

An Overview of Machine Learning Models in Autonomous Driving

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Abstract:

From the first DARPA challenge in 2004 in Mojave Desert where the self-driving car could only manage about 7 miles to present year 2021, where various companies have claimed to successfully cover hundreds of miles with minor intervention, it's quite an achievement how far the advancements in autonomous driving has come. Machine learning (ML) in autonomous driving makes it possible for a vehicle to collect data on its surroundings using sensors, interpret them and then decide what action to take. Recent advancements in ML allow vehicles to learn how to perform various tasks as well as (or even better in some cases) humans.

A subset of ML called deep learning is the driving force for majority of the autonomous driving tasks, however, with advancement in other sensors such as Radar and Lidar, the deep learning black box technology is being challenged and a need for developing neural networks from scratch is desired. Since autonomous driving is an extremely dynamic area of research, the challenges related to regulations, law enforcement, and ISO standards are still being worked out.

This talk will introduce, the landscape of autonomous driving including framework, modelling and challenges of training and deploying a ML system onto an autonomous vehicle. The framework will include the sensor, hardware and software stack that is commonly used in the autonomous vehicle. The way these sensors interact with the mixed traffic, in which vehicles of different automation, bikes, pedestrian are involved will be discussed. An overview of common deep learning models and learning strategies along with a deep dive into the fundamental building blocks of deep learning will also be discussed. The talk will go thru a case study for a common task of "driving scene understanding" using vision sensor. The talk will also explain the recent challenges while deploying ML models and issues with government/legal agencies.

Who should attend:

- 1) Senior undergrad, Master's and early Ph.D students interested in neural networks, computer vision, microcontrollers and optimization theory.
- 2) Anyone who wants to get a bird eye view of self-driving industry in general.

About the Speaker :

Kanishka Tyagi received his Bachelor's Degree in Electrical Engineering in 2008 from Pantnagar, India. Later he worked as a Research Associate at the Department of Electrical Engineering, Indian Institute of Technology, Kanpur, with Dr.P.K.Kalra. He received his M.S. and Ph.D. degree with Dr. Michael Manry in Department of Electrical Engineering at The University of Texas at Arlington in 2012 and 2017. Currently, he works as a lead machine learning autonomous driving scientist at Aptiv corporation in Agoura Hills, California. Prior to Aptiv, he worked at Siemens research, interned in ML groups at The MathWorks and Google Research. He has worked as a visiting researcher at Ajou University and Seoul National University. His research interests are optimization theory, music and audio processing, neural networks, hardware machine learning and radar machine learning. He received the 2007 and 2011 IEEE CIS Outstanding Student Paper Travel Grant Award and 2013 IEEE Computational Intelligence Society Walter Karplus Summer Research Grant award, 2013. Dr. Tyagi has published over 25 papers and filed 15 U.S. patents/trade secrets.