# Estimation of Lateral Distances between Vehicles and Lane Markers Using Sensor Fusion and Deep Neural Networks

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**Key words** : Lateral distance, Lateral position, Sensor fusion, Deep learning, Neural network, Autonomous vehicle

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In advanced driving assistance systems or autonomous driving systems, accurate localization of surrounding vehicles is very important for path planning and anomaly detection through monitoring and predicting the movement and behavior of the vehicles. In this paper, we propose a novel method to accurately estimate the lateral distance of a nearby vehicle to lane markers by the fusion of vision and lidar sensors as well as the fusion of deep neural networks in 2D and 3D space.

In this method, LiDAR's point cloud is first projected onto the camera's image plane. Next, lane markers in the image plane are detected using a deep neural network. The lidar points projected on the detected lane marker are searched, and their corresponding points in the 3D space are found. By fitting the found 3D points, the curves for lane markers in 3D space are obtained. Meanwhile, another deep neural network detects vehicle objects from LiDAR's point cloud. Finally, the distances from the rear center of the vehicle object to the lane markers are calculated.

The KITTI dataset and our dataset collected using LIVOX LiDARs and ZED cameras were used to develop and validate the system. This method allows finding more precise lane markers and vehicles' lateral positions in 3D space than those in the 2D image plane.

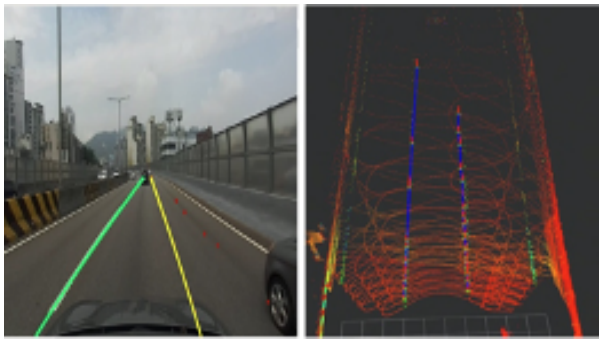

Figure 1. Lane detection in 2D and 3D spaces.

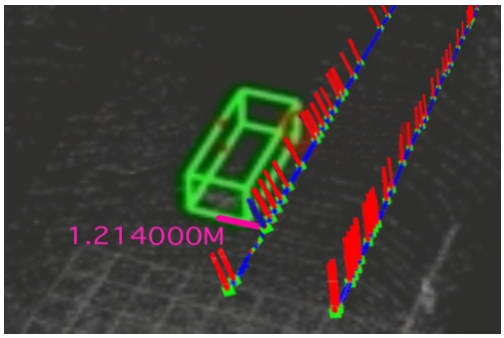


Figure 2. Estimation of the lateral distance of a vehicle to lane markers.

**Acknowledgement**

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2020R1A2C1102767).