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Traffic Sign Recognition Using Machine Learning

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ABSTRACT

With advancement in artificial intelligence (AI), Deep learning models are used to imitate the actions of human beings. These activities of personage are controlled by their brain and similar to that, machines are capable of data processing, decision making, speech recognition and language translations just like human beings. One of the applications of deep learning includes Autonomous Vehicles design i.e., driver less cars. To implement this, we need an automatic traffic sign recognition (TSR) model. These models are designed with the use of convolutional neural networks (CNN). The main task of this model is to extract the various features of the different traffic sign images and classify according to unique categories. This paper includes a comprehensive review of various models that can be used for classifying traffic signs. Researchers have applied various CNN models to predict the class of traffic sign and these are proven to be better than machine learning algorithms. CNN works as a feed forward neural network which has been stimulated from animal visual cortex.

Introduction: Recently the number of road vehicles has increased enormously thanks to the technological achievements in the motor industry and very precisely the availability of low rates. With this remarkable growth, the number of accidents is as well in an infinite raise year after year, due to different causes, in which the ignorance of traffic signs is considered as a major cause of these lasts.

Developing automated traffic sign recognition systems helps assisting the driver in different ways in order to guarantee his/her safety, which preserves as well the safety of other drivers and pedestrians. These systems have one main goal: detecting and recognizing traffic signs during the driving process. With these functionalities the system can guide and alert the drivers to prevent danger. Even though it is possible to develop a system that can recognize traffic signs, it doesn't mean that any sign can be correctly recognized by the system due to some traffic environmental challenges, for example: lightning variations, bad illumination, weather changes and signs in a ruined condition.

Traffic signs (TS) are generally divided into three main categories according to their functions: regulatory signs to give notice of traffic laws or regulation, warning signs to give notice of a situation that might cause danger and finally guide signs to show information about route destinations, distances, etc. In each mentioned TS category, there are different subclasses with similar generic shape and appearance but different details. This suggests that traffic sign recognition should be carried out in two phases: the first phase consists of detecting traffic signs

in a video sequence or an image using image processing algorithms that are generally based on shape and color segmentation. The second one is normally related to recognition of the detected signs in the first step, by applying a classification algorithm. Various methods have been developed in this area on top of them, artificial neural networks.

Literature Survey: In any kind of study, the most critical move is to do a literature review. This move would allow us to identify any gaps or flaws in the current structure which will attempt to find a way to get around the limitations of the current method. We briefly discuss similar work on traffic sign detection identification and recognition in this segment.

Shihavuddin c, Muhammad Abul Hasan describe the "A novel lightweight CNN architecture for traffic sign recognition without GPU requirements". Author focused on Main challenges in detecting traffic signs in real time scenarios includes distortion of images, speed factor, motion effect, noise, faded color of signs. Training only on grayscale images gives average accuracy. So, authors proposed DeepThin architecture which is divided into 3 modules input processing, learning, and prediction. Architecture is deep and thin at the same time. Thin because they considered small number of feature maps per layer and deep because 4 layers used. And since number of feature maps, and large convolution strides, it has become possible to train without a GPU. use of overlapping max pooling and sparsely used stride convolution made training faster and reduced overfitting issue. Data augmentation is performed in order to achieve robustness. For augmentation they used operations such as original random shearing of training images, zoomed-in/zoomed-out, horizontally-shifted, vertically-shifted during training. For experimentation German Traffic Sign Recognition Benchmark and Belgian Traffic Sign Classification dataset is used. hyper parameter tuning is done for kernel size and feature map and During training phase CNN model is used with backpropagation learning algorithm, cross-entropy, stochastic gradient descent (SGD) as the optimizer.

Shijin Songa ,Zhiqiang Que b, JunjieHoua , Sen Dua , YuefengSonga describe the "An efficient convolutional neural network for small traffic sign detection". In this paper, researcher focused on issues for small object detection and proposed efficient convolutional neutral network for small traffic sign detection and compared accuracy against R-CNN and Faster R-CNN.CNN model is explained in detail along with forward propagation, back word propagation, loss functions. Authors increased the number of convolutional kernels per Conv layer from the start and implemented Max-pooling layers with a stride of 2 to down-sample the network in the feature extraction phase. To optimize this model further three strategies used convolution factorization, redundant layer cropping and fully connected transformation. The Tsinghua-Tencent data set is used for evaluation. Proposed model is not only efficient but also consumed less GPU memory and save the computation cost.

Ivona Matoš; Zdravko Krpić; Krešimir Romić describe the "The Speed Limit Road Signs Recognition Using Hough Transformation and Multi-Class Svm". In this paper preprocessing step, hue, saturation, and lightness (HSL) values are used to improve the contrast in dataset images, making detection simpler.The Hough Circle feature was used in the detection process. It

uses the Hough transformation to locate circles inside pictures. HOG descriptor is used for edge detection and at the end SVM classifier is used to train and test model and proposed model is tested on MASTIF and GTSRB data set .

Proposed system and results: Coding is the process of designing, writing, testing, debugging, and maintaining the source code of computer programs. This source code is written in one or more programming languages. The purpose of programming is to create a set of instructions that computers use to perform specific operations or to exhibit desired behaviors. The process of writing source code often requires expertise in many different subjects, including knowledge of the application domain, specialized algorithms and formal logic.

In proposed system, a CNN based model to recognize the traffic sign. The model consists of four parts: importing the image dataset, images preprocessing, training the model using CNN, uploading the image and recognition.

Initially, we have collected the dataset from Kaggle and imported it into our project. After loading the dataset, we perform preprocessing on it by splitting the dataset into training and testing dataset. Later, we train our model using the CNN. Then, we recognize any traffic sign which is uploaded through GUI.

Testing can also be stated as the process of verifying and validating that a software or application is bug free, meets the technical requirements as guided by its design and development, and meets the user requirements effectively and efficiently with handling all the exceptional and boundary cases.

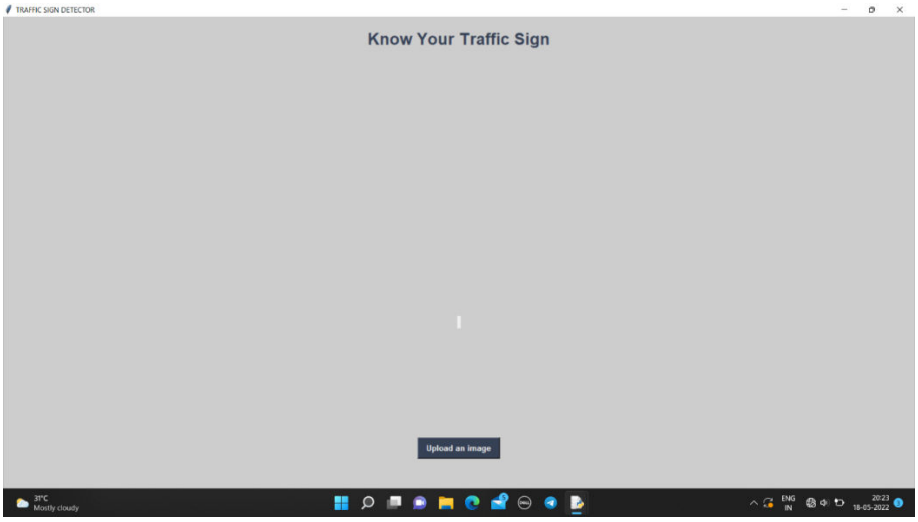

Fig: Uploading an Image

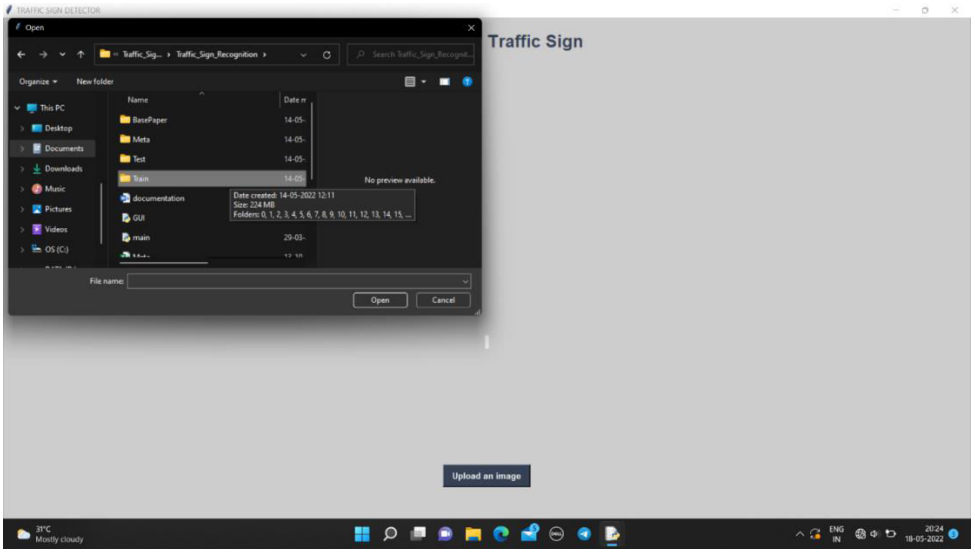

Fig: Selecting from train set

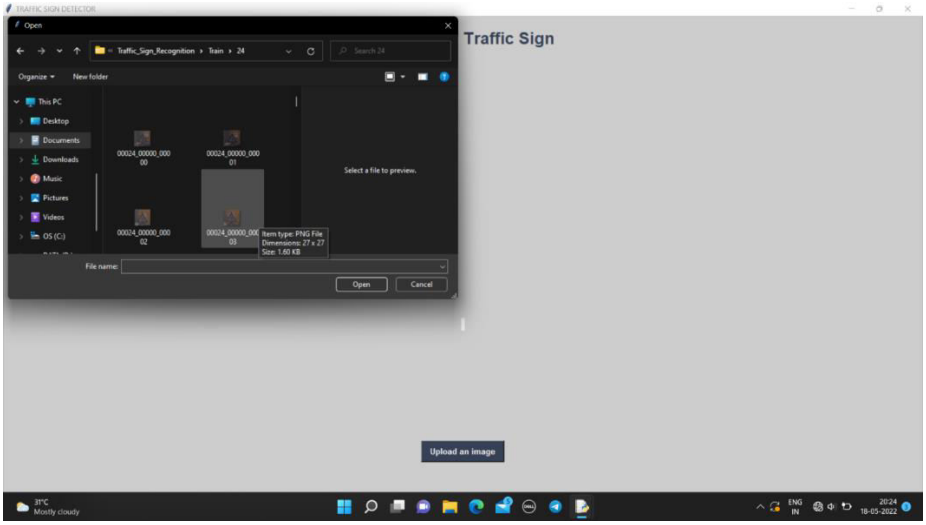

Fig: Image selection

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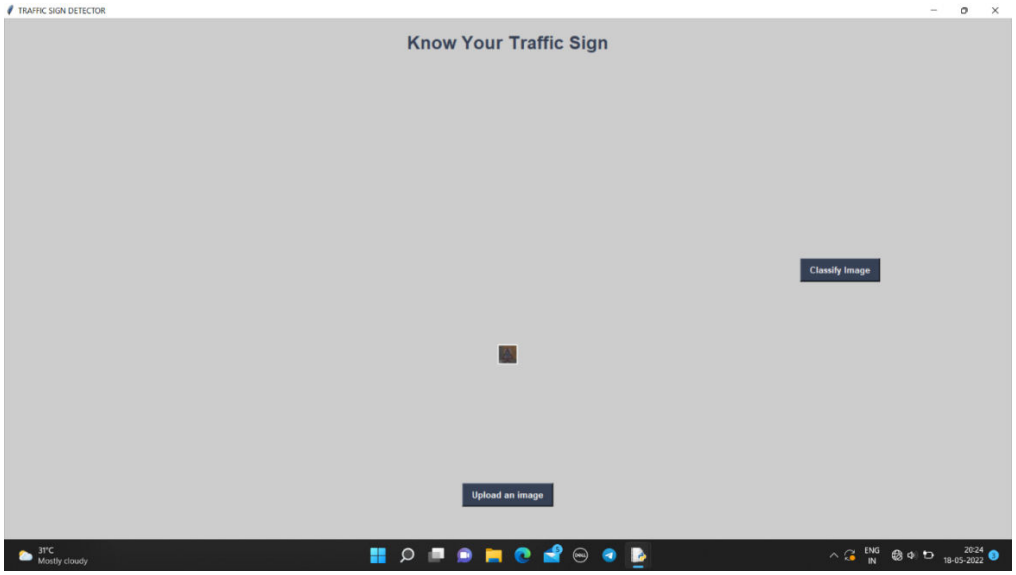

Fig: Classifying Image

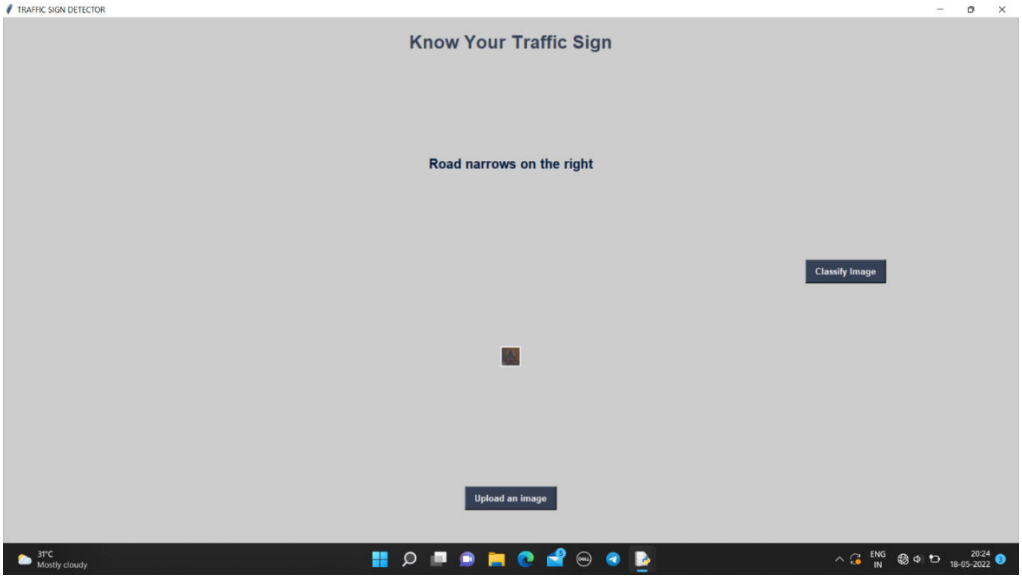

Fig.: Final Output

Conclusion: The whole theme of introducing the technique of traffic sign recognition using CNN algorithm is to reduce the degree of accidents and increase the reliability in traffic safety and traffic rules maintenance. The proposed system will help the drivers to maintain the all kinds of certain speed limits, avoids different types of accidents and makes the driver to follow the traffic rules appropriately. The algorithms used in the proposed system maintains the accuracy to 99.75% to give the relevant results to all the users. Regardless of weather and image specifications, the built model will be able to classify the image and provide the results.

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