Road Lane Reconstruction Using Multiview GoPro Images

Yu-Xuan Zheng[1], Pei-Cheng Chen[1], Tee-Ann Teo[1], Kuan-Yi Lee [2], Xuan Yang [2], Zhan-Qing Lin[2]*

[1] Department of Civil Engineering, National Yang Ming Chiao Tung University

[2] CECI Engineering Consultants, Inc., Taiwan

Rich and detailed road maps are critical assets for Vehicle-to-Vehicle (V2V) communication and the new generation of Advanced Driver Assistance Systems (ADAS). Therefore, the importance of road lane detection and extraction techniques is increasingly highlighted. Many algorithms, such as LaneNet, which uses a dual-network architecture for end-to-end road lane detection from monocular onboard images, are applicable for road lane detection. The advantage of LaneNet is its ability to detect multiple road lanes and use line fitting to compensate for locally obscured areas. However, LaneNet research primarily aimed at road detection and navigation, with the detection results limited to two-dimensional image spaces, not the three-dimensional coordinate spaces needed for map construction. This study focuses on the application of road mapping with the objective of obtaining three-dimensional coordinates of road lanes. Onboard imaging data are captured by multi-view GoPro cameras, acquiring sequential high-overlap images. This process is followed by image orientation reconstruction and dense image matching to generate the road surface. Then, LaneNet is used to detect the road lanes in the image space. The detected lanes are projected onto the object space and a point cloud clustering lane fitting is performed to complete the reconstruction of the three-dimensional road lanes. This study experimental area is the loop road of the Guangfu Campus of National Yang Ming Chiao Tung University, using GoPro as the imaging tool. After correcting for camera lens distortion, the images are projected onto the object space to generate a point cloud. Following point cloud clustering and lane fitting, the results meet the sub-meter level accuracy requirements for road lanes on flat roads. The research results demonstrate the potential of using GoPro imaging technology mounted on vehicles for road lane detection and reconstruction.

Keywords: Georeferencing of Driving Images, Road Lane Detection, Road Lane Mapping