

# OVERVIEW OF AN AUTO PILOTED VEHICLE BASED ON MACHINE LEARNING

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## ABSTRACT

This paper gives an overview of an Autonomous car based on machine learning by using the raspberry pi concept. Machine learning is a type of artificial intelligence (AI). It provides computers with the ability to learn without being explicitly programmed. We are using a machine learning concept, here a car can be automated (self-driving). We train the car with specific images and whenever it detects the trained images, it operates according to the trained instruction. Here we use a pi camera component and it is used for train and detect the objects. This autonomous car is the prototype to the self-driving cars which is the present growing advanced technology in the present scenario. The future of autonomous vehicles is an ambitious era of safe and comfortable transportation. Many existing algorithms like neural networking and machine learning are combined together to provide the necessary control to the car. The application is automated driving during the heavy traffic jam, hence relaxing driver from continuously pushing break, accelerator or clutch. Since taking intelligence decision in the traffic is also an issue for the automated vehicle so this aspect has been under consideration in this paper

## INTRODUCTION

*Today, losses of lives are being lost due to accidents. The accidents are due to different reasons such as Distracted driving, Speeding, Drunk Driving, running red lights, Rash driving, Night driving, Drugs, Wrong way driving, Improper turns and many more reasons. Decision making is most important. Hence, we have proposed an "Auto-Piloted Vehicle System using Machine Learning". This system involves machine learning and Artificial Intelligence AI. A scaled down version of self-driving system using a RC car, Raspberry Pi and open source software. In this system we use a Raspberry Pi with a camera and an ultrasonic sensor as inputs and a processing computer that handles steering and object recognition (stop sign and traffic light). An autonomous car is a robotic vehicle that is associated by a driver.*

*Machine learning is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. The process of machine learning is similar to that of data mining. Both systems search through data to look for patterns. However, instead of extracting data for human comprehension as is the*

case in data mining applications -- machine learning uses that data to detect patterns in data and adjust program actions accordingly.

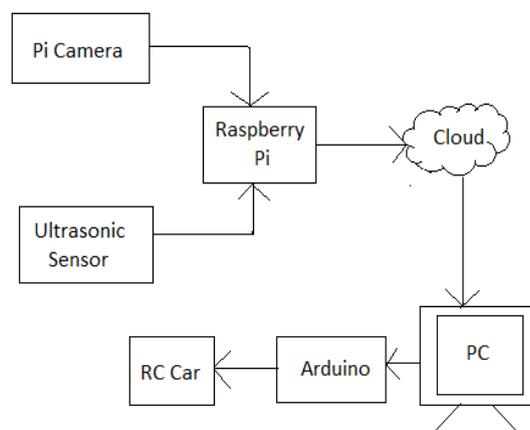
An artificial neural network is an interconnected group of nodes. It consists of the input layer, output layer and a hidden layer. Here, each circular node represents an artificial neuron. Each layer of this includes one or more neurons directionally. And an arrow represents a connection from the output of artificial neuron to the input of another.

Billions of people have lost their lives and have become physically disabled worldwide in past many years as a result of traffic accidents. This has given motivation to the auto-piloted vehicle has almost most of the traffic accidents caused by the human mistakes.

## LITERATURE SURVEY

A driverless car is an autonomous vehicle that can drive itself from one point to another without any assistance from a driver. This system can make a transform in the industry. A driverless car would eliminate the accidents and loss of life. Autonomous vehicles will be successfully resolved to withstand the real world test of time so that safety, reliability and robustness of highly complex systems can be assured. Technology development includes the 4D approach to dynamic real time vision that used an internal 3D representation in space and time suitable for driving vehicles at highway speeds [6]. Self-driving vehicle technology, is a powerful. It includes a range of possible technology, and also comprises vehicle sensing technology that enables real time gathering of information about the vehicle and its environment. This data comprises geographical coordinates and cars speed, stop sign and traffic lights and also obstacles detection [5]. Communication technology facilitate the self-driving vehicle to detect and communicates with other vehicle and basic structure by means of short range and makes the transfer of periodic messages to inform the surrounding vehicle and foundation, stop signs, traffic lights and lane tracking [7].

## PROPOSED WORK



*Fig: Block diagram*

The system consists of 3 sub system its followed as:

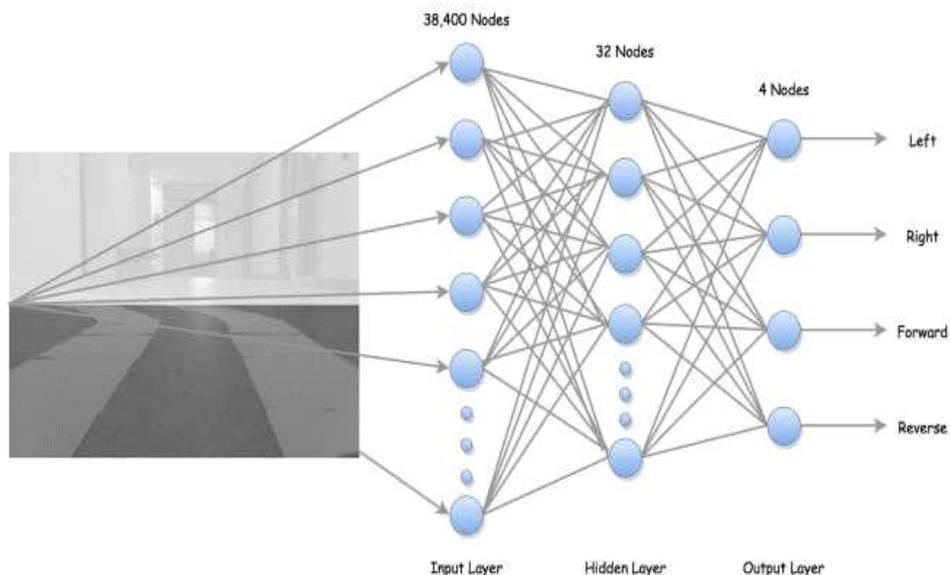
- Input unit (camera & ultrasonic sensors).
- Processing unit (computer, raspberry pi).
- RC car control unit (radio controlled car).

Input unit: -A raspberry pi board is attached to the pi camera module. The ultrasonic sensor is used to determine the distance to an obstacle. Pi camera is used to capture the image. Streaming colour video and an ultrasonic sensor data are the programs run on raspberry pi it is connected computer via local Wi-Fi connection. A minimal autopilot includes sensor packages for state determination and on board processes for estimation and control uses [2].

Processing unit: - The processing unit controllers multiple task of receiving data from raspberry pi, processes the image and use it for training and prediction, object detection & distance measurement, sending instruction to Arduino through USB connection.

TCP/IP Server: -A multi thread TCP/IP server program runs on the computer to receive stream image frames and ultrasonic data from the Raspberry Pi.

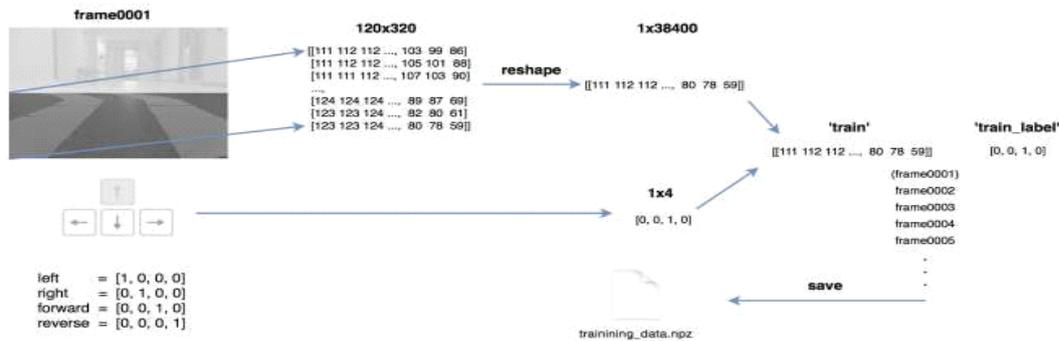
Neural network: -The RC car is trained using Open CV3(Neural networks). This model is trained. It needs to load trained parameters afterwards, thus prediction can be very fast. Only lower half of the input image is used for training and prediction purposes. There are 38,400 (320×120) nodes in the input layer and 32 nodes in the hidden layer. The number of nodes in the hidden layer is chosen fairly arbitrary. There are four nodes in the output layer where each node corresponds to the steering control instructions: left, right, forward .and reverse respectively.



Then the train image is paired with train label (human input). Below shows the training data collection process.

First each frame is cropped and converted to a numpy array. Then the train image is paired with train label

(human input). Finally, all paired image data and labels are saved into a npz file. The neural network is trained in OpenCV3 using back propagation method. Once training is done, weights are saved into a xml file. To generate predictions, the same neural network is constructed and loaded with the trained xml file.



**Object Detection:** - The object is detected based on the dimension, colour and the context. The image is converted into frames and that features picks up using Raspberry Pi. This project is mainly focused on stop sign and traffic light detection and front collision. In particular, traffic light positive samples contain equal number of red traffic lights and green traffic light. The same negative sample dataset was used for both stop sign and traffic light training. Below show some positive and negative samples used in this project.

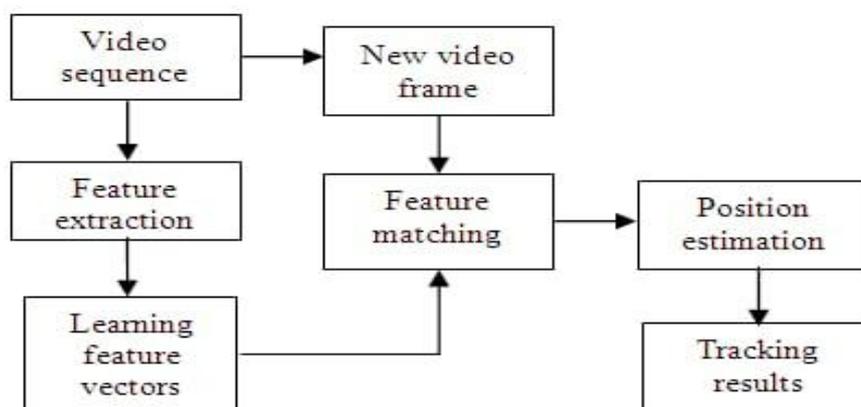


**RC car control unit:** - This project has an off/on switch type controller. An Arduino board is used to simulate button press actions. Four Arduino pins are chosen to connect four chip pins on the controller, corresponding to forward, reverse, left and right actions respectively. Arduino pins sending LOW signal indicates grounding the chip pins of the controller; on the other hand, sending HIGH signal indicates the resistance between chip pins and ground remain unchanged. The Arduino is connected to the computer via USB. The computer outputs commands to Arduino using serial interface, and then the Arduino reads the commands and writes out LOW or HIGH signals, simulating button-press actions to drive the RC car.



## MACHINE LEARNING

Machine learning is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. The process of machine learning is similar to that of data mining. Both systems search through data to look for patterns. However, instead of extracting data for human comprehension as is the case in data mining applications -- machine learning uses that data to detect patterns in data and adjust program actions accordingly. Supervised algorithms can apply what has been learned in the past to new data. Unsupervised algorithms can draw inferences from datasets. Behind the scenes, the software is simply using statistical analysis and predictive analytics to identify patterns and position is estimated accordingly.

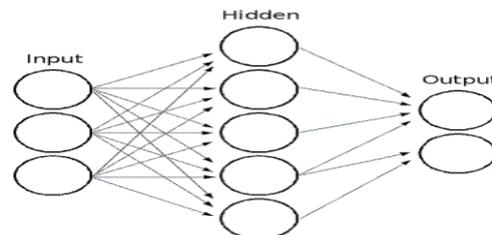


**Fig: Block Diagram**

## NEURAL NETWORKS.

An artificial neural network is an interconnected group of nodes. It consists of the input layer, output layer and a hidden layer. Here, each circular node represents an artificial neuron. Each layer of this includes one or

more neurons directionally. And an arrow represents a connection from the output of artificial neuron to the input of another. Below diagram shows a 3-layers with two outputs, three inputs and a hidden layer. Hidden layer includes five neurons that is:

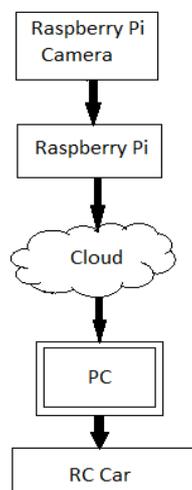


The neural network itself is not an algorithm, but rather a framework for many different machine learning algorithms to work together and process complex data inputs. Artificial neurons may have a threshold such that the signal is only sent if the aggregate signal crosses that threshold. Typically, artificial neurons are aggregated into layers. Different layers may perform different kinds of transformations on their inputs. Signals travel from the first layer (the input layer), to the last layer (the output layer), possibly after traversing the layer multiple times.

The users specify the trained network works as follows:

1. Take the feature vector as input.
2. The input layer size is equal to vector size.
3. Hidden layer output is computed using activation functions and weights.
4. Self-Driving RC Car
5. Python + OpenCV3 Neural Network + Haar-Cascade Classifiers
6. Objective
7. Modify a RC car to handle three tasks: self-driving on the track, stop sign and traffic light detection, and front collision avoidance.

#### FLOWCHART



## CONCLUSION

*Automatic vehicle provides some relevant real world traffic scenarios. This analysis is to avoid the accidents over all kinds of representative situations that can occur on main roads, side streets or urban traffic. The scenarios can be extrapolated to include same road networks in world-wide. This will lead to develop the subsequent real-life testing. In this automated vehicle platform, it supports user friendly control of vehicles. If the distance is more there is a rapid change in a camera that camera will coordinate. Thus greater the error. Further, the RC car could successfully handle to drive on the track, stop sign, traffic light and to avoid a front collision. The principle for motivators is driving both technology development and government investment in autonomous vehicles.*

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