KI DATA TOOLING
The Data Kit for Automotive AI

Domain Adaptation with cDCGAN for Semantic Segmentation

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ML Function Development

Motivation and Contribution

Aim: Automatic understanding of complex visual street scenes from RGB images using semantic segmentation as a supervised learning task.

Challenges:

- *Supervised learning:* Ground truth is necessary for Neural Network (NN) training ⇨ Rule of thumb: The more labeled proper data, the better!
- *Real-world data:* Lack of large amounts of labeled data because annotation is time-consuming and expensive.
- *Synthetic data:* Automatic generation of the desired amount and scenes (e.g. safety-critical situations) of labeled data by simulators *but*: NN trained on synthetic data are likely to perform poorly on real-world scenarios due to the domain gap.

Solution (Domain Adaptation): Development of methods and models to bridge the gap between the source domain (synthetic data) and the target domain (real-world data).

Our contribution: Enrichment of synthetic data with photorealistic appearance using the conditional Deep Convolutional Generative Adversarial Network (cDCGAN) pix2pixHD to increase the amount of training images for the supervised learning task and thus improve its performance.

Domain Shift of Semantic Segmentation Masks

Input of the pix2pixHD: *Smoothed* synthetic segmentation masks.

Figure 1: Domain Shift between human-labeled and synthetic segmentation masks.

Inference for Smoothed CARLA Masks

Training of pix2pixHD on the real-world domain represented by the Cityscapes and A2D2 datasets using the RGB images and segmentation masks. At inference time, the trained generator receives as input smoothed CARLA semantic segmentation masks.

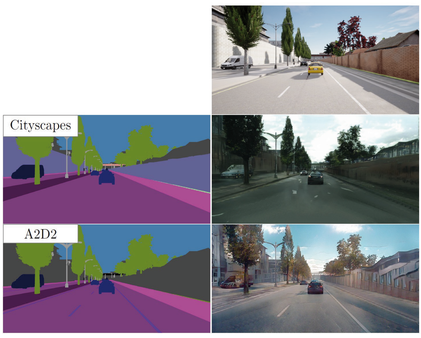

Figure 2: pix2pixHD-synthesized images obtained by generators trained on Cityscapes or A2D2.

Safety-Critical Situations

Use GAN-synthesized images in safety-critical situations to test semantic segmentation networks trained on real-world data.

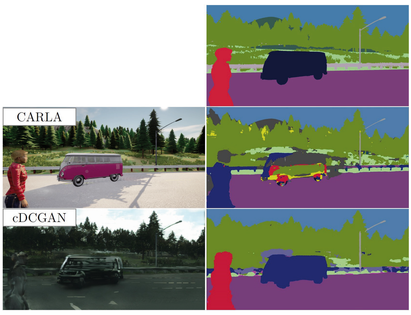

Figure 3: Predictions for CARLA and cDCGAN-synthesized images in safety-critical situations using the Swiftnet semantic segmentation network trained on Cityscapes.

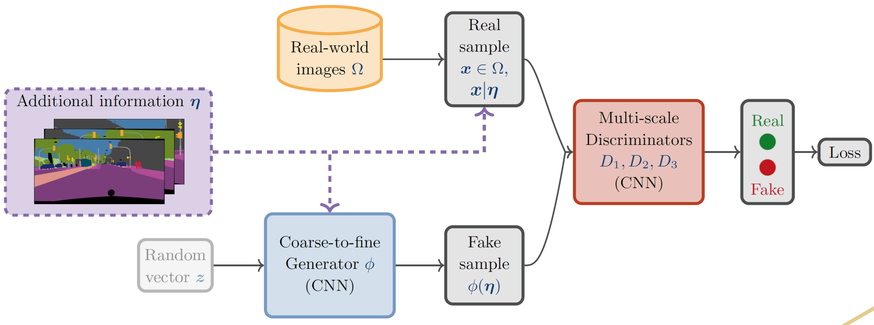

Figure 4: Architecture of the conditional DCGAN pix2pixHD.

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