING WITH  │
│                  │      │   TRAINING DATA  │
└──────────────────┘      └──────────────────┘
                                   │
                                   ▼
                          ┌──────────────────┐
                          │   GIVES RESULT   │
                          │                  │
                          └──────────────────┘
```

5.2 SOLUTION & TECHNICAL ARCHITECTURE

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 that 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 a damage as in minor, moderate or severe.
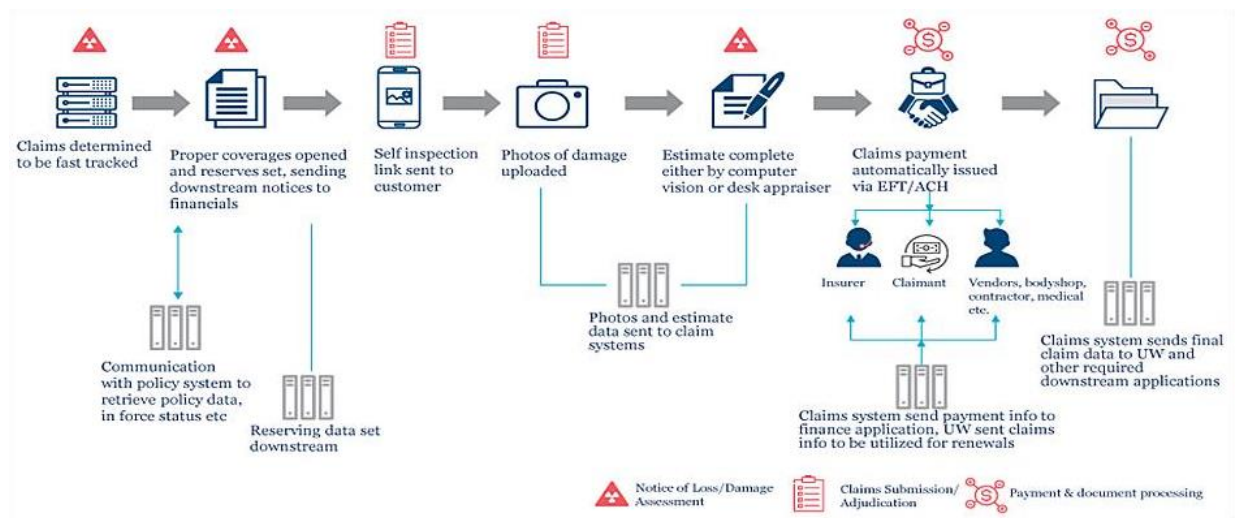
5.3 USER STORIES

User Type	Functional Requirement(Epic)	User Story Number	User Story/ Task	Acceptance Criteria	Priority	Release
Customer	Registeration	USN-1	As a User, I can register for the apllication by entering my email, password and confirmingthe password	I can accessmy account/my dashboard	high	Sprint-1
		USN-2	As a user , I willreceive confirmatiom email once, I have registeredfor the application	I can receive confirmatio n email & click confirm	high	Sprint-1
		USN-3	As a User, I canregister for the application through Gmail	I can register & access the dashboar dwith gmail login	Low	Sprint-1
		USN-4	As a User, I canfor the application through Facebook	I can register & access the dashboar dwith Facebook login	Low	Sprint-1
	Login	USN-5	As a User, I can log onto the application by entering email &password	I can register & access the dashboar dby entering the email & passwor dLogin	High	Sprint-1
	Dashboard					

Customer	Import Images	USN-6	As a User, After loggin in , Import the images of the vechicle damage	I can upload the images of the damaged vehicle in the website	high	Sprint-2

Customer Care Service	Address User Problems	USN -1	As a Customer Care Service Executive, I can address the user problems regarding the website if it does not work properly	I can address the problems of customer	Low	Sprint - 2
Administrator	Working ofWebsite	USN-1	As a administrator, Imake sure thatthe website works properlyamd make any changes , updates the website if necessary	I can makesure that website works properly	High	Sprint-2

6. PROJECT PLANNING& SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement(Epic)	User Story Number	User Story / task	Story points	Priority	Team Members
Sprint -1	Data Collection(dataset)	USN -1	As a User, I will download dataset of gestures forthe project	2	High	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN
Sprint -1	image preprocessing	USN -2	As as user user, I will import necessary libraries for configuration of image datagenerator and applying them to test and train dataset.	2	High	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN
Sprint -2	Model building	USN - 3	As a user, I can import necessary libraries andmodel of CNN and adding dense layers	2	Low	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN
Sprint -2	Model Building	USN - 4	As a user , Iwill trian, save and test the model	2	Medium	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN
Sprint -3	Application building	USN -5	As a user , Icreate htmlfront page (CSS for styling webpage and JS to connect to backend)	1	High	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN

Sprint	Functional Requirement(Epic)	User Story Number	User Story/ Task	Story points	Priority	Team memberS
Sprint - 3	Application building	USN -6	As a User , I use python for building backend (for server side scripting)	2	High	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN
Sprint - 3	Apllication Building	USN -7	As a user , going to runthe application by combining both front end and back end	2	High	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN
Sprint - 4	Train the modelon IBM	USN - 8	As a user , register for IBM cloud	1	Medium	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN
Sprint - 4	Train the modelon IBM	USN - 9	As a user , the model onIBM and integrate it with the flask application	2	High	NATARAJAN JANARTHANAN VEERAKUMAR NAVEEN

6.2 SPRINT DELIVERYSCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End date	Story points Completed (as on Planned End Date)	Sprint release Date (Actual)
Sprint-1	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-2	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-3	20	6 Days	13 Nov 2022	19 Nov 2022	20	19 Nov 2022
Sprint-4	20	6 Days	20 Nov 2022	26 Nov 2022	20	26 Nov 2022

6.3 REPORTS FROM JIRA

<u>**Velocity:**</u>

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

<u>**Burndown Chart:**</u>

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn downcharts can be applied to any project containing measurable progress
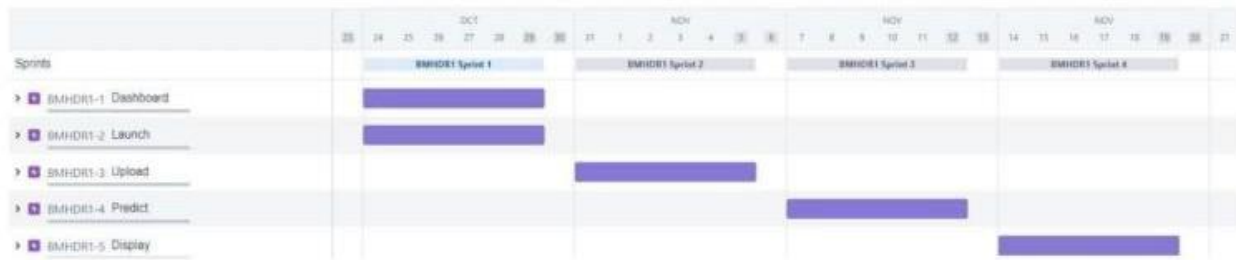
over time.

7. CODING & SOLUTIONING

7.1 FEATURE 1

MODEL BUILDING LIBRARIES

```python
import tensorflow as tf
from tensorflow.keras.layers import Input
from tensorflow.keras.layers import Lambda, Dense, Flatten
from tensorflow.keras.models import Model
from tensorflow.keras.applications.vgg16 import VGG16
from tensorflow.keras.applications.vgg19 import VGG19
from tensorflow.keras.preprocessing import image
from tensorflow.keras.preprocessing.image import ImageDataGenerator,load_img
from tensorflow.keras.models import Sequential
import numpy as np
from glob import glob
```

LOADING MODEL

```python
IMAGE_SIZE = [224, 224]
train_path = '/content/drive/MyDrive/Dataset/Car damage/body/training'
valid_path = '/content/drive/MyDrive/Dataset/Car damage/body/validation'
```

MODEL OBJECT

```python
[15] model = Model(inputs=vgg16.input, outputs=prediction)
```

```python
model.summary()
```

```
Model: "model"
_____
Layer (type)                Output Shape              Param #
=================================================================
input_1 (InputLayer)        [(None, 224, 224, 3)]     0

block1_conv1 (Conv2D)       (None, 224, 224, 64)      1792

block1_conv2 (Conv2D)       (None, 224, 224, 64)      36928

block1_pool (MaxPooling2D)  (None, 112, 112, 64)      0

block2_conv1 (Conv2D)       (None, 112, 112, 128)     73856

block2_conv2 (Conv2D)       (None, 112, 112, 128)     147584

block2_pool (MaxPooling2D)  (None, 56, 56, 128)       0

block3_conv1 (Conv2D)       (None, 56, 56, 256)       295168

block3_conv2 (Conv2D)       (None, 56, 56, 256)       590080
```

ADDING OUTPUT LAYER

```
[13] prediction = Dense(len(folders), activation='softmax')(x)
```

```
[15] model = Model(inputs=vgg16.input, outputs=prediction)
```

ADDING FLATTEN LAYER

```
x = Flatten() (vgg16.output)
```

SAVE THE MODEL

```
from tensorflow.keras.models import load_model
model.save('/content/drive/MyDrive/Dataset/Car damage/body.h5')
```

7.2 FEATURE 2

TRAIN THE

```
[17] model.compile(
    loss='categorical_crossentropy',
    optimizer='adam',
    metrics=['accuracy']
    )
```

```
r = model.fit_generator(
training_set,
validation_data=test_set,
epochs=25,
steps_per_epoch=len(training_set),
validation_steps=len(test_set)
)
```

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:6: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please

MODEL

TEST THE MODEL

```
[27]  def detect(frame):
        img = cv2.resize(frame,(224,224))
        img = cv2.cvtColor(img,cv2.COLOR_BGR2RGB)

        if(np.max(img)>1):
            img = img/255.0
        img = np.array([img])
        prediction = model.predict(img)
        label = ["front","rear","side"]
        preds = label[np.argmax(prediction)]
        return preds

[28]  import numpy as np

      data = "/content/drive/MyDrive/Dataset/Car damage/body/training/00-front/0003.JPEG"
      image = cv2.imread(data)
      print(detect(image))

      1/1 [==============================] - 1s 684ms/step
      rear
```

8. TESTING

8.1 TEST CASES

A test case has components that describe input, action and an expected response, in order to determine if a featureof an application is workingcorrectly. A test case is a setof instructions on "HOW" to validate a particular test objective/target, which when followed will tell us if the expected behavior of the system is satisfied or not.

Characteristics of a good test case:

    i.   **Accurate: Exacts the purpose.**

    ii. **Economical: No unnecessary steps or words.**

    iii. **Traceable: Capable of being tracedto requirements.**

    iv. **Repeatable: Can be used to perform the test overand over.**

    v. **Reusable: Can be reused if necessary.**

S.NO	Scenario	Input	Excepted output	Actual output	Status
1	User login	User name andpassword	Login	Login success.	**Pass**
2	Upload Image	Upload damaged vehicle imageasa input	Detecting object and analyzefor claim inurance	Details are stored in a database.	**Pass**
3	**Backend**	**Check if details are stored in the database**	**details are stored in the database**	**Details are stored in the database**	**Pass**
4	**Model**	**Check if model can handle various sizes of images**	**The model should rescalethe image and predict theresults**	**working as expected**	**Pass**
5	**Home Page**	**Check if the page redirectsto result page once we upload the images**	**The page should redirect to theresultant page**	**working as expected**	**Pass**
6	**Home Page**	**Check If cannot upload unsupported files**	**The application should not allow user toselect non - image files**	**User is able to upload anyfiles**	**Fail**
7	**Home Page**	**Check If usercan upload the file**	**The input image should be uploade to the application successfully**	**working as expected**	**Pass**

8	Home Page	Verify UI elements inthe Home Page	The Home page must beDisplayed properly	working as expected	Pass

8.2 USER ACCEPTANCE TESTING

       This sort of testing is carried out by users, clients, or other authorised bodies to identify the requirements and operational procedures of an application or piece of software. The most crucial stage of testing is acceptance testing since it determines whether or not the customer will accept the application or programme. It could entail the application's U.I., performance, usability, and usefulness. It is also referred to as end-user testing, operational acceptance testing, and user acceptance testing (UAT).

8.2.1 TEST CASES

Resolution	Severity-1	Severity-2	Severity-3	Severity-4	Total
By Design	1	0	1	0	2
Duplicate	0	0	0	0	0
External	0	0	2	0	2
Fixed	4	1	0	1	6
Not Reproduced	0	0	0	1	1
Skipped	0	0	0	1	1
Won't Fix	1	0	1	0	2
Total	6	1	4	3	14

8.2.2 TEST CASE ANALYSIS

Section	Total cases	Not Tested	Fail	Pass
Client Application	8	0	1	7
Security	2	0	1	1
Performance	3	0	1	2
Exception Reporting	2	0	0	2

9.RESULTS

LOGIN PAGE

NEW USER PAGE

USER LOGIN PAGE

UPLOAD IMAGE PAGE

ESTIMATED COST OF THE VEHICLE PAGE

9.1 PERFORMANCE METRICS
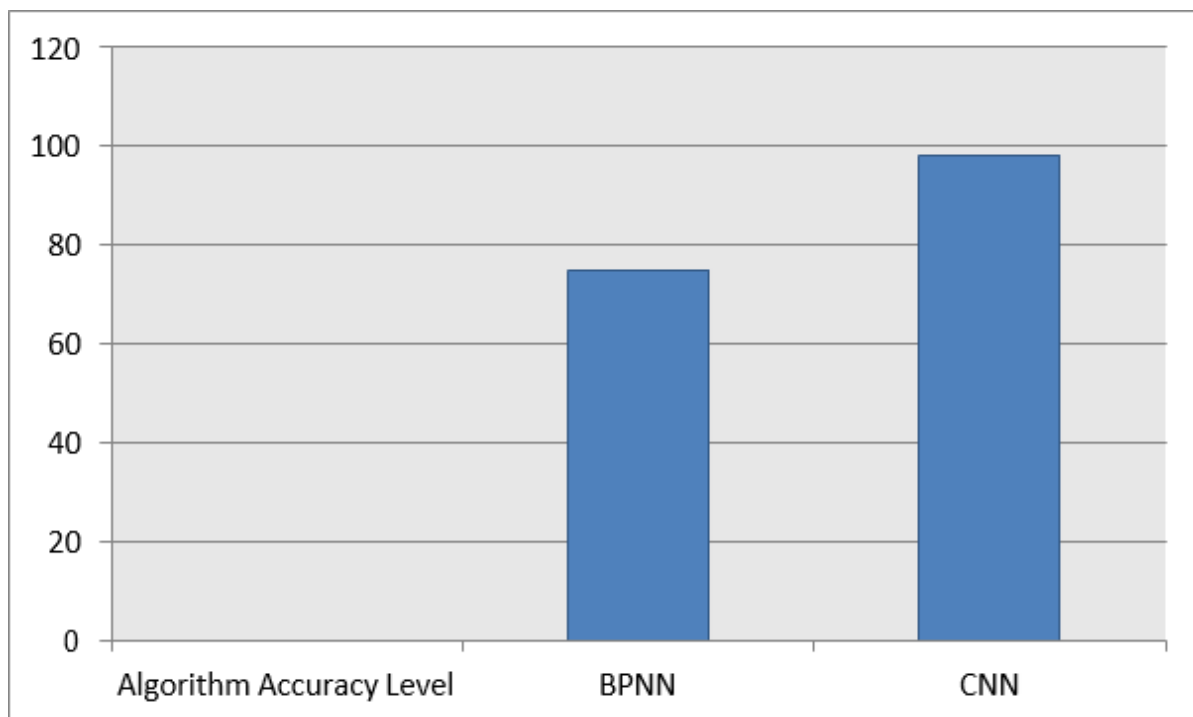
10. ADVANTAGES &DISADVANTAGES

ADVANTAGE

- Digitalized claim processmakes easy to use
- Give the accurateresult of the damaged vehicle
- Helps the insurance companyto analyze the damagedvehicleand also paymentprocess.

DISADVANTAGE

- It will take more time to claim the insurance in manualprocess
- Because of incorrect claims, the company behaves badlyand doesn'tmake paymentscurrently.
- Poor customer support

11. 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 evaluateitand determine whether there is damage of any type, where it is located, and how severe it is.

12. FUTURE SCOPE

In future work, need to use several regularisation methods with a big dataset in our next work. Anticipate the cost of a car damaged component more accurately and reliably if we have higher quality datasets that include the attributes of a car (make, model, and year of production), location data, kind of damaged part, and repair cost. This study makes it possibleto work together on picture recognition projects in the future, with a focus on the auto insurance industry. The study was able to accurately validate the presence of damage, its location, and its degree while eliminating human bias. These can be further enhanced by adding the on the fly data augmentation approaches.

13. APPENDIX

SOURCE CODE

```
from flask import Flask, render_template, flash,
request,sessionfromcloudant.client import Cloudant
import cv2
client = Cloudant.iam("eb55a2b7-ae45-4df8-8d1c-69c5229ffdbe-
bluemix","YzG5FZg9Vs_HScOBZaWyVXm7PpNjbPrmPaPMfHx7w3X9",co
nnect= True)
my_database = client.create_database("database-
dharan")app = Flask(_name_)
app.config.from_object(_name_)
app.config['SECRET_KEY'] =
'7d441f27d441f27567d441f2b6176a'@app.route("/")
def homepage():
    return
render_template('index.html')
@app.route("/userhome")
def userhome():
    return
render_template('userhome.html')
@app.route("/addamount")
@app.route("/NewUser")
def NewUser():
    return render_template('NewUser.html')

@app.route
("/user")def
user():
```

```python
        return render_template('user.html')
@app.route("/newuse",methods=['GET','P
OST'])def newuse():
    if request.method == 'POST':
        x = [x for x in
        request.form.values()]
        print(x)
        data = {

            '_id': x[1],
            'name': x[0],
            'psw': x[2]
        }
        print(data)
        query = {'_id': {'Seq':data['_id']}}
        docs =
        my_database.get_query_result(query
        )print(docs)
        print(len(docs.all()))
        if (len(docs.all()) == 0):
            url = my_database.create_document(data)
            return render_template('goback.html', data="Register, pleaselogin
using yourdetails")
        else:
            return render_template('goback.html', data="You are already a
member, pleaselogin using your details")
@app.route("/userlog", methods=['GET',
'POST'])def userlog():
    if request.method ==
        'POST': user =
        request.form['_id']
        passw =
```

```
request.form['psw']

print(user, passw)

query = {'_id': {'$eq': user}}

docs =

my_database.get_query_result(query

)print(docs)

print(len(docs.all()))

if (len(docs.all()) == 0):

    return render_template('goback.html', pred="The username is not

found.")else:

    if ((user == docs[0][0]['_id'] and passw ==

        docs[0][0]['psw'])):return

        render_template("userhome.html")

    else:

        return render_template('goback.html',data="user name and password

incorrect")


@app.route("/predict", methods=['GET',

'POST'])def predict():

  if request.method == 'POST':

    file =

    request.files['fileupload']f

    ile.save('static/Out/Test.j

    pg') import warnings

    warnings.filterwarnings('i

    gnore')import tensorflow

    as tf

    classifierLoad =

    tf.keras.models.load_model('body.h5')import

    numpy as np

    from keras.preprocessing import image
```

```
test_image = image.load_img('static/Out/Test.jpg',
target_size=(200, 200))img1 = cv2.imread('static/Out/Test.jpg')
# test_image =
image.img_to_array(test_image)
test_image = np.expand_dims(test_image,
axis=0)result=
classifierLoad.predict(test_image)
result1 = ''
if
    result[0]
    [0] ==
    1:result1
    = "front"
elif
    result[0][1
    ] ==
    1:result1 =
    "rear"
elif
    result[0][2
    ] ==
    1:result1 =
    "side"
file =
request.files['fileupload1
']file.save('static/Out/Te
st1.jpg')  import
warnings
warnings.filterwarnings(
'ignore')
importtensorflow as tf
```

```python
classifierLoad =
tf.keras.models.load_model('level.h5')import
numpy as np
from keras.preprocessing importimage
test_image = image.load_img('static/Out/Test1.jpg',
target_size=(200, 200))img1 = cv2.imread('static/Out/Test1.jpg')
# test_image = image.img_to_array(test_image)

test_image = np.expand_dims(test_image,
axis=0)result=
classifierLoad.predict(test_image)
result2 = ''
if result[0][0]
    ==
    1:result2 =
    "minor"
elif result[0][1] ==
    1:result2 =
    "moderate"
elif
    result[0][2
    ] ==
    1:result2 =
    "severe"
if (result1 == "front" and result2 ==
    "minor"):value = "3000 - 5000
    INR"
elif (result1 == "front" and result2 ==
    "moderate"):value = "6000 8000 INR"
elif (result1 == "front" and result2 ==
    "severe"):value = "9000 11000 INR"
```

```
        elif (result1 == "rear" and result2 ==
            "minor"):value = "4000 - 6000
            INR"
        elif (result1  ==  "rear"  and  result2  ==
            "moderate"):value = "7000 9000 INR"
        elif (result1 == "rear" and result2 ==
            "severe"):value = "11000 - 13000
            INR"
        elif (result1 == "side" and result2 ==
            "minor"):value= "6000 - 8000 INR"
        elif (result1 == "side" and result2 ==
            "moderate"):value = "9000 - 11000
            INR"
        elif (result1 == "side" and result2 ==
            "severe"):value = "12000 - 15000
            INR"
        else:
            value = "16000 - 50000INR"
        return render_template('userhome.html',
    prediction=value)if __name__ == '_main_':
    app.run(debug=True, use_reloader=True)
```

GITHUB

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