Evaluating Depth Estimation Algorithms in Unstructured Driving Environments

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Abstract (150 words, Font 12):
Autonomous vehicles use different sensors to estimate their surroundings, one of which is a stereo camera. However, the efficiency of this sensor in unstructured and heterogeneous traffic has not been studied. This paper discusses and evaluates some state-of-the-art depth estimation algorithms alongside traditional stereo-matching algorithms. The algorithms have been evaluated in various weather conditions and times of the day. The environment contained unstructured and heterogeneous traffic elements such as cyclists, dense traffic, two-wheeled vehicles, and random pedestrians. The paper considers different methods for stereo-matching and generating disparity maps. To ensure that, the results were produced in diverse scenarios, the stereo depth estimation algorithms were evaluated on ApolloScape, and data was generated from CARLA.

Purpose: To study the feasibility of a stereo camera as an obstacle detection sensor for unstructured environments

Design/Methodology/ Approach: Writers studied different algorithms, evaluated them on ApolloScape and generated the data from CARLA.

Findings: From all the tested algorithms, PSMNet has the best performance on average for all values. Unlike other algorithms like noon and sunset, it gives the same results for nightly weather conditions.

Research Limitations/ implications: The writers are going to make the results reproducible and add details to studied algorithms.

Originality/ Value: This is an evaluation and study of Stereo Vision effectiveness in an unstructured environment. This will add to our understanding of computer vision and its

application in ADAS and AV.

Description: When the stereo camera is the primary sensor, the presence of a complete and robust dataset becomes necessary. We have initiated the study by evaluating algorithms on the already existing dataset ApolloScape, as it is one of the closest datasets to unstructured scenarios with ground truth. We also extracted data from the simulator CARLA and evaluated the same depth estimation algorithms on the extracted dataset. Further on we surveyed the algorithms on the data extracted from CARLA. Using CARLA, we partially simulated an unstructured traffic environment by using high-traffic scenarios and the presence of pedestrians and cyclists. Due to limitations in CARLA, we could not add all elements that lead to unstructuredness, such as stray animals, high density of two-wheelers, three-wheelers and pedestrians crossing the road randomly (not on crosswalks). Moreover, the dataset was created using the CARLA simulator with the elements mentioned above for different weather conditions and different times of the day. We have evaluated and compared various popular depth estimation methods in the following sections. The results of various algorithms in different weather and time conditions are discussed in this work.