



**IJIRCCCE**

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 8, Issue 8, August 2020

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 7.488**

9940 572 462

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www.ijircce.com

# Vehicle Speed Detection Using Convolutional Neural Network Model

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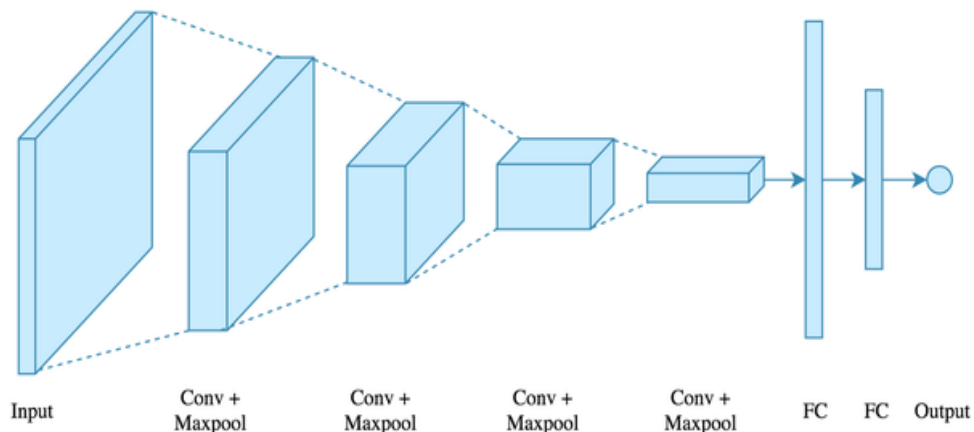
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**ABSTRACT:** In this paper, we propose the image recognition based technique, Convolutional Neural Network algorithm to detect the speed of a vehicle. The system requires a camera for input, and network capabilities to send data and so it will not be a troublesome task to install this system. To estimate the speed of a vehicle, we need to estimate the pixels per meter values manually for the current road to calculate pixels per meter (PPM). Therefore, the value will vary from road to road and have to be adjusted to be used on any other video. For how to estimate ppm, we need to know the actual width in meters of the road. Also, we have taken the video frame and calculated the width of the road in pixels digitally. Now, we have the width of the road in metres from the real world and in pixels from our video frame. To map the distances between these two worlds, we have calculated pixels per metre by dividing distance of road in pixels to metres. distance\_pixels gives the pixel distance travelled by the vehicle in one frame of our video processing. To estimate speed in any standard unit first, we need to convert d\_pixels to d\_metres. Now, we can calculate the speed (speed = d\_metres \* fps \* 3.6). d\_metres is the distance travelled in one frame. We have already calculated the average fps during video processing. So, to get the speed in m/s, just (d\_metres \* fps) will do. We have multiplied that estimated speed with 3.6 to convert it into km/hr.

## I. INTRODUCTION

Nearly 1.25 million people die in road crashes each year, on average 3,287 deaths a Day. An additional 20-50 million are injured or disabled. Most of the accidents are due to not following traffic rules and rash driving. Though lakhs of traffic policemen monitor the traffic in hefty traffic areas, there are some places where there is no one to monitor the traffic and it is difficult for a policeman to alert the rule violators of crossing the speed limit. This problem can be overcome by properly utilizing the growing concept of deep learning, Convolutional neural network. CNN is now the trending model on every image-related problem. In terms of accuracy, they are now best in competition. It is also successfully applied to human recognition systems, natural language processing and more. The main advantage of CNN compared to its predecessors is that it automatically detects the important features without any human supervision. It accurately recognizes the moving object or a still image which can be used to detect the speed of a moving vehicle by calculating the frame difference of the moving vehicle. CNN is a very powerful and efficient model which performs automatic feature extraction to achieve superhuman accuracy and so CNN models do image classification better than humans. CNN consists of multiple layers; it extracts the efficient features from the input image and gives the high recognition rate. This will be a better replacement for monitoring the traffic and finding the rule violators. And the major advantage is that it doesn't require human effort. This system produces accurate results compared to all existing systems.



**Figure 1: CNN process Model**

CNN includes multiple processing units that is, multiple layers for feature extraction and classification. CNN is a 5 layer architecture consist of convolution layer, pooling layer and classification layer. Convolution layer and pooling layer is used to extract the unique attributes from the input image and to minimize the dimensionality of feature vector respectively. Final classification layer is used for classification of these attributes with respect to the query image. Normally CNN is trained using back-propagation algorithm.

### II.LITERATURE SURVEY

PAPER TITLE	AUTHOR	YEAR	TECHNIQUES
1)An Algorithm for Automatic Vehicle Speed Detection Using Video Camera.	Jianping Wu, Zhabin Liu, Jinxang Li	2009	This paper presents a method based on image processing to identify vehicle speed. The detected vehicle speed's average error is below 4%.
2)Speed Detection Camera System Using Image Processing Techniques On Video Streams.	Osman Ibrahim, Hazem Elgendy, Ahmed M.Elshafee	2011	This paper presents a Speed Detection Camera System(SDCS) that is a radar alternative. It proved to have a satisfactory performance.
3)Single Camera Vehicles Speed Measurement	Abbas Dehghani, Ali PourMohammad	2013	This paper investigates the image processing techniques based vehicles speed measurement

4)Development Of Prototype For Vehicle Speed Measurement.	Rohit M.Waregaonkar, J.V.Kulkarni, S.S.Patankar	2017	This paper aims to detect vehicle speed using algorithm based on background modeling and blob detection.
5) A Video-Based System For Vehicle Speed Measurement in Urban Roadways.	Diogo Robinera Calvizon, Rodrigo Minetta	2017	This paper proposes a non-intrusive video-based system for vehicle speed measurement in urban Roadways.

### III.PROPOSED SYSTEM

There are modules involved in this system which each target a certain problem. The hardware part will consist of various parts. A camera for getting the input, a microprocessor to make necessary computations and a network module to send the data to the centralized server. A storage device is also required to store certain data in case of loss of network. When the network comes back, the data can then be sent. Whenever an object passes through the frame, the system will capture object in multiple frames using the camera and by calculating the frame difference and certain calculations will identify the speed of a moving object accurately using the the algorithm convoluional Neural Network. Once Speed is calculated the system gives output as speed and thre type of vehicle.This proposed system has several advantages;

- More accurately detects the speed of moving Vehicle.
- No need of Human Intevention.

#### Convolutinal Neural Networks In Deep Learning

The Convolutionary Neural Network (CNN) is a deep learning technique, commonly used to solve complex issues. It masters the weaknesses of conventional approaches to machine learning. This study 's purpose is to provide the information and understanding about different aspects of CNN. This study gives CNN and its three most popular architectures a conceptual understanding.

#### Explosion Of the number of parameters

MLPs are extremely effective in solving multiple problem categories, such as classification, estimation, approximation, recognition, etc. However, they can quickly become limited , especially with input data of very high dimensions. The model is trained on a 420x420px grayscale image dataset; after the training, we want the model to be able to tell what the image is.For example, one first approach will be to use a multilayer perceptron with a 128-neuron input layer. Because each layer neuron receives the values of 420x420 pixels as input and assigns a weight per pixel value, we have  $420 \times 420 = 176400$  weights per neuron, multiplied by a total of 128 neurons to which we add 128 biases, one bias per neuron, at last. Training a multilayer perceptron allows input data to be supplied as a vector (a one-dimensional array). If the input data is a matrix image then a vector would need to be flattened. In natural images, however, there are very strong links between neighboring pixels; by flattening the image, we lose that information, making it harder for the network to interpret the data during the training phase.

#### Convolution Filter

There are several filter forms, which include:

- 1.Vertical Sobel filter
- 2.Horizontal Sobel filter

These filter actions may be combined to accomplish more complex operations. There are several more filters already listed which, depending on the task to be solved, can be used directly this way: average filter, Gaussian filter etc. Until Deep



Learning emerged, human experts had to measure and evaluate the correct filters to be used to perform different image processing actions: face recognition, photo editing, such as Snapchat filters, etc. Now with Deep Learning, learning is done automatically to decide these filters, the model will find the appropriate filters from the training data according to the question to be solved.

### Deep Learning Approach For Convolution

Therefore, the ideal would be to start from an image in order to be able to extract the key characteristics which are important for the classification problem using correct filters. In a sense of deep learning, determining such filters by training on the dataset would be the standard. Training begins with random kernel initialized values (the filter), these values will be modified via gradient backpropagation during training. Since we're talking about Deep Learning, we can guess that to increase model performance, several layers of convolution will be stacked one after another.

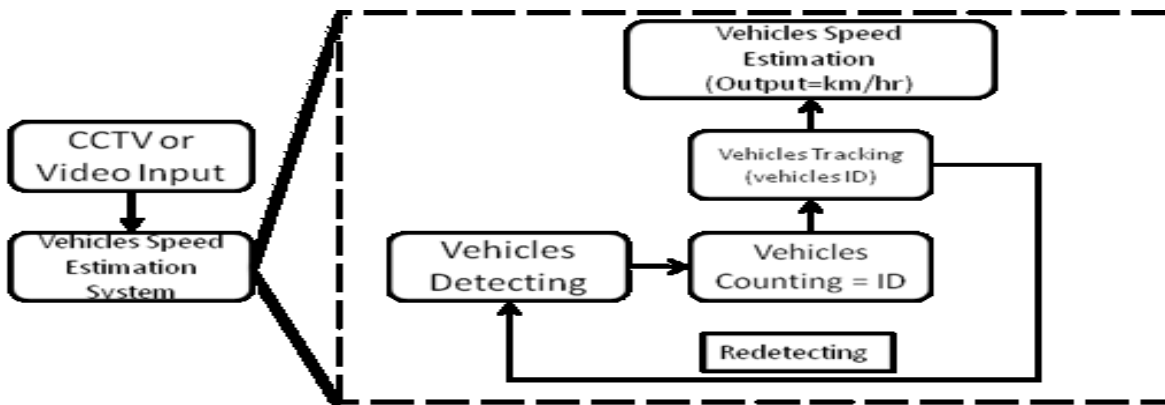


Figure 2: System Architecture

### IV.EXPERIMENTAL RESULTS

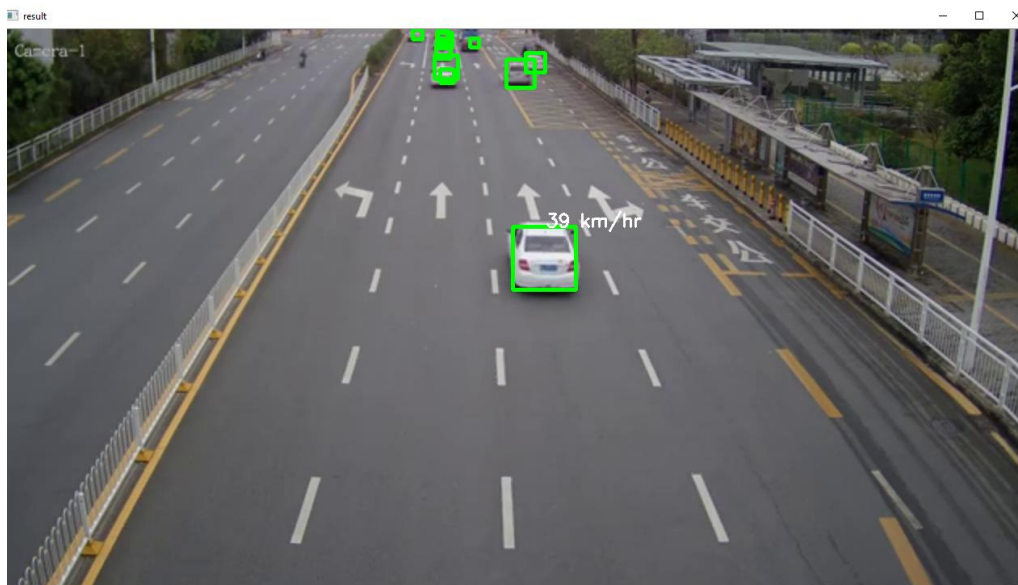


Figure 3: Screenshot 1 of the project

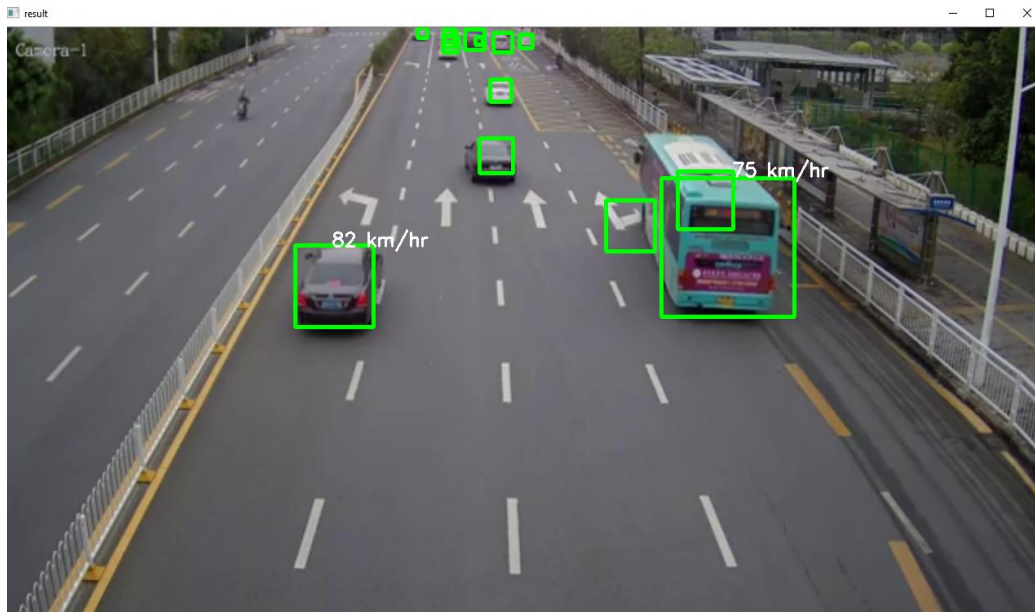


Figure 4: Screenshot 2 of the project

## V.CONCLUSION

The inaccuracies in detecting speed through the devices used by Traffic Policemen and unfortunately missing rule violatoes can be overcome by the technology used in this project.This project will provide better results in detecting speed and identifying rule violators in appropriate time to avoid accidents. This doesn't require any human effort which is more advantageous than proposed system. The deep learning concept of image recognition, Convolutional Neural Network(CNN) learns every time it recognizes a image and provides better results through each process.

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Impact Factor:  
7.488

**ISSN** INTERNATIONAL  
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