Deep Learning Application for 3D LiDAR Odometry Estimation in Autonomous Vehicles

From the accumulation of past and repeated experiences, driving a vehicle for most people has become almost an automatism. People do it without being really conscious of all the multiple tasks involved.

When it comes to autonomous driving, it is a great challenge to transform this acquired knowledge into machine learning techniques.

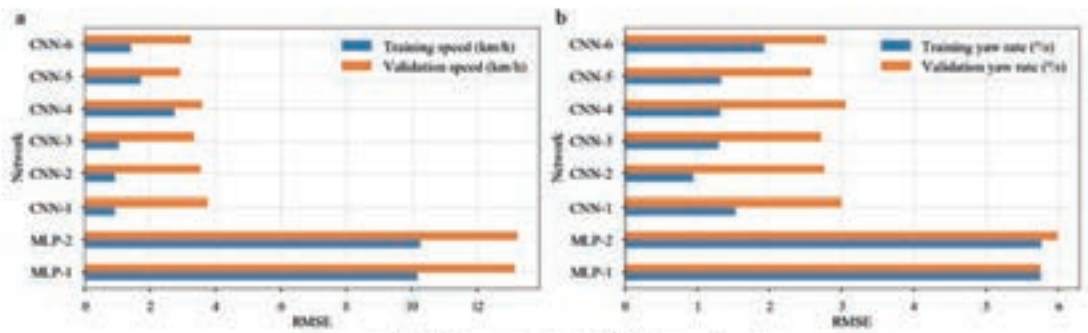
Progressively deep learning has become the best tool to use for autonomous driving vehicle since it is possible to emulate the behaviour of the human brain in a large number of intelligent vehicles applications.

The most common use of this type of techniques has been the implementation of Convolutional Neural Networks (CNNs) for classification and identification of obstacles and pedestrians in the vehicle's surroundings. CNNs are especially dedicated to image analysis and, even though they have been successfully used for classification and pattern learning, it is possible to use them for regression.

Therefore, with a CNN architecture, continuous data can be predicted, like other classical neural networks.

On the other hand, an accurate knowledge of vehicle odometry is of vital importance in autonomous driving. When exact positioning by GPS is not possible, knowing the trajectory and specific location of vehicle become fundamental for safety.

While using the advantages of CNN, this paper presents a deep learning application that estimates continuously the vehicle speed and yaw rate to realize the reconstruction of the car's odometry. Since CNNs are suited for training with imagery, a 3D LiDAR sensor has been used for the recognition of the environment as well as reconstruction of data-images. The results indicate that the network's architecture is able to estimate the speed and yaw rate from the LiDAR's data-images. These facts can be used to support autonomous navigation •



(a) RMSE for speed value; (b) RMSE for yaw rate value