



Article Title: Dense Net Model Based Traffic Sign Board Recognition and Voice Alert System

Dense Net Model Based Traffic Sign Board Recognition and Voice Alert System

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ABSTRACT

To ensure a smooth and secure flow of traffic, road signs are essential. A major cause of road accidents is negligence in viewing the Traffic signboards and interpreting them incorrectly. The proposed system helps in recognizing the Traffic sign and sending a voice alert through the speaker to the driver so that he/ she may take necessary decisions. The proposed system is trained using Convolutional Neural Network (CNN) which helps in traffic sign image recognition and classification. A set of classes are defined and trained on a particular dataset to make it more accurate. The German Traffic Sign Benchmarks Dataset was used, which contains approximately 43 categories and 51,900 images of traffic signs. The accuracy of the execution is about 98.52 percent. Following the detection of the sign by the system, a voice alert is sent through the speaker which notifies the driver. The proposed system also contains a section where the vehicle driver is alerted about the traffic signs in the near proximity which helps them to be aware of what rules to follow on the route. The aim of this system is to ensure the safety of the vehicle's driver, passengers, and pedestrians.

Keywords: Traffic Signs, Automatic Recognition system, CapsNet, Traffic safety.

1 Introduction

Traffic signs location and acknowledgment is a critical viewpoint for giving security for all the street clients. Various computer vision frameworks have been created as of late for traffic signs examination. But the characteristics of existing calculations (acknowledgment accuracy, false caution rate, vigor against air changes) are still not great sufficient to substitute a human operator. Over the world, 1.2 million individuals were slaughtered in traffic crashes in 2002, which was 2.1% of all worldwide passings and the 11th positioned cause of passing. These days, we are moving towards a unused period in which, much obliged to advances, crashes are uncommon or maybe then commonplace. In truth, modern Brilliantly Transport Frameworks (ITS) have been presented in automotive industry in arrange to spare cash and lives, and to create the driving secure and convenient. There have been a part of innovative headways and cars with auto-pilot mode have come up. Independent vehicles have come into presence. There has been a boom in the self-driving car industry. Be that as it may, these highlights are accessible as it were in a few high-end cars which are not reasonable to the masses. We needed



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to plan a framework which makes a difference in easing the work of driving to a few extent. On conducting a overview, we found that the size of street mischances in India is alarming. Reports recommend that each hour there are approximately 53 disasters taking put on the roads. Additionally, each hour more than 16 happen due to these disasters. When passings someone neglects to comply traffic signs whereas driving, they are putting their life as well the life of the other drivers, their travelers and those on the street at hazard. Consequently, we came up with this system in which traffic signs are naturally identified utilizing the live video stream and are read out out loud to the driver who may at that point take the specified choice. Another range of center in our framework is the thought of getting the area of the client utilizing GPS. Moreover, all the traffic signs will be put away in a database together with their area so that the driver will be informed in advance with respect to the another drawing nearer traffic sign which traffic signs are naturally identified utilizing the live video stream and are read out loud to the driver who may at that point take the specified choice. Another range of center in our framework is the thought of getting the area of the client utilizing GPS. Moreover, all the traffic signs will be put away in a database together with their area so that the driver will be informed in advance with respect to the another drawing nearer traffic Sign. The traditional CNN cannot effectively recognize traffic signs in images taken in different, environments, speeds, positions, poses, angles or directions.

2 Recent Works

[1] Indian Traffic Sign Board Recognition and Driver Alert System Using Machine Learning. International Journal of Applied Sciences and Smart Technologies, Yadav, Shubham&Patwa, Anuj&Rane, Saiprasad&Narvekar, Chhaya, 2019. Sign board recognition and driver alert system which has a number of important application areas that include advance driver assistance systems, road surveying and autonomous vehicles. The system uses image processing technique to isolate relevant data which is captured from the real time streaming video. The proposed method is broadly divided in five-part data collection, data processing, data classification, training and testing. System uses variety of image processing techniques to enhance the image quality and to remove noninformational pixel, and detecting edges. Feature extractor are used to find the features of image. Machine learning algorithm Support Vector Machine (SVM) is used to classify the images based on their features. If features of sign that are captured from the video matches with the trained traffic signs, then it will generate the voice signal to alert the driver. In India there are different traffic sign board and they are classified into three categories: Regulatory sign, Cautionary sign, informational sign. These Indian signs have four different shapes and eight different colors. The proposed system is trained for ten different types of signs. In each category more than a thousand sample images are used to train the network.

[2] Automatic Signboard Detection System by the Vehicles, Anusree's., S., Kumar, H., Iram, I., &Divyam, K. 2019. A major cause of accidents is not considering the signboards on



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roads, and not following the rules accordingly. So to avoid this problem, introducing a signboard detection system in the vehicle which will detect the signboard and warn the driver about it. It displays the alert message or information on provided LCD and voice alert through speakers. Traffic sign recognition is important to transport system on the highway or road. Major approach is to detect road sign and extract it using OpenCV. The system will play an important role in saving many lives.

[3] A smart driver alert system for vehicle traffic using image detection and recognition technique, S. Harini, V. Abhiram, R. Hegde, B. D. D. Samarth, S. A. Shreyas and K. H. Gowranga, 2017. Road signs are important to ensure smooth traffic flow without bottle necks or mishaps. Road symbols are the pictorial representations having different necessary information required to be understood by driver. Road signs in front of the vehicle are ignored by the drivers and this can lead to catastrophic accidents. This paper presents an overview of the traffic sign board detection and recognition and implements a procedure to extract the road sign from a natural complex image, processes it and alerts the driver using voice command. It is implemented in such a way that it acts as a boon to drivers to make easy decisions.

[4] Research and Application of Traffic Sign Detection and Recognition Based on Deep Learning. Wang, 2018. Intelligent Transportation System (ITS), including unmanned vehicles, has been gradually matured despite on road. How to eliminate the interference due to various environmental factors, carry out accurate and efficient traffic sign detection and recognition, is a key technical problem. However, traditional visual object recognition mainly relies on visual feature extraction, e.g., color and edge, which has limitations. Convolutional neural network (CNN) was designed for visual object recognition based on deep learning, which has successfully overcome the shortcomings of conventional object recognition. In this paper, the implement an experiment to evaluate the performance of the latest version of YOLOv5 based on our dataset for Traffic Sign Recognition (TSR), which unfolds how the model for visual object recognition in deep learning is suitable for TSR through a comprehensive comparison with SSD (i.e., single shot multibox detector) as the objective of this paper. The experiments in this paper utilize our own dataset. Pertaining to the experimental results, YOLOv5 achieves 97.70% in terms of mAP@0.5 for all classes, SSD obtains 90.14% mAP in the same term. Meanwhile, regarding recognition speed, YOLOv5 also outperforms SSD.

[5] Traffic sign recognition with convolutional neural network based on max pooling positions, Qian, Y. Yue, F. Coenen and B. Zhang, 2021. Recognition of traffic signs is very important in many applications such as in self-driving car/driverless car, traffic mapping and traffic surveillance. Recently, deep learning models demonstrated prominent representation capacity, and achieved outstanding performance in traffic sign recognition. In this paper, we propose a traffic sign recognition system by applying convolutional neural network (CNN). In comparison with previous methods which usually use CNN as feature extractor and multilayer perceptron (MLP) as classifier, we proposed max pooling positions (MPPs) as an effective



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discriminative feature to predict category labels. Through extensive experiments, MPPs demonstrates the ideal characteristics of small inter-class variance and large intra-class variance. Moreover, with the German Traffic Sign Recognition Benchmark (GTSRB), outstanding performance has been achieved by using MPPs.

3 Proposed Methodology

Convolutional Neural Network (CNN) is an algorithm falling in the domain of Deep Learning. CNN can take a picture as input, assign priority to different items in the picture, and distinguish them from one another. It requires much less pre-processing as compared to other classification algorithms. Convolutional Network has the ability to learn the filters or characteristics in the images as opposed to the primitive methods filters where they are done manually. The architecture of a Convolutional Network can be compared to the connectivity pattern of Neurons in the Human Brain. The design itself was inspired by the organization of neurons as present in the Visual Cortex of the human brain. The neurons respond to stimuli only in a certain region of the field of view which is known as the Receptive Field. The visual area is a collection of a number of such receptive fields which help us in viewing objects. Once the model is trained over a series of epochs i.e., iterations, it develops the ability to distinguish between the dominating features and certain low-level features in the images. Dense Net model used in proposed system.

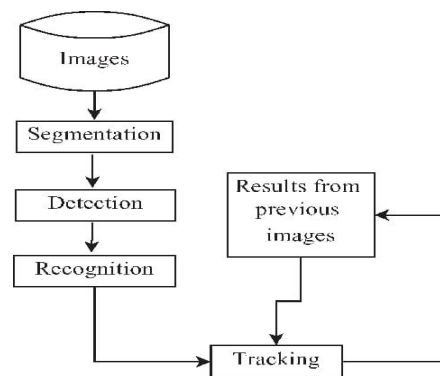


Figure 1: System architecture

3.1 Data Pre-processing

Data preprocessing is a step in the data mining and data analysis process that takes raw data and transforms it into a format that can be understood and analyzed by computers and machine learning. Raw, real-world data in the form of text, images, video, etc., Not only may it contain errors and inconsistencies, but it is often incomplete, and doesn't have a regular, uniform design. Machines like to process nice and tidy information – they read data as 1s and 0s. So calculating structured data, like whole numbers and percentages is easy. Unstructured in the form of text and images must first be cleaned and formatted before analysis.



3.2 Clustering Analysis and K – means Algorithm

Apply cluster analysis into the dataset. The purpose of clustering analysis is simply to find a convenient and efficient way to organize data, not to establish rules for classifying future data.

3.3 Discriminant Analysis and Bayes Discrimination

Discriminant analysis is a statistical analysis method to determine the category of samples. Bayes discriminant method support to find prior probability of the population to minimize the average loss of my student dataset. Discriminant analysis belongs to the branch of classification methods called generative modeling, the try to estimate the within-class density of X given the class label. Combined with the prior probability of classes, the posterior probability of Y can be obtained by the Bayes formula.

3.4 Deep Learning and CNN

In deep learning, a convolutional neural network is a class of artificial neural network (ANN), most commonly applied to analyze visual imagery. CNNs are also known as Shift Invariant or Space Invariant Artificial Neural Networks (SIANN), based on the shared-weight architecture of the convolution kernels or filters that slide along input features and provide translation-equivariant responses known as feature maps. Counterintuitively, most convolutional neural networks are only equivariant, as opposed to invariant, to translation. They have applications in image and video recognition, recommender systems, image classification, image segmentation, medical image analysis, natural language processing, brain–computer interfaces and financial time series. CNNs are regularized versions of multilayer perceptron. Multilayer perceptron usually means fully connected networks, that is, each neuron in one layer is connected to all neurons in the next layer. The "full connectivity" of these networks makes them prone to overfitting data. Typical ways of regularization, or preventing overfitting, include: penalizing parameters during training or trimming connectivity (skipped connections, dropout, etc.) CNNs take a different approach towards regularization: they take advantage of the hierarchical pattern in data and assemble patterns of increasing complexity using smaller and simpler patterns embossed in their filters. Therefore, on a scale of connectivity and complexity, CNNs are on the lower extreme.



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Convolutional Neural Networks

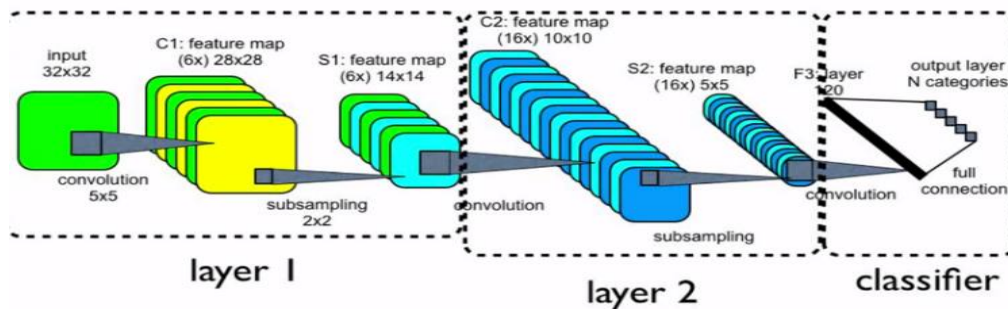


Figure 2: *Convolutional Neural Networks*

3.5 Metrics for Performance Evaluation

To evaluate the performance or quality of the model, different metrics are used, and these metrics are known as performance metrics or evaluation metrics. These performance metrics help us understand how well our model has performed for the given data. In this way can improve the model's performance by tuning the hyper-parameters.

4 Result And Discussion

The proposed system can operate at a range of vehicle speeds and was tested under a various conditions. Also our proposed system will save the valuable life by preventing accidents due to the negligence of traffic signs. The paper is mainly focus on majority of the society who used to travel especially the night travelers and it also helps traffic police to reduce the traffic issues. The main idea for this paper is from the road accidents that take place due to driver's ignorance of traffic signs. People die to driver's ignorance of traffic signs. People die in these road accidents which is a great loss for the family. It provides maximum efficiency and is user friendly. The proposed system is trained using Convolutional Neural Network (CNN) which helps in traffic sign image recognition and classification. A set of classes are defined and trained on a particular dataset to make it more accurate. The German Traffic Sign Benchmarks Dataset was used, which contains approximately 43 categories and 51,900 images of traffic signs. The accuracy of the execution is about 98.52 percent. Following the detection of the sign by the system, a voice alert is sent through the speaker which notifies the driver. The proposed system also contains a section where the vehicle driver is alerted about the traffic signs in the near proximity which helps them to be aware of what rules to follow on the route. The aim of this system is to ensure the safety of the vehicle's driver, passengers, and pedestrians.



5 Conclusion

The system is used to save the valuable life by preventing accidents due to the negligence of traffic signs boards. The paper is mainly focus on majority of the society used to travel especially the night travelers and it also helps traffic police to reduce the traffic issues. The main idea for this paper is from the road accidents that take place due to driver's ignorance of traffic signs. People die in these road accidents which is a great loss for the family. It provides maximum efficiency and is user friendly. At present 40% percentage of death that taking place in a day is mainly due to the road. By our paper expected that can able to reduce it up to 20%.

6 Future Enhancement

The prototype can be expanded to include an inbuilt alert system with a camera in the vehicle's center. Also, the feature of getting the estimated time for reaching that particular traffic sign can be added. This system can also be expanded for identification of traffic signals and hence prompt the user about the time to reach that particular signal and its status as well. The user can accordingly plan their trip start time and hence cross all signals without having to wait. Also, the driver verification will be done with the help of an API providing the information about the license holder and the license number.

References

1. S. Estable, Year: 2011, "Traffic-Sign Recognition Systems", Springer Briefs in Computer Science, pp. 2921 – 2929.
2. Jack Greenhalgh; Majid Mirmehdi, Year: 2012, "Real-Time Detection and Recognition of Road Traffic Signs", IEEE Transactions on Intelligent Transportation Systems, Vol: 13, pp.818 – 833.
3. Frank Lindner; Ulrich Kressel; Stephan Kaelberer, Year: 2001, "Real-time Vision for Intelligent Vehicles", IEEE Instrumentation & Measurement Magazine, pp. 248 – 255.
4. Ian Fletcher; Bill J. B. Arden; Chris S. Cox, Year: 2003, "Automatic Braking System Control", IEEE International. Symposium on Intelligent Control Houston, Texas, pp. 203 – 210.
5. Chia-Hsiung Chen; Marcus Chen; Tianshi Gao, Year: 2016, "Detection and Recognition of Alert Traffic Signs".
6. Shubham Yadav; Saiprasad Rane; Anuj Patwa; Chhaya Narvekar, Year: 2019, "Indian Traffic Sign Saiprasad Board Recognition and Driver Alert System Using Machine Learning", International Journal of Applied Sciences and Smart Technologies, Vol: 1, no: 1, pp. 1 – 10.
7. Canyong Wang, Year: 2018, "Research and Application of Traffic Sign Detection and Recognition Based on Deep Learning", 2018 International Conference on Robots & Intelligent System (ICRIS), pp. 150 – 152.



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8. M. A. Muchtar; M. F. Syahputra; N. Syahputra; S. Ashrafia; R. F. Rahmat, Year: 2017, “Augmented reality for searching potential assets in medan using GPS based tracking”, Journal of Physics: Conference Series, Vol: 801, no: 1, pp. 012010.
9. A. S. Anushree; H. Kumar; I. Iram; K. Divyam, Year: 2019, “Automatic Signboard Detection System by the Vehicles”, pp. 311 – 318.
10. Yanmei Jin; Yusheng Fu; Wenqin Wang; Jinhong Guo; Chunhui Ren; Xin Xiang, Year: 2020, “Multi-feature fusion and enhancement single shot detector for traffic sign recognition”, IEEE Access, Vol: 8, pp. 38931 – 38940.
11. T. Y. Zheng; N. Wang; J. Tang, Year: 2017, “Traffic signs detection based on ICF and multi-class classifier”, Transducer Microsyst. Technol., Tech. Rep., pp. 331 – 335.
12. Cen Han; Guangyu Gao; Yu Zhang, Year: 2019, “Real-time small traffic sign detection with revised faster-RCNN”, Multimedia Tools Appl, Vol: 78, pp. 13263 – 13278.
13. Mucahit Karaduman; Haluk Eren, Year: 2017, “Deep learning based traffic direction sign detection and determining driving style”, 2017 International Conference on Computer Science and Engineering (UBMK), pp. 1046 – 1050.
14. Ranabir Pal; Amrita Ghosh; Raman Kumar; Sagar Galwankar; Swapan Kumar Paul; Shrayan Pal; Debashis Sinha; A. K. Jaiswal; Luis Rafael Moscote-Salazar; Amit Agrawal, Year: 2019, “Public health crisis of road traffic accidents in India: Risk factor assessment and recommendations on prevention on the behalf of the Academy of Family Physicians of India”, Journal of family medicine and primary care, Vol: 8, no: 3, pp. 775 – 783.
15. David Silver; Aja Huang; Chris J. Maddison; Arthur Guez; Laurent Sifre; George Van Den Driessche; Julian Schrittwieser; I. Antonoglou; V. Panneershelvam; M. Lanctot; S. Dieleman, Year: 2016, “Mastering the game of go with deep neural networks and tree search”, Nature, Vol: 529, no: 7587, pp. 484 – 489.