LITERATURE SURVEY ON INTELLIGENT VEHICLE DAMAGE ASSESSMENT AND COST ESTIMATION FOR INSURANCE COMPANIES

TEAM ID: PNT2022TMID24296

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1. Assessing Car Damage with Convolutional Neural Networks

Authors: Harit Bandi, Suyash Joshi, Siddhant Bhagat, Amol Deshpande.

Publication: IEEE 2021 (ICCICT)

Description:

This paper deals with estimating car damage, primarily with auto insurers as their key potential customers. For this purpose, three distinct Transfer Learning approaches are used which detect the presence of damage, location, and severity of the damage. The basis for algorithms used lies in Convolutional Neural Networks, customized to optimize accuracy. Each approach is analyzed and varying degrees of accuracy were achieved across different models deployed ranging from 68% to 87%. Accuracy as high as 87.9% was obtained in this paper. This research fine-tunes a number of existing approaches and opens doors for collaboration in image recognition, particularly for the car insurance domain.

2. Deep Learning Based Car Damage Classification and Detection

Authors: Mahavir Dwivedi , Malik Hashmat Shadab, SN Omkar, Edgar Bosco Monis , Bharat Khanna, Satya Ranjan Samal, Ayush Tiwari, Aditya Rathi.

Publication: Advances in intelligent systems and computing, Springer, Singapore.

Description:

In this paper, they worked on the problem of vehicle damage classification/ detection which can be used by insurance companies to automate the process of vehicle insurance claims in a quick fashion. The recent advances in computer vision largely due to the adoption of fast, scalable and end to end trainable Convolutional Neural Networks makes it technically feasible to recognize vehicle damages using deep convolutional networks. They manually collected and annotated images from various online sources containing different types of vehicle damages. Using CNN models pretrained on ImageNet dataset and using several other techniques to improve the

performance of the system, we were able to achieve top accuracy of 96.39%, significantly better than the current results in this work. Furthermore to detect the region of damage they used stateof-the-art YOLO object detector and achieved a maximum map score of 77.78 % on the held-out test set, demonstrating that the model was able to successfully recognise different vehicle damages. In addition to this, the paper also proposes a pipeline for a more robust identification of the damage in vehicles by combining the tasks of classification and detection.

3. Damage Assessment of a vehicle and Insurance Reclaim.

Authors: Vaibhav Agarwal , Utsav Khandelwal , Shivam Kumar, Raja Kumar , Shilpa M

Publication: IJCRT 2022

Description:

In this paper, under damage analysis of a vehicle in general and insurance reclaim, a system has been designed using CNN and image classification which takes the input from a user as an image to test the severity of damage, which happens in a sequence of two steps. First being the image classification, here the input provided by the user is processed by the neural network to identify the car that if the car is damaged or not. and later on the second step, the flattened input obtained as the output in step 1 is applied for object detection to identify the region and severity of damage, where region might be rear, front or side and severity is divided into minor, moderate and major. The R-CNN network identifies the severity of damage and a report is filed and sent to the user and the insurance firm. The user will be able to get payment based on the models outcome with minimal human interaction.

4. Vehicle Damage Classification and Fraudulent Image Detection Including Moiré Effect Using Deep Learning

Authors: Umer Waqas, Nimra Akram, Soohwa Kim, Donghun Lee, Jihoon Jeon

Publication: 2020 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE)

Description:

This paper proposes deep learning based methods for classification of car damage types - MobileNet to classify the vehicle damage into three categories which include medium damage, huge damage and no damage. The severity of damage from medium to huge is decided by the amount of damage present on the vehicle. The damage categories are based on common damage types such as broken lamp or bumper, shattered glass, dents on front or rear etc. However, in real-time applications automation comes with various obstacles. User can upload the fake images instead of taking a picture of vehicle in real-time. Fake images include taking screenshots from devices, downloading image from internet, capturing images from other devices screens and using some image editing tools to cover damage. In this paper a hybrid technique is also proposed to handle these kinds of fraudulent images. Metadata analysis and image editing software signatures detection is performed in order to verify if image is edited or it is a screenshot. Moiré effect

detection is proposed to identify if the image is taken from other device screen such as taking a picture of a car with mobile phone from a computer screen.

5. Car Damage Assessment based on VGG Models:

Authors: Phyu Mar Kyu, Kuntpong Woraratpanya

Publication: IAIT 2020

Description:

This paper explores deep learning-based algorithms, VGG16 and VGG19, for car damage detection and assessment in real-world datasets. These algorithms detect the damaged part of a car and assess its location and then its severity. Initially, we discover the effect of domain-specific pretrained CNN models, which are trained on an ImageNet dataset, and followed by fine-tuning, because some of the categories can be fine-granular to get our specific tasks. Then they applied transfer learning in pre-trained VGG models and use some techniques to improve the accuracy of our system which results in better performance of VGG19 than VGG16. All of the above, their pre-trained VGG models not only detect damaged part of a car but also assess its location and severity.

6. A Unified Framework of Intelligent Vehicle Damage Assessment based on Computer Vision Technology

Authors: Xianglei Zhu , Sen Liu, Peng Zhang, Yihai Duan

Publication: 2019 IEEE 2nd International Conference on Automation, Electronics and Electrical Engineering (AUTEEE) **Description:**

The main contribution of this paper is it proposes a framework of intelligent vehicle damage assessment algorithm including the three parts to provide a unified solution for the actual application of intelligent loss assessment. The experiment here shows that this proposed method has better accuracy. The proposed algorithm makes use of advanced computer vision technology (object detection, image segmentation, image classification), offers accurate estimated repair price based on photos provided by users and greatly saves loss costs of insurance man. The algorithm includes the identification of vehicle parts, damage position and damage type and degree classification. RetinaNet is used for the identification of damaged parts, and the results are processed with disjoint set and the identification accuracy is improved. Mask R-CNN is adopted for the identification of vehicle parts, the damaged parts are determined by the method of sampling, and the time complexity is greatly reduced. In addition, Inception is applied for the classification of damage types and the last layer is revised to be suitable for multi-label classification.

7. Front-View Vehicle Damage Detection using Roadway Surveillance Camera Images

Authors: Burak Balci, Yusuf Artan, Bensu Alkan and Alperen Elihos

Publication: 5th International Conference on Vehicle Technology and Intelligent Transport Systems

Description:

In the damaged vehicle detection problem using roadway cameras, the presence of symmetry is an important indicator in differentiating between damaged and non-damaged vehicles. Therefore, this paper proposes a method that combines vehicles' frontal image information with a term that computes the similarity of the left and right halves of the vehicles' front view image. Adding symmetry information substantially improves prediction performance in this task. In this paper, they proposed a deep learning based method on the damaged vehicle detection problem from front view roadway camera images. Single shot multi box (SSD) object detector is utilized to extract a tight region of the front side of the vehicle. Next, InceptionV3 convolutional neural network (CNN) based novel feature extraction approach is used to derive feature vectors, which are used by a linear support vector machine (SVM) classifier to determine damaged/non-damaged class of the vehicle.

8. Yet Another Deep Learning Approach for Road Damage Detection using Ensemble Learning

Authors: Vinuta Hegde, Dweep Trivedi , Abdullah Alfarrarjeh , Aditi Deepak, Seon Ho Kim, Cyrus Shahabi

Publication: 2020 IEEE International Conference on Big Data (Big Data) **Description:**

An automated solution for road damage detection and classification using image analysis is nowadays timely needed for smart city applications. In this paper, they designed deep learning approaches based on one of the state-of-the-art object 5558 detection approaches, namely YOLO. To increase the accuracy of the trained models generated by YOLO, they presented three approaches using ensemble learning. One approach uses multiple transformed images of the test image to ensemble the final output. The other approach ensembles multiple trained models and averages predictions from these trained models. The third approach combines the latest two approaches. All these three approaches were evaluated using the public image dataset provided by the 2020 IEEE Big Data Global Road Damage Detection Challenge. This paper's approaches were able to achieve an F1 score of up to 0.67.