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Deep Learning based vehicle pose estimation using UAV imagery

Proposal for a Master thesis topic (EN)

Detecting and extracting the position and orientation of object instances within a scene using aerial imagery remains a challenging task in both photogrammetry and computer vision. Accurate information regarding the pose of objects is necessary in various applications that rely on vision-based scene understanding, such as autonomous driving and traffic monitoring. Recently, drones, or Unmanned Aerial Vehicles (UAVs), are increasingly used in such applications. UAVs can play a significant role in assisting autonomous driving scenes and traffic management by being used as integral components of the monitoring infrastructure for these scenes and contributing to the exchange of information with other vehicles or infrastructure. Hence, the shared information facilitates traffic agents in comprehending road conditions, recognizing traffic congestion, and responding to accidents. Specifically, this thesis is focused on estimating the pose of vehicles seen in a traffic scene using UAV imagery. In such an application, a monocular camera setup is used due to their user-friendly nature in comparison to more complex configurations like stereo or multi-view systems.

Nowadays, deep learning techniques based on artificial neural networks are used to detect objects in RGB images. However, in order to detect the 3D pose from single images, a 3D model of the vehicle has to be available. The task to be solved becomes a combination of an vehicle detection and (pose) parameter estimation problem based on deep learning. To solve the task, modern deep learning methods based on CNN or comparable architectures should be applied. New methods can be built by extending object detection techniques found in literature research, with additional network branches for predicting the required pose parameters. These methods can also be compared with alternatives. To compare different network variants and parameter settings, a series of experiments shall be conducted and evaluated.

The student will be provided with datasets. Previous knowledge in the field of image analysis and programming is mandatory.

This thesis will be supervised by Sara El Amrani Abouelassad M.Sc.

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