

# Chapter 7

## Comprehensive Overview of Neural Networks and Its Applications in Autonomous Vehicles

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### ABSTRACT

*Deep learning and Artificial intelligence (AI) have been trending these days due to the capability and state-of-the-art results that they provide. They have replaced some highly skilled professionals with neural network-powered AI, also known as deep learning algorithms. Deep learning majorly works on neural networks. This chapter discusses about the working of a neuron, which is a unit component of neural network. There are numerous techniques that can be incorporated while designing a neural network, such as activation functions, training, etc. to improve its features, which will be explained in detail. It has some challenges such as overfitting, which are difficult to neglect but can be overcome using proper techniques and steps that have been discussed. The chapter will help the academicians, researchers, and practitioners to further investigate the associated area of deep learning and its applications in the autonomous vehicle industry.*

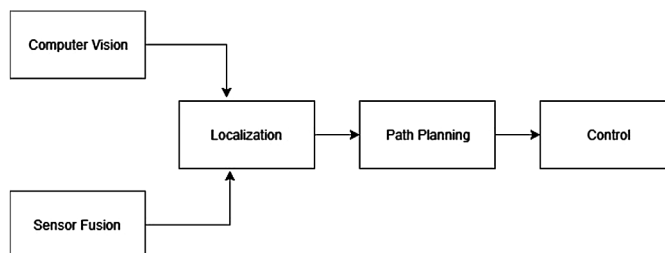
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## INTRODUCTION

Neural Networks has been the one of the buzzwords from last 5 years. Neural Networks are used in Deep Learning (Yoshua Bengio 2015) which is a sub field of Machine Learning, and tries to solves complex problems which cannot be solve by traditional Machine Learning models and algorithms. It has rose to the popu;arity in last 5 years mainly because of the computing power and the data available. Neural Network require lots of Computing power to function since it has many mathematical operation which needs to be performed simultaneously. The image recognition problem was a big problem, it requires features to be detected such as curves, shapes etc., which was not possible by traditional machine learning algorithms. Neural Networks are good at recognizing the features by itself. In the given figure, it can be seen that, the neural network first tries to detect edges, then it tries to detect complex shapes using those edges, and then the objects get detected. For example, Convolutional Neural Networks or CNNs (Yann LeCun, 1994) is now used everywhere for object detection, video recognition, Natural Language Processing(NLP) (Wenpeng Yin 2017) and recommender systems.

Also, the results are very better when used Neural Networks as compared to Machine Learning model. And it takes lesser time to do the task once, the neural networks are trained (learning through examples). This characteristics of learning through examples has made the Autonomous Vehicles possible. There are many situations in which the severals controls has to be applied. Manually programming autonomous vehicles is not possible since it would take lot of time. Deep learning is the best possible solution since it learns the behavior through real world driving examples and has a ability get better over a period of time.

*Figure 1. Detecting features  
(Honglak Lee, 2011)*



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