THE TEAM



STAKEHOLDERS

ASD

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Project SALTI executive summary

Robust object detection is vital for safe realization of self-driving vehicles. The MPS lab at TU Eindhoven aims to enhance the robustness of camera-based object detection systems by installing a thermal camera parallel to the color camera. Introducing a thermal camera has as main advantage that its performance is almost invariant to the lighting conditions. Therefore, the combined performance of the object detection system can be significantly improved. In addition, the distinctive heat signature of pedestrians will enhance the detection of vulnerable road users, being (motor)cyclists and pedestrians. This will increase robustness of the system and therefore enhance road safety.

A thermal camera-based object detection system has been realized in the test vehicle of the MPS lab by the 2019 ASD trainees. Because the algorithm was trained on a relatively small dataset, the performance can still be improved by enlarging the training dataset. To enlarge the dataset, a labeler needs to manually label many images. The goal during this project was to facilitate the labeling process by realizing a semi-automatic labeling program, which reduces the required work.

To facilitate the labeling process, we present SALTI: a software program that Semi-Automatically Labels Thermal Images. This Python-based software program provides a solution to the labeling problem by predicting the labels of the training data. The labeler is still responsible for verifying the accuracy of the predicted labels. By predicting the labels, a major part of the labeling process is automated, and therefore a lot of time is saved during the labeling process.

The power of SALTI comes from the fact that it employs two object detection algorithms. We designed SALTI such that it takes the detections from a pair of color and thermal images, both from the same objects (synchronized images). Color detection algorithms have already proven their superiority during good lighting conditions. The thermal object detection jumps in when the color algorithm fails at night. By combining the two, we exploit the benefits of both variants.

The project was concluded by evaluating the proposed value of SALTI. The software demonstrated superior labeling performance when compared to variants that employ either a RGB or color detection algorithm. Additionally, we compared the labeling time of fully manual labeling with SALTI labeling. Our tests showed a significant reduction of the time required for labeling images by approximately 50%.

For more documentation on the project, please refer to wiki page of the SALTI GitHub repository¹. This is a private repository managed by Pavol Jancura (<u>p.jancura@tue.nl</u>).

This project was performed by the 2020 Automotive Systems Design trainees. We had a common learning goal to develop our Python programming skills, which made us choose for a Python-based solution. At the beginning of the project, we had little Python programming experience. By the end of the project, many of us reached our Python personal learning goal. In addition, we learned a lot about software development in general, and how to work on large software projects as a group. In hindsight, we consider the project as being very successful.

¹ Project SALTI GitHub repository, https://github.com/tue-mps-edu/asd-pdeng-project-2020-developer