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VEHICULAR DISASTER IMPACT IDENTIFICATION USING DEEP LEARNING

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ABSTRACT

The rapid growth of the civilization has made our lives easier and increases the auto vehicles usage to a great extent. With great increase in the usage of cars and automotive vehicles, chances of getting accidents are also very high. India needs to improve the way they respond to the road accidents this is a system that can help in the identifying the severity of the accident and detect the accident using deep learning and computer vision techniques. The project aims to monitor the accident in cities and to reduce the death rates. Nowadays, road accident rates are very high. Early detection and timely medical aid will help a lot in these situations. Regular traffic systems are implemented with cameras and installed in most of the town to watch and control traffic. A Smart City with an AI traffic monitoring and reporting mechanism, a more superior traffic monitoring method may recognize and discover moving objects like automobiles and motorbikes in live camera supports. Furthermore, detect collision of those moving objects and helps to provide an accurate location to the nearby center about the accident to supply immediate medical care and sends a message to the closest police headquarters.

Keywords- Deep Learning, OpenCV, Object Detection, Tensorflow, Traffic.

1. Introduction

The increase in the usage of automotive vehicles is bound to have increased the accident rates during the last five years in India. The traffic accidents are not only restricted to developed geographies, even tier 2 and tier 3 cities in India also prone to severe accidents in the last three years. The percentage of causalities happens more in underdeveloped countries due to the inappropriate roads infrastructure and not proper signal controlling. A system that can detect the accidents and send an alert to the immediate nearby response team is very much need of the hour.

There are many reasons why an accident happens when a vehicle collides with other vehicles. Accidents happen due to road obstacle, pedestrian, line crossing, objects on the road. However, the most common kind of road accident is a vehicle collision, and 60 per cent of the accidents happen because of the road vehicle collision.

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Object detection technology is actively used to determine the position plus size of targeting objects emerging on image or video. Object tracking is a different field in image processing to happen accomplished with novel testimony and tracing the points of recognized objects across periods. Nevertheless, to trace objects, it is essential to determine object class and status first in a firstly yielded static image with object detection. Hence, the completion of object tracking should remain intensely reliant upon the fulfillment of the object detection included.

2. Literature survey

M Seoane Santos et al. [8] the objective was essentially threefold: (i) to highlight the danger of over-optimism related to the frequent use of CV and over-sampling; (ii) to identify the over-optimism problem from the over-sampling problem and to research the impact of the complexity of the datasets produced by over-sampling algorithms on the assignment task; (iii) to evaluate the output of state-of-art over-sampling procedures; Overall, the most reliable oversampling procedures have three key features: use of cleaning methods, cluster-based example synthesis and adaptive weight of minority examples. Besides, they conducted a clustering and regression analysis that confirmed in a quasi-linear manner that the complexity created by the oversampling algorithms is related to the results of classification.

L Wang et al. [6] suggested a Image-text embed approach in which a multi-layered two branch networks trained using an objective margin-based framework consisting of structure-preserving terms and bidirectional ranking term motivated by metric learning. The simple architecture is flexible and can apply to different types of textual and visual features. Thorough experiments show that its system components are well selected. Their results on the Flicker30 K and MSCOCO datasets greatly surpassed state of the art and have also shown compelling developments over the Canonical Correlation Study on the latest term localization issue in the Flicker30 K Entities dataset.

Sharaf Alkheder et al. [11] the study consists of developing an Artificial Neural Network (ANN) to examine traffic accident data and predict traffic accident injury cruelty based on traffic accident reports in Abu Dhabi over six years from 2008-13. Traffic accident data brought down to sixteen attributes and four grades of injury severity (death, extreme, moderate, and minor) following the preprocessing of data. Traffic accident data analysis carried out using the data-mining software WEKA to generate and validate the ANN model. Based on the outcomes of the data evaluation and analysis carried in this paper, the following conclusions drawn:

- Overall model prediction output was 81.6 percent and 74.6 percent, respectively, for train data and test data.
- ANN predicts death accuracy, severe, medium, and minor accidents were 0 percent, 0 percent, 78.4 percent, and 82 percent, respectively, based on the test data set.
- Clustering proved overall performance of the model foresight for the training dataset was 95.2%, 94.1%, and 97.1% respectively for the 0, 1, and 2 clusters. The average

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performance of the model prediction was 69.2 percent, 71.8 percent, and 72.1 for clusters 0, 1, and 2, respectively, for the research data set.

- The ordered probity model is used as a comparable benchmark for validating the performance of an ANN model.

Paul Barham et al. [9] have explained this system and its programming model TensorFlow. The dataflow representation of TensorFlow actual work on parameter server methods. It offers a set of similar concepts that allow users to check large-scale composite systems for both production tasks and explore new approaches. They have shown many examples of how the TensorFlow programming model encourages innovation and demonstrates the resulting realizations' efficiency and scalability. Its initial TensorFlow experience was encouraging. TensorFlow was implemented in production by a large number of groups at Google, and TensorFlow is helping researchers make new developments in machine learning. Since releasing TensorFlow as open software, the source code repository has branches of more than 14,000 people, the binary division has downloaded more than a million times, and hundreds of ML models use TensorFlow have released. TensorFlow is a work underway. The flexible representation of the data flow allows users to achieve significant efficiency, but they have not yet developed default behaviors that function for all users. At the system level, they are actively advancing algorithms for automated placing, kernel merging, memory management, and schedule. While the present implementation of fault tolerance and mutable state is sufficient for applications with weak consistency requirements, some TensorFlow applications expect greater consistency and are examining how to develop such policies for user-level.

Marco D'Ambros et al., [7] Distortion desire has made no matter how you look at it excitement for a noteworthy time allotment. The driving circumstance is resource conveyance. Time and work being constrained resources, it looks good to name work drive and also advantages for areas of an item system with a higher conceivable measure of flaws. A benchmark for defect desire presented, as an uninhibitedly available enlightening gathering involving a couple of programming systems, giving a deep connection of the explanative and perceptive power of unquestionably comprehended flaw Figure approaches, together with novel strategies considered. The number of elements considered for the investigation less. The reproduced framework isn't speaking to this present reality framework. Exactness score determined on a single informational index. Correlation over various datasets could have been a superior decision.

Daxin Tian et. al [2] have proposed the CVIS (Cooperative Vehicle Infrastructure System) automatic method for the detection of accidents in cars. They first introduce in the CVIS the principles of application of their proposed method. The second is that they have developed a new CAD-CVIS image dataset, which is better suited for a CVIS intelligent roadside device car accident detection process. The YOLO-CA car accident-detection module was prepared based upon a CAD CVIS and profound learning algorithms. The multiscale loss function and fusion was combined with dynamic values to boost the YOLO-CA's real-time and accuracy. Finally, they present the results of their methods' simulation tests, which show that their methods can detect car accidents with a 90.02

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percent AP in 0.0461 seconds. Furthermore, the results of experiments shows that YOLOCA has a complete function of car accident-detection in terms of accuracy, compared to other detection models.

Liujuan Cao et al. [5] gave a system that detects vehicles, combined with Exemplar ESVMS. This sturdy case classifier provides sturdy detection of vehicle in images from satellite, based on the Deep CNN. They adopt DNN in particular to learn discriminatory image properties with exceptional learning abilities. In their practice, the DNN support has significantly increased representation compared to several handcrafted features. They also adopt a rugged E-SVM classification to improve more the robustness of the classification, which is seen as a metric-learning scheme. They also show that by combining both systems can benefit together in order to together increase detection precision and efficiency by conducting widespread experiments with examples with advanced and alternative works.

Tree boosting is a process of machine learning which is very useful and broadly used. This paper, T Chen & C Guestrin [12] have expressed a scalable tree boost system named XGBoost, widely utilized to deliver state-of-art machine learning outcomes on several challenges. They proposed a new sparsity aware algorithm and weighted quantile representation for comparative tree learning for sparse data. More specifically, they give insights into cache-access patterns, data compression, and sharding to create a scalable tree advancing framework. By integrating ideas, XGBoost requires fewer resources than current methods to scale beyond trillions of instances. This paper described a scaling tree boosting system when building XGBoost. They submitted a novel sparsity intelligent algorithm for managing sparse data and a weighted quantile description for relative learning, which was theoretically justified. That refers to other ML systems. By merging this perspicacity, XGBoost will be able to use a minimum amount of resources to solve real-world problems.

Welli Wei Tao et. al [13] proposed spatio-temporal predicting module focused on linked convolutionary network and long-time attention-to-crowd-flow prediction memory (ST-DCCNAL). Their approach uses a DensaNet model for capturing and merge the spatial dependency with external characteristics. The LSTM module for the extraction of time patterns is applied. Deep learning technique are combined innovatively to build a new model for traffic flow forecasting. The model proposed can extract the deeply hidden spatiotemporal characteristics. Their model was evaluated using two datasets of the actual crowd’s flows, and the experiment results show that the STDCCNAL model exceeds many striving method substantially. They have found that the DenseNets module better shapes space relations than CNNs norm and improves the attention mechanism for the time capture of LSTM. In addition, the external feature of auxiliary data can enhance prediction accuracy.

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3. Implementation

Any supervised algorithms of machine learning will require a systematic flux of the steps below. They are simplified structures that can help to better identify the problem and to structurally implement the all phases of the project. We have the following modules: Convolution, Kernel Filter, Max Pooling, Activation Function, Model Validation, Model Deployment.

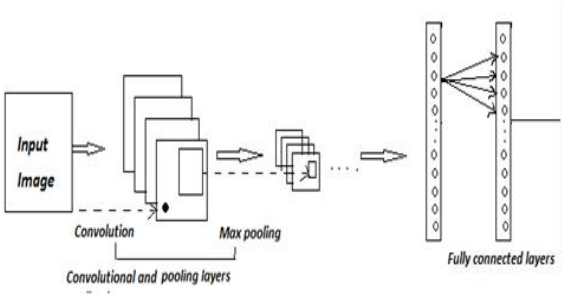

Figure 1 Different modules in CNN

a. Convolution

In mathematics, the term convolution is refereed as mathematical operations that applied upon a function with the help of the functions .it is defined as integral part of the product that is applied and shifted over producing the convolution function. A CNN is Deep Learning algorithm that uses images as inputs and assigns weight and bias to different aspect of the images and can differentiate between them.

The time taken to preprocessing the data in convolutional neural networks is very less when compared to other machine algorithms the architectures of a convolutional neural networks is similar to the brain of the human where multiple neurons are connected over the cortex. It has the capacity to process the information through series of signals Images are generally made up of pixels the images size is typically represented in the form of rows, columns and RGB color formats. In case of a binary image that is a gray scale image the images are treated as binary values the black is represented as zero and white color is represented is white.

A ConvNet is can successfully capture the overlay parts of the images and an image will be processed through the pixel by pixel by taking a 3*3 or 5*5 convolution and the convolutions are processed through the entire images to create the new features after each convolution the images are processed through the weights and biases.

The visualization of 3*3 filters is in 3d space is visualized as below and the process leads to generate the multiple images of smaller sizes and the convolutional are used in creating feature maps the higher feature maps the higher the accuracy of the models can be possible over a period of time we are going to process the complete image for creating by applying a better kernel filters through the images.

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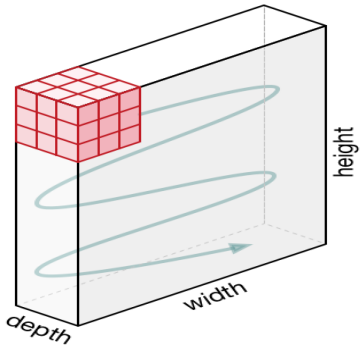

Figure 2 Visualization of 3x3 filters in 3D space

The feature maps are the actual features that goes as input to the convolutional neural networks the images will be processed through a predefined the activation functions and the activation functions are used to calculate the different weighted features and the process of the process the image is very fast. Before the fully connected layers the entire images processing happens through the convolutional neural networks, and they are process with large scale and faster than the expected method. With different types of kernel s applied there is great chance of the getting bets features in the convolutional neural networks and the output is predicted the final outcome.

B. Kernel Filter

The kernel filters are generally a matrix of operations that applied up on original matrix

1. **Convolutional 1D:** it has row level values the values that are randomly generated. it is used to multiple with the original kernel of the image
2. **Convolutional 2D:** These images are 2*2 matrixes. It has rows and columns as input to the image.
3. **Convolutional 3D:** These convolutional filters are 3*3 and they have been used to process the RGB images and the process of the images was happens through this multi-channel the images and the images was sided over the convolutional process and sided over the image to generate the multiple features maps this is standard filter we us whenever we want to process the images of the convolutions and created the features.

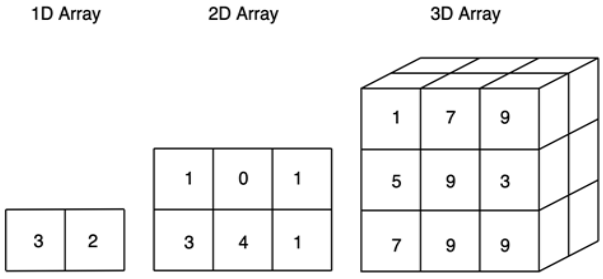

Figure 3 Kernel Filter

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C. Max Pooling

Convolutional neural networks are images that a filter applied systematically on the images to process images. The process of converting multiple feature maps can result in the create great feature maps we will be using a method called down sapling to process the images and the images processed through down sampling images are having better features. Convolutional neural networks are proven to be very effective when we are stacking multiple layers.

A common approach to this problem is that down sampling can achieve through the process of taking a maximum of the convolutional neural network convolutions. A better approach is to use the pooling layer. The pooling layers is the method of using the maximum number of the image. It can also be called as max pooling.

The two types of pooling layers are the listed below

1. **Average pooling:** After applying the filter we take the average number out of all the processing.
2. **Maximum Pooling:** After applying the kernel we will be applying the maximum number as the process for the analysis.

d. Activation Function

Activation functions are the key to convert the images to meaning full features that can be used as input to the convolutional neural network. Activation functions also can help in processing the images trough the final outputs of the models that can result in predicting the outcome of a variables.

Sigmoid Function: The sigmoid activation function is a binary predictive variable it takes the input of a value and try to squash between the values that are in the range of 0 to 1 this particular activation function is used in the process of predicting the final variables of a binary outcome of the model. In general machine learning model perspective, it is also called a sigmoid function. Based on the input value the outcome will be predicted in the range of 0 to 1 and the final output can be used to make informed decision about the models.

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

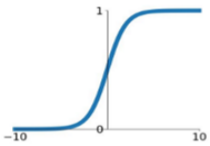

Figure 4 Sigmoid Function

RELU: Rectified linear units is the activation function that is used to predict a continuous variables between 0 to infinity. The process of the predicting the output using the input variables is done via activation function. The Tanh is function that helps in predicting a positive number. It is very common practice for predicting sales, units, transactions …etc.

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$$\max(0, x)$$

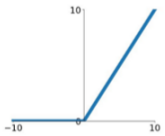

Figure 5 RELU Function

MAXOUT: The activation function's is a combination of the weight and biases that are processed through the weights and biases. There are multiple values that can be processed through the activation function method, and they have been variously proceeded through the multiple layers of convolutional neural networks to get the final values of the output.

$$\max(w_1^T x + b_1, w_2^T x + b_2)$$

Figure 6 Maxout Function

e. Model Validation

Model validation is the common process of the validating the predicted model through the multiple images and the multiple images are processed through the convolutional neural networks. A batch of 80 images is has been used to process through the convolutional neural networks and predicted the predicted values are compared against the original values and the accuracy of the model will be judged.

As research, we have narrowed down all the different techniques below as the reference based on the volume of the data, we can select the technique that is used for predicting the images in the feature. A common practice is to use the images that are given for training purpose and divide them into two categories as they would be seeing as training and testing, and a common ratio split is 80:20

Different techniques exist for the model validation, and these are primarily used for validating the numerical data and however, can be leverage for the images as well these are the process that can help in predicting the models that are predicting are right or wrong

- Leave-p-out cross-validating
- Leaving-one-out cross-validating
- K-fold cross-validation
- Holdout method
- Returned random sub-sampling validating

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f. Model Deployment

Once the model is developed it needs to be hosted in an environment which can be easily available for everyone access there are many techniques available for hosting propose in this project, we have selected Django and flask frameworks for predicting the final values. The model output will be created as API and the API will be used for the predicting the accident happening evening sand non happening events. We have trained the models with hundreds of images and the hundreds of images re used for predicting the labelled data into the process of the predicting for the new variables.

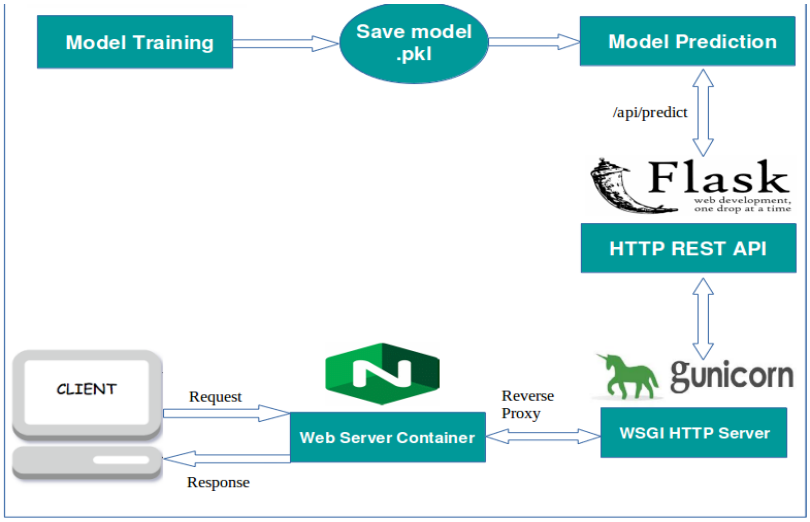

Figure 7 Deployment Model

4. Experimental Results and Analysis

As per the tests done, we are getting the expected output and the alerts. Object detection and opencv gave the best result when compared with the existing methods. The proposed model can successfully identify accidents and the severity level of the accident. A screenshot is captured when an accident is detected, and an alert will be showed on the home screen.

Figure 8 Accident detected

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As a result, we are getting the alert message on the monitoring screen which will be helpful to get the attention of the person who is monitoring the system.

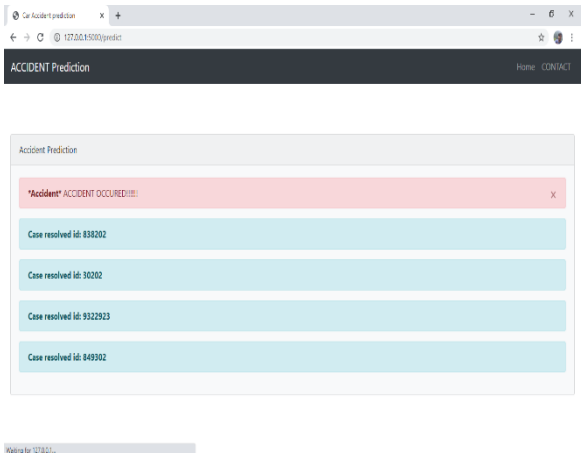

Figure 9 Alert Message displayed when accident is detected

5. Conclusion and Future Work

In this project the proposed method is an automatic accident detection and gives the severity. The simulation experiments result of our method, which demonstrates our proposed method can successfully detect the accident and give the severity. This model can be used in real-time system to get a better experience, and this will be helpful to provide emergency service when an accident is occurred.

To further enhancements and advanced models can be used to identify the accidents. An end-to-end product which can be used by the clients to identify how many people in the accident are injured this can be treated as enhancement for future work.

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