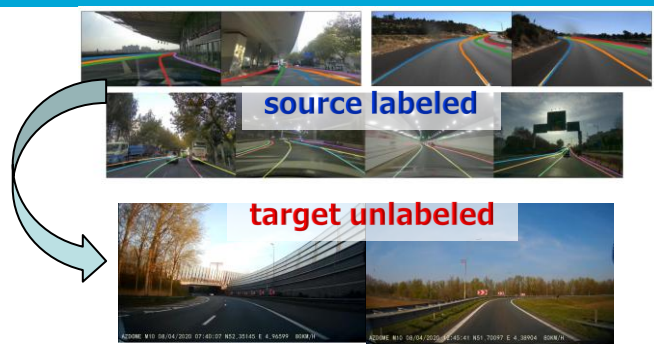
MSc. Thesis Project

Few-shot learning and domain adaptation for lane detection with pretrained large model



Problem description

Lane detection in driving scenes is crucial and critical for vehicle localization and trajectory planning, which is the fundamental of various ADAS and Autonomous Driving applications. In recent years, many sophisticated visual-based lane detection methods, especially these employing Deep Learning (DL), have been proposed. One of the significant defects of DL methods, is that the data must be finely labeled, which is always a tedious work. Plus, models trained on one dataset might have limited generality on new datasets. Regarding lane detection, different countries/regions have different road layouts/structures and different types of lane marking. Thus, DL models trained on a specific labeled dataset in one country might not work well for lane detection task in another country. One intuitive solution is to add labeled data from new countries to the training set. However, it is time-consuming and not feasible to label all the data. Domain adaptation methods and few shot-learning come to tackle the aforementioned dilemma. This research aims to introduce, implement, and compare popular domain adaption and few-shot learning methods, e.g., Domain-Adversarial Neural Networks (DANN), Adaptive Batch Normalization (AdaBN), Adversarial Discriminative Domain Adaptation (ADDA), etc., in the lane detection context. To be specific, fine-labled open-sourced datasets, e.g., tvtLane, LLAMAS, CurveLanes, would be the (main) fine labeled training data from source country (US., China), while the data collected in the Netherlands by TU Delft TTS Lab would be the target unlabeled data. A small proportion of the data could be labeled to serve for few-shot learning and evaluation. The objective is to verify and evaluate the benefits of domain adaption together with few-shot learning regarding lane detection task. Insights could be very beneficial to road authorities, road maintainers, and OEMs.

Assignments

- Review and compare state-of-the-art domain adaption methods, especially in the fields of CV and NLP;
- Screen out the SOTA few-shot learning and domain adaption methods suitable for lane detection (e.g., DANN)
- Implement, validate, and compare the selected domain adaption methods with the same DL backbone, using open-source labeled datasets (CurveLanes, CULane, etc.) and the unlabeled data we collected;
- Analyze the benefits & insights of domain adaption, and encapsulate the results into a demo for visualization.
- **Requirements:** Experienced in Python and TensorFlow/Pytorch; Expertise in DL /ML / Computer Vision; Prior knowledge and experience of domain adaption methods would be a high priority.

Research group

Automated Mobility in Mixed Traffic; Transpiration AI; Transport & Planning

Thesis supervisors: Yongqi Dong (https://yongqidong.github.io/)

External supervisor: possibility with industry partners

Information

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