Car Damage Detection and Analysis System Using Computer Vision

Computer Vision Project Report

Building and Developing AI Models Bootcamp

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Introduction:

This project aims to reduce time and human effort by automating the process of vehicle damage inspection resulting from accidents using Deep Learning and Computer Vision Techniques. The system is designed to identify the various parts of the vehicle and detect any damaged components. After identifying the damages, the system generates a report listing the affected parts.

This solution not only improves efficiency but also enhances accuracy in damage assessment, offering a faster and more reliable way to inspect vehicles after accidents.

1. Dataset Overview

For the Datasets, in this project we have used two datasets, **Car Parts and Car Damages Datasets**, which has two datasets; One for car parts, and the other for Car Damage in combination with the other Dataset **CarDD.**

Datasets Sizes:

CarDD: 4000 images

CPACD (Damage): 814 images

CPACD (Parts): 998 images

2. Methodology

a. Part and Damage Detection:

Two **Detectron2 Zoo** models were used in the project using Transferred Learning technique, because of the Unsatisfying results from the from scratch models.

b. Combining the two models results:

We have used calculating the overlapping between the segments from the Parts Detection model, and the Damage detection, and return every part with the overlapping damages with certain IoU.

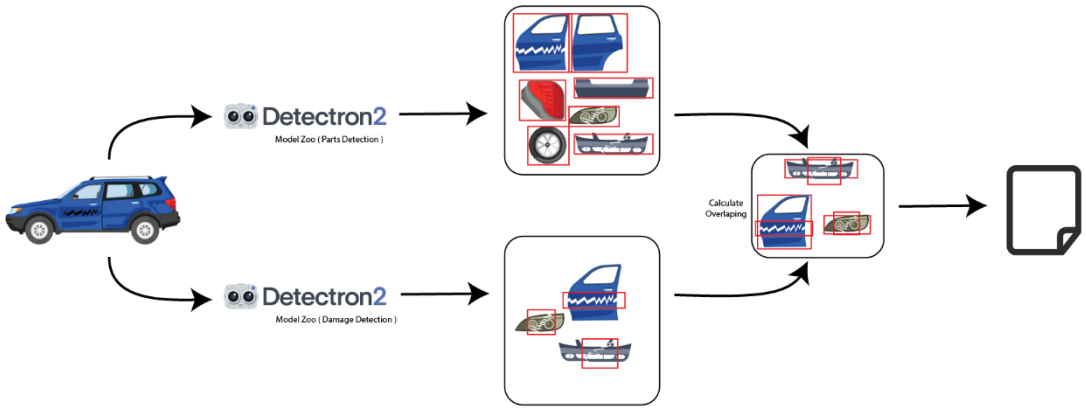

Figure1: Methodology

3.Results:

Parts Detection Model Results:

Figure 2: Parts Detection

Damage Detection Model Results:

Figure 3: Damage Detection

Final Result:

Detected Damages:

Detected damages for part 'Hood':

- Scratch (IoU: 0.39)

Detected damages for part 'Headlight':

- Flaking (IoU: 0.19)
- Dent (IoU: 0.43)

Detected damages for part 'Front-wheel':

- Flaking (IoU: 0.06)

Detected damages for part 'Back-bumper':

- Flaking (IoU: 0.74)

Detected damages for part 'Quarter-panel':

- Broken part (IoU: 0.56)

Figure 4: final Result

4.Challangese and Obstacles and Lessons Learned:

First Challenge we had was time and computational power, Computer Vision models take a lot of time to train, and the results might be not satisfying, and the datasets we have trained the data on were in different places the world, but since our environment are special and unique, the tested images that were taken in Saudi Arabia had a little accuracy drop, and other effects like strong reflections, dark colored cars and strongly damaged cars.

Also, the original planned project, the methodology were a little bit different, which is using Parts Detection model at first, to separate the car parts then apply the Damage Detection model on each part, but unfortunately the model were trained on a whole cars images, which had faced difficulties detecting damage on separate parts.

The project were planned to analyze the results using LLM, **OpenAI API** to be specific, but unfortunately we could not get access to the beta features of the API, which was web access, we also have tried **Google Custom Search Engine** along with **Google Search API,** but we did not get satisfying outputs.

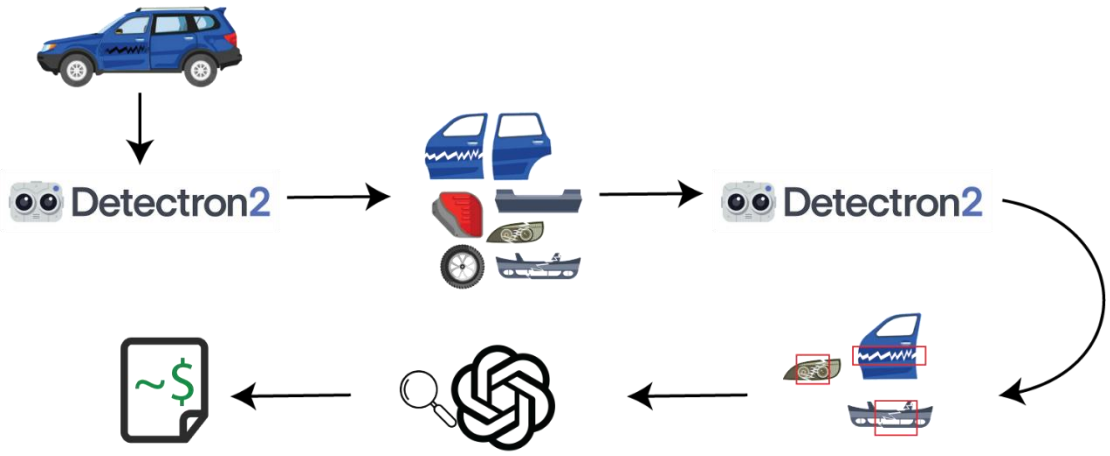

Figure 5: The Figure Bellow Shows the Planned Methodology for the project

End Of the Report.