

ABSTRACT

Smart Surveillance System (SSS) is one of the most important components on an Autonomous Vehicle (AV) to improve driving safety without driver. This is inseparable from the application of Artificial Intelligence (AI) to detect objects around the vehicle. However, the performance of this object detection can be decreased in adverse environmental conditions such as hazy scenes. The presence of haze can make objects less visible so that the AV fails to detect the surrounding objects. Therefore, in this Final Project, the author designed an object detection system that equipped with image dehazing capabilities to improve the performance of object detection in hazy scenes.

The system designed uses Two-Branch Neural Network as image dehazing subnet and EfficientDet as object detection subnet. The merging of these two subnets is known as a Dual Subnet Neural Network. The dataset used to fine tune the object detection subnet is Foggy Cityscapes, while for image dehazing the author uses a pre-trained model that has been trained with the ENTIRE 2021 NH-Haze dataset. The object classes used are car and person. System performance analysis was measured through testing on Cityscapes and Foggy Cityscapes datasets with performance parameters Peak Signal to Noise Ratio (PSNR), Structural Similarity (SSIM), Mean Average Precision (mAP), and Frames per Second (FPS).

A series of tests were carried out to analyze the system performance on the effect of adding image dehazing subnet, level of haze, merging configuration of the two subnets, system stability, and system working speed. Best system performance with mAP@0.5 of 43.615% obtained through a parallel combined configuration between object detection subnet which trained on hazy images and serial combinations of image dehazing subnet and object detection subnet. This performance increase is significant because system with regular object detection only obtained mAP@0.5 of 39.482%. Based on the result, Dual Subnet Neural Network with proper merging configuration is proven to be successful in improving the performance of object detection in hazy scenes.

Key Word : Smart Surveillance System, Autonomous Vehicle, image dehazing, object detection