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Master Thesis

Ego-Car Shadow Detection and Removal in a Surround-View System using Deep Learning

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Abstract

A modern surround-view system consisting of four fisheye cameras can expand the field of view for the driver up to 360 degrees, which assists the driver in avoiding collisions during low-speed maneuvers such as parking. The See-Through-Bonnet view from Continental enables the driver to see the ground beneath the engine compartment by stitching the camera images from the previous frames to the current frame on the ground plane. However, the texture of the ego-car shadow, i.e., the shadow of the own car, is propagated continuously throughout the ground plane, resulting in zigzag artifacts which severely detract from the overall appearance. To eliminate such undesirable artifacts, we propose a two-stage pipeline using deep learning to detect and remove the ego-car shadow while preserving all other natural shadows in the same scene. In this work, FSDNet and G2R-ShadowNet are chosen as the basic model for shadow detection and removal. To adapt the networks to specific characteristics of the task addressed in this work, we further optimize the model by modifying loss functions and embedding additional information. For the model training, we use the CARLA simulator to build a synthetic shadow dataset which contains 162 video clips with 18292 fisheye images, each with a labeled ground-truth ego-car shadow mask and a non-ego-car-shadow image. We evaluate the pipeline on synthetic as well as real-world data. The results demonstrate that the proposed two-stage pipeline successfully detects and removes ego-car shadow in the majority of the scenarios.

Keywords Shadow Detection, Shadow Removal, Surround-View System