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A Research Paper on Traffic Sign Recognition with Machine Learning and IOT

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Abstract: This paper will help to bring out some amazing findings about autonomous prediction and performing action by establishing a connection between the real world with machine learning and Internet Of thing. The purpose of this research paper is to perform our machine to analyze different signs in the real world and act accordingly. We have explored and found detection of several features in our model which helped us to establish a better interaction of our model with the surroundings. Our algorithms give very optimized predictions performing the right action .Nowadays, autonomous vehicles are a great area of research where we can make it more optimized and more multi - performing .This paper contributes to a huge survey of varied object detection and feature extraction techniques. At the moment, there are loads of object classification and recognition techniques and algorithms found and developed around the world.
TSD research is of great significance for improving road traffic safety. In recent years, CNN (Convolutional Neural Networks) have achieved great success in object detection tasks. It shows better accuracy or faster execution speed than traditional methods. However, the execution speed and the detection accuracy of the existing CNN methods cannot be obtained at the same time. What's more, the hardware requirements are also higher than before, resulting in a larger detection cost. In order to solve these problems, this paper proposes an improved algorithm based on convolutional model
A classic robot which uses this algorithm which is installed through raspberry pi and performs dedicated action.
Keywords: deep neural network, supervised learning, IOT, opencv, object detection

I. INTRODUCTION

Autonomous vehicle driving systems (AVDS) recognize potential dangers, threats, driving limitations and possibilities. One of the key factors for a successful AVDS development is to identify appropriate traffic rules valid on a certain road sector or in a junction. Such a visual recognition helps auto navigation or navigation assisting systems to be more safe, because the most of car accidents occur due to lack of concentration and failures to notice important traffic signs.

A large variety of traffic sign recognition systems have been developed since the 1980s. The early ideas relied on optical-based micro-programmed hardware to overcome computational complexity and other current mobile computing-related constraints. With the first in-car integrations, software-based solutions appeared later [2]. Although in-car embedding necessitated real-time image processing, parallel hardware components were employed for acceleration, as well as relatively low camera resolution and frame rate to reduce data size complexity. In the mid-2000s, web cams were less expensive and had improved resolution, which improved traffic sign recognition research in recent years. But at the other hand, high accuracy real-time traffic sign identification remains a difficult issue since data size rises quadratically when utilising high resolution cameras, although computer power improves linearly according to Moore's law. In mobile situations, computational power restricts applications even further.

We suggest a unique way to deal with real-time difficulties in high-resolution video streams in this work. The following is how the paper is structured: The most essential difficulties to be solved for real-time traffic sign recognition systems are shown in Section II through sample situations. Section III summarises a thorough overview of earlier studies. Section IV introduces a unique approach for dealing with high-resolution data in low-resource computing environments. Finally, Section IV analyses the performance of traffic sign recognition systems.

II. GENERAL PROBLEM

Traffic sign recognition is about to understand vision based real life scenarios in an artificially controlled environment. While limitations help engineers to build AVDS by having an extensive knowledge on traffic situations when traffic rules are not broken, real life scenarios still differ in many ways (see Figure 1), i.e. the problem space is quasi infinite.

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Fig 1:- different sign at the roadside

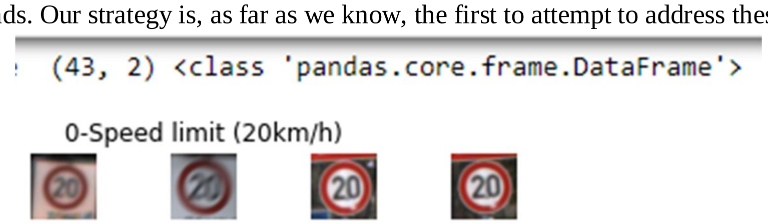
A. The design to monitor and correct for variations in ambient lighting conditions, such as weather changes, daylight, and automobile turns, is among the most debated issues. Because cameras are designed for human vision (in)abilities, they adjust the colour representations exhibited in real time based on lighting angle and brightness. To capture the sensation of shadow, fog, wet, or overcast weather, or to compensate for greyish patterns in photos, cameras add the least significant hue (typically blue). In indirect lighting situations, another method is to minimise the red components (and enhance grey): human eyes still detect large red pixels, but pictures appear more real.When cameras are placed against incoming illumination, such as facing the Sun, they compensate for high brightness values by rendering all hues grey. It's worth noting that there are hardly no projects that take place at night TSR

B. Occlusions of traffic signs due to the presence of objects such as trees, buildings, vehicles, pedestrians, or other signs are also an important factor to be considered. If part of the object is covered then successful detection and classification require recognition tasks to relax some preconditions that also increase the number of non-traffic sign objects to be recognized as road signs. A general approach is to calculate and record a large number of features on image objects, however, because of the computational complexity real-time criteria can be met only at a very low speed or frame rate.

C. Different in-plane and out-of-plane rotations, and the viewing angle can cause problems for recognition as both shape based recognizer, and classification methods are not robust enough for n-dimension non-affine transformations. For example, squared traffic signs are rather like trapezes from the driver point of view, According to nonlinear optical transformations in cameras, even circles become ovals. As a result, in the vast majority of circumstances, non-linear, adaptive normalisation is required; however, in order to find the ideal transformation, one must first identify the reference object.

D. Videos are sequences of photos recorded at varying speeds, which might cause focusing or blurring issues, and can also prevent traffic signs from being caught at a reasonable (e.g. at least 12px) size. At a speed of 50 km/h, cameras, for example, take photos every 0.5m, resulting in traffic signs appearing for no more than two frames at fast right turns. Increase the frame rate until real-time constraints are reached to accommodate for high-speed camera recordings.

E. Last but not least, traffic sign colour codes, shapes, and pictograms change not only across cities but also between countries. In Germany, for example, “one way street” traffic signs are long, lying blue rectangles; in the United States, they are white rectangles; and in Hungary, they are squared blue rectangles. Stop signs and other text-based traffic signs can have even more variations1. Some countries (such as Macedonia) utilise yellow backgrounds for traffic signs, whereas others (such as Hungary) only use white backgrounds. Our strategy is, as far as we know, the first to attempt to address these concerns.



III. ARCHITECTURE FOR TRAFFIC SIGN RECOGNITION

Real-time AVDS must deal with all of the aforementioned issues while completing the three basic recognition phases (see Figure 2):

1) Color segmentation or adjustment which includes video/image decoding and color space transformation
2) Selection of regions of interests (ROI) where traffic signs are present in the image
3) Feature extraction techniques paired with data mining classifiers are used to identify traffic signs.

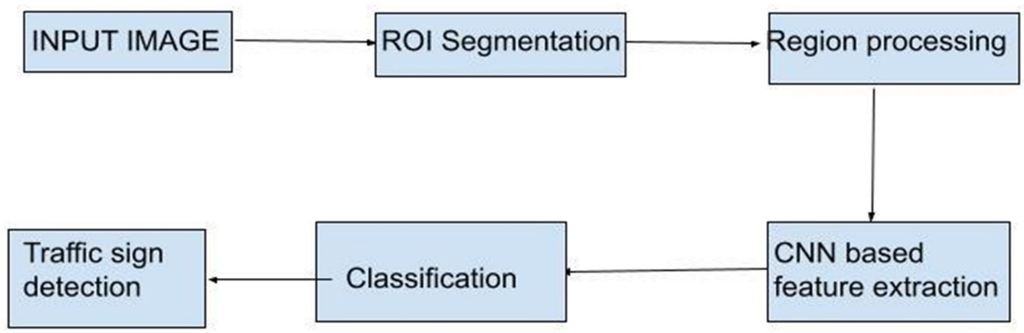


Fig 2. Machine learning working diagram of an algorithm

A. Identifying Traffic Signs

Preprocessing and classification are usually the first two phases in the identification process. Multi-layer Perceptrons (MLP), Radial Basis Functions (RBFs), SVMs, k-nearest neighbours, and decision trees are susceptible to input data discrepancies, such as data shifting, rotation or pin changes, occlusions or fading, and scaling difficulties, especially if the input data is 2D objects.

Input data must be normalised in whatever manner feasible for classifiers to work, which is why feature extraction techniques are so important for translating data into a consistent feature space. Some of the solutions rely on quick, basic colour distribution or pattern matching based on rules. While they are fairly resilient in the face of occlusions, they are incapable of handling rotations or simultaneous traffic signs. Others try to employ well-known data mining feature selection techniques like Principal Component Analysis (PCA), Singular Value Decomposition (SVD), and different forms of Fourier Transformations, however these methods are not only computationally expensive but also potentially harmful.

IV. PROPOSED SYSTEM

A. Proposed System Architecture

The objective of this work is to develop a method to segment the traffic sign from the background image by applying various techniques like ReLu, pooling, filtering, edge detection, and full connection.

Detecting road barriers is one of the most tough actual-time obligations for independent vehicle navigation systems. The main idea is to develop a powerful device for an actual-time such that it reacts by surroundings signs. road accidents are human suffering sometimes animal too which passes, in terms of unhappy deaths, injuries, and loss of possible profits. India is home to around one percent of the world's car population. However, it only accounted for around 6% of all global traffic accidents. In India, over 151 thousand people died in traffic accidents in 2018. Now it is clear that the key driver is one of the major causes of road injuries. So we can extend object detecting structures that aid the motive force, reducing the number of accidents, absence, and here's a look at which is focused on dual carriageway safety and safety. Drivers are alerted via voice message whereas an item is being detected. Object identification and tracking are crucial elements in many object detection, which are utilised in autonomous vehicles, medical diagnostics, surveillance, and industrial automation. There has been tremendous progress in this field during the last few decades.

B. ReLU

The rectifier function is used to increase non-linearity in the CNN at this step. Different things that are not linear to each other are used to create images. The picture classification will be handled as a linear issue if this function is not used, even if it is a nonlinear problem.

C. Pooling

The idea of spatially invariant says that the placement of an object in the image has no bearing on the neural network's capacity to recognise its individual properties. Pooling allows the CNN to recognise characteristics in several images despite differences in illumination and camera angles.

D. Flattening

After we've received the pooled featured map, we'll need to flatten it. The whole pooled feature map matrix is flattened into a single column, which is then supplied to the neural network for processing.

Model: "sequential_1"

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 28, 28, 60)	1560
conv2d_2 (Conv2D)	(None, 24, 24, 60)	90060
max_pooling2d_1 (MaxPooling2	(None, 12, 12, 60)	0
conv2d_3 (Conv2D)	(None, 10, 10, 30)	16230
conv2d_4 (Conv2D)	(None, 8, 8, 30)	8130
max_pooling2d_2 (MaxPooling2	(None, 4, 4, 30)	0
dropout_1 (Dropout)	(None, 4, 4, 30)	0
flatten_1 (Flatten)	(None, 480)	0

E. Full connection

The compressed feature map is then put through a neural network after flattening. The input layer, the fully linked layer, and also the output layer make up each step. In ANNs, the fully connected layer is identical to the hidden layer, except it is fully linked in this case. The anticipated classes are found in the output layer. The data is sent over the network, and the prediction error is determined. The error is then sent back into the algorithm in order to enhance the forecast.

$$\sigma : \mathbb{R}^K \to (0,1)^K$$

$$\sigma(\mathbf{z})_j = \frac{e^{z_j}}{\sum_{k=1}^{K} e^{z_k}} \quad \text{for } j = 1, \ldots, K.$$

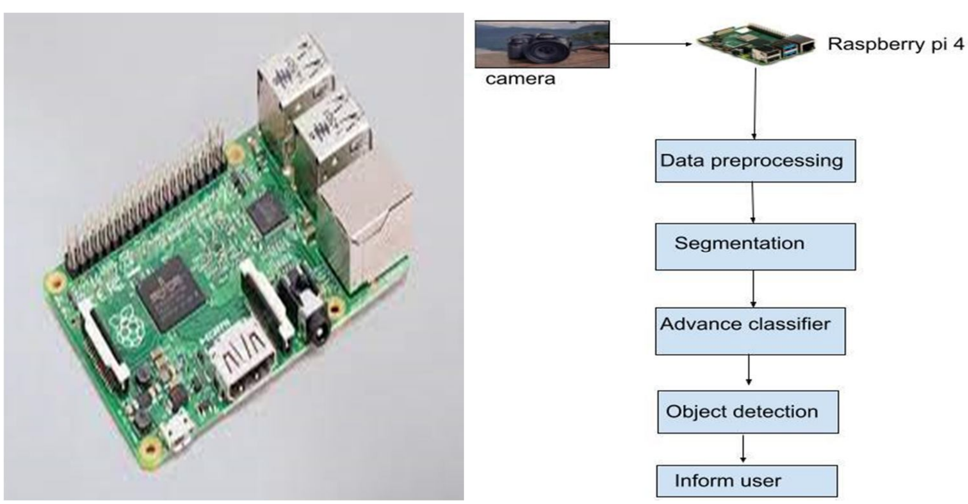


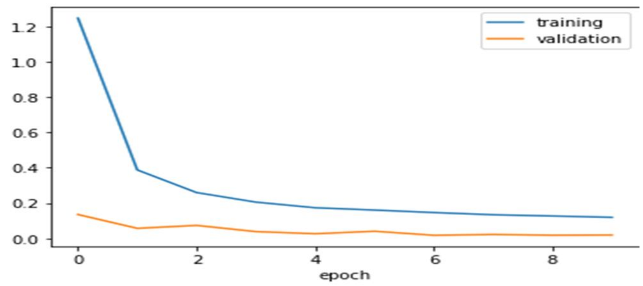
Fig 2 :- Proposed system architecture

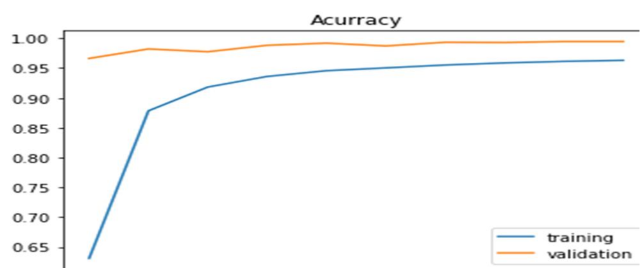
The Raspberry Pi can quickly capture a sequence of images using its capture port with a JPEG encoder. Our Raspberry Picamera can record images at a rate of 40 frames per second at 640x480 using the capture sequence method.

The camera is helpful to capture real-time photos in a continuous loop. These photographs may be sent to the Raspberry Pi, which can then use them to operate the car using the images available from the camera.

V. CONCLUSION

As is clear from the above text, we are very eager to implement this project concept using machine learning and the internet of things. Using traffic sign colour and form data, the difficulty of traffic sign recognition for the purpose of road sign inventory has been overcome. A new set of algorithms has been designed and tested in a range of settings, and the results have been solid and consistent. The proposed system's success gives up new possibilities for future research. This exploration into designing autonomous vehicles sign recognition provides great accuracy of about 97.4% in testing and above 92% in general detection and additional multi voice feature gives best multi functional algorithm for driving autonomously. Automation of road sign inventories is becoming a necessity for road authorities, and such a system will be in use in the not-too-distant future.





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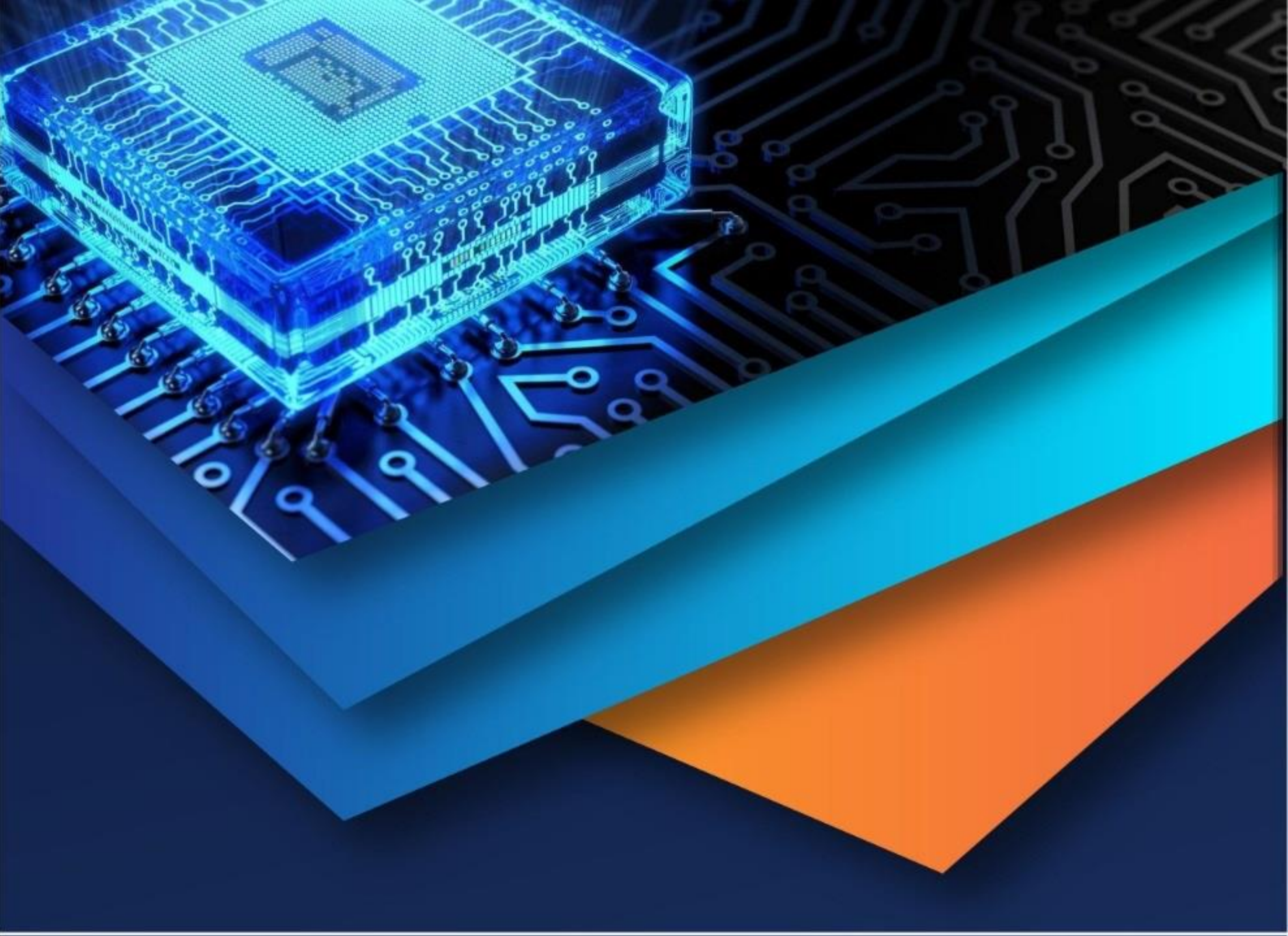

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