COMPUTER VISION

SEMESTER PROJECT

REPORT

*Histogram, Mean shift and Semantic Segmentation techniques for Autonomous Driving System using computer vision methods.*

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Abstract:

An autonomous vehicle can operate without requirement of any human control and can sense the environment. An autonomous car is sometimes called self – driving car, or driverless car. Computer vision uses real-time images to create a 3D map. With the usage of 3D maps, autonomous vehicles can decipher the driving space for risk-free driving and opt for alternate routes in case of projected collision. This makes driving easy and accident-free for its passengers.

The prime and the most basic task of computer vision algorithms is to recognize an object in a picture. While computers outperform humans in multiple image recognition tasks, there are several which are particularly interesting in the context of autonomous vehicles. Object recognition needs to be done in a real-time environment. When it comes to input from a camera, it is sometimes based on a set of lines that are constantly flowing from the sensor and are used to refresh an ever changing image on a screen, rather than on a series of complete and whole images. Thus, there is a need to recognize objects without actually seeing them.There are multiple elements in an environment that can be confusing for an autonomous system. This first challenge can be solved by training a model on the data delivered by the sensor as an output, practically switching the model toward signal analysis rather than image recognition. The second challenge is an example of a typical problem of AI being unable to generalize and having no prior knowledge on a subject. An interesting solution comes from [enriching image recognition with partial evidence](https://www.tooploox.com/blog/augmenting-ai-image-recognition-with-partial-evidence).

Image **segmentation** is a method in which a digital image is broken down into various subgroups called Image segments which helps in reducing the complexity of the image to make further processing or analysis of the image simpler.

**Semantic segmentation** is about spotting the difference between each object in the scene. For a car’s system it is not enough that there are simply three cars on the road – it needs to be able to differ between them easily in order to track their individual behavior. While semantic segmentation frames each car, each tree and each pedestrian, semantic instance segmentation labels each as car1, car2, tree1, tree2 etc.

Semantic segmentation was seen as a tough computer vision problem few years ago. Due to recent developments in deep learning, relatively accurate solutions are now possible for its use in automated driving. Most of the current semantic segmentation algorithms are designed for generic images and do not incorporate prior structure and end goal for automated driving.

Semantic image segmentation has witnessed tremendous progress recently with deep learning. Semantic segmentation is targeted towards partitioning the image into semantically meaningful parts with various applications for that. It has been used in robotics, medical applications, augmented reality, and most prominently automated driving. Few years ago, semantic segmentation was seen as a challenging problem to achieve reasonable accuracy. The main approaches used in semantic segmentation was based on random forest classifier or conditional random fields.

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Description automatically generatedA picture containing text, way, scene, road

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