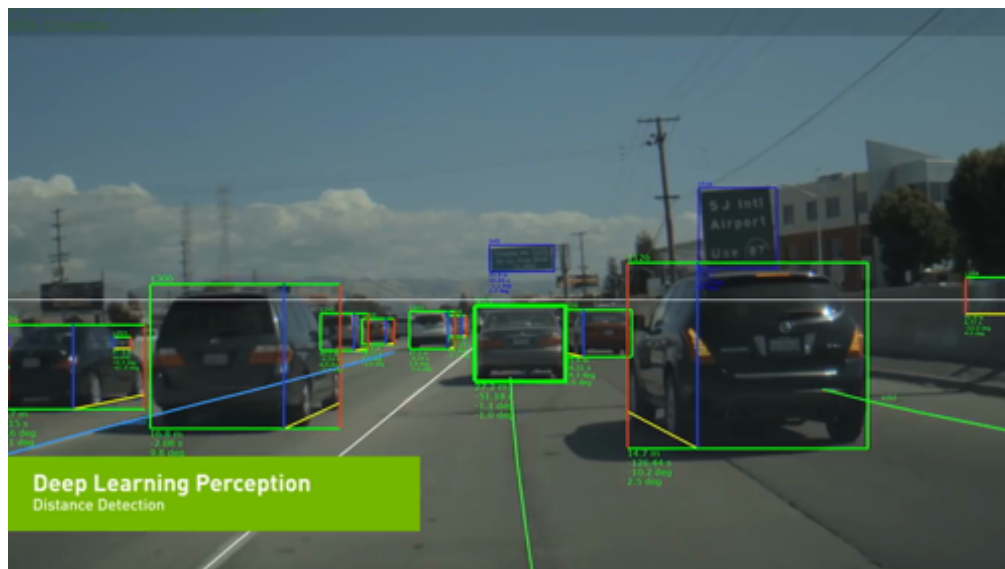


# Automating Vehicles using Machine Learning

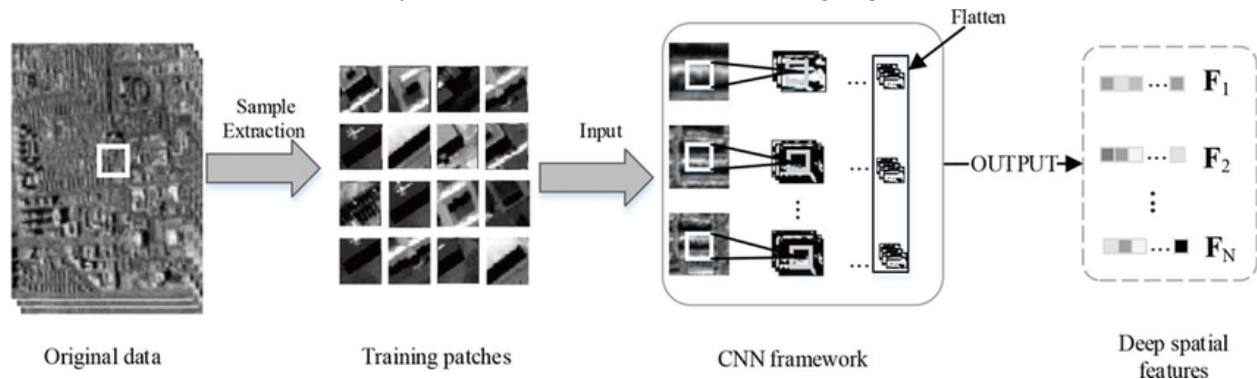
## Introduction

Autonomous vehicles or self-driving car is an art in itself. By observing the surrounding environment variables like the number of vehicles, speed of vehicles, pedestrians, and traffic signs and using various machine learning algorithms for object detection and classification, automation of vehicles takes place. Cameras, Lidars, and radars are used to provide a clear view of surrounding objects. Autonomous vehicles have to make some critical decisions like What should be the speed and acceleration of the car based on the other vehicles in front of it or in the surrounding space, proper control of the steering. Various machine learning algorithms like LSTM and CNN can be used to help in making these decisions.

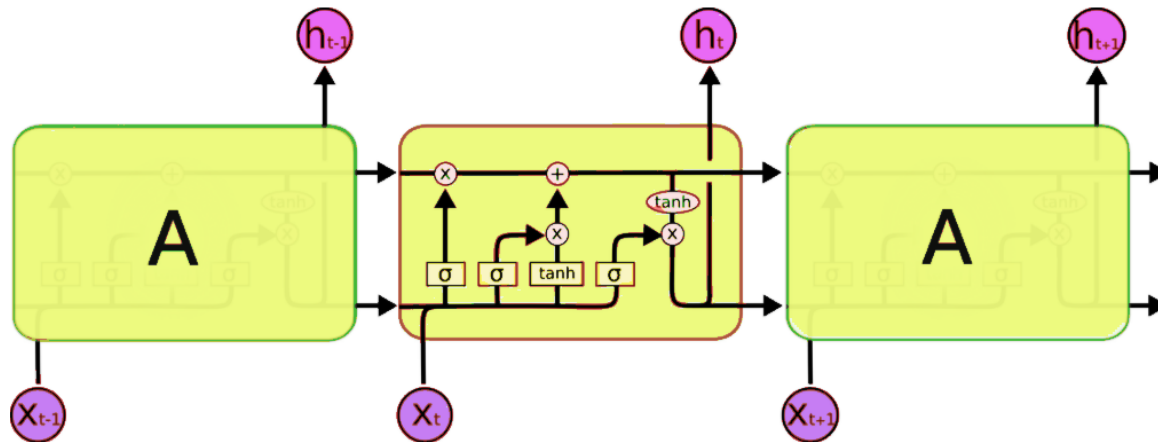


## Why LSTM(Long short-term memory) and CNN(Convolution neural networks)?

Convolution neural networks(CNN) can be used to extract essential features of the image from their pixels for classification or other purposes. CNN can be used to represent the image into a vector which then can be easily used for other machine learning algorithms.



Long short-term memory(LSTM) can be used in time series analysis as it can memorize past information. It is used in place of RNN as RNN had the vanishing gradient problem. As in autonomous vehicles, we will handle mostly the image data and time-series data so both CNN and LSTM would be handy here.



## How can we use LSTM for autonomy purposes?

Autonomous vehicles have cameras in the front, side, and back. The cameras, Lidars, and Radars send the images, information about surrounding objects, speed of the vehicle in front, weather information, etc each second to the AV. The images can be fed to the CNN to extract the essential feature vector. The feature vector from the image combined with other environment variables like speed or acceleration of the surrounding vehicles, surrounding objects like red light, pedestrians, and footpath can be fed as input features to the LSTM. AV will receive the information about its surrounding objects or vehicles each second which can be fed to LSTM at each timestamp. Based on the information from previous timestamps In output LSTM will return the required speed and acceleration of the autonomous vehicle. For example: if the brake is applied to the vehicle in front of it, then the AV will decrease down its acceleration. LSTM here remembers the previous speed and position of the vehicle ahead of it and hence gives the output according to that. LSTM can also be used to decide whether to overtake a vehicle or take a sharp turn and when to apply a brake.

## Conclusion

Most of the data in AVs is time series. Hence it is very important to utilize the information from previous timestamps. That's why LSTM can be used which can utilize time series data so well and can help AVs to take critical decisions about the speed and acceleration of the vehicle.