Domain Adaptation with GANs

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Abstract and Contribution

Aim:

- Automatically understanding complex visual scenes from RGB images
- → Semantic segmentation (pixel-wise classification of the image) with deep neural networks (DNNs)

Challenges:

- Neural networks need plenty of labeled images to generalize well on unseen scenes
- Manual label process is time and cost consuming

Solutions:

- Simulations of urban scenes were developed and improved
- Images generated by a simulation often come with labels for the semantic content for free [2]
- But: Domain gap to the real world – switching domains confuses the DNN
- Domain adaptation methods to mitigate the gap, e.g., Image-to-image translation

Our main contributions are:

- A semi-supervised domain adaptation method for semantic segmentation to guide the generator of a generative adversarial network (GAN) to downstream task awareness [3].
- Enrichment of synthetic data with photo-realistic appearance to increase the amount of training images for the supervised learning task and hence improve its performance.

GAN Concept

Computational cost

DNN	time per epoch
Deeplabv3-ResNet101 [4]	45 min
CycleGAN [5]	16 min

References

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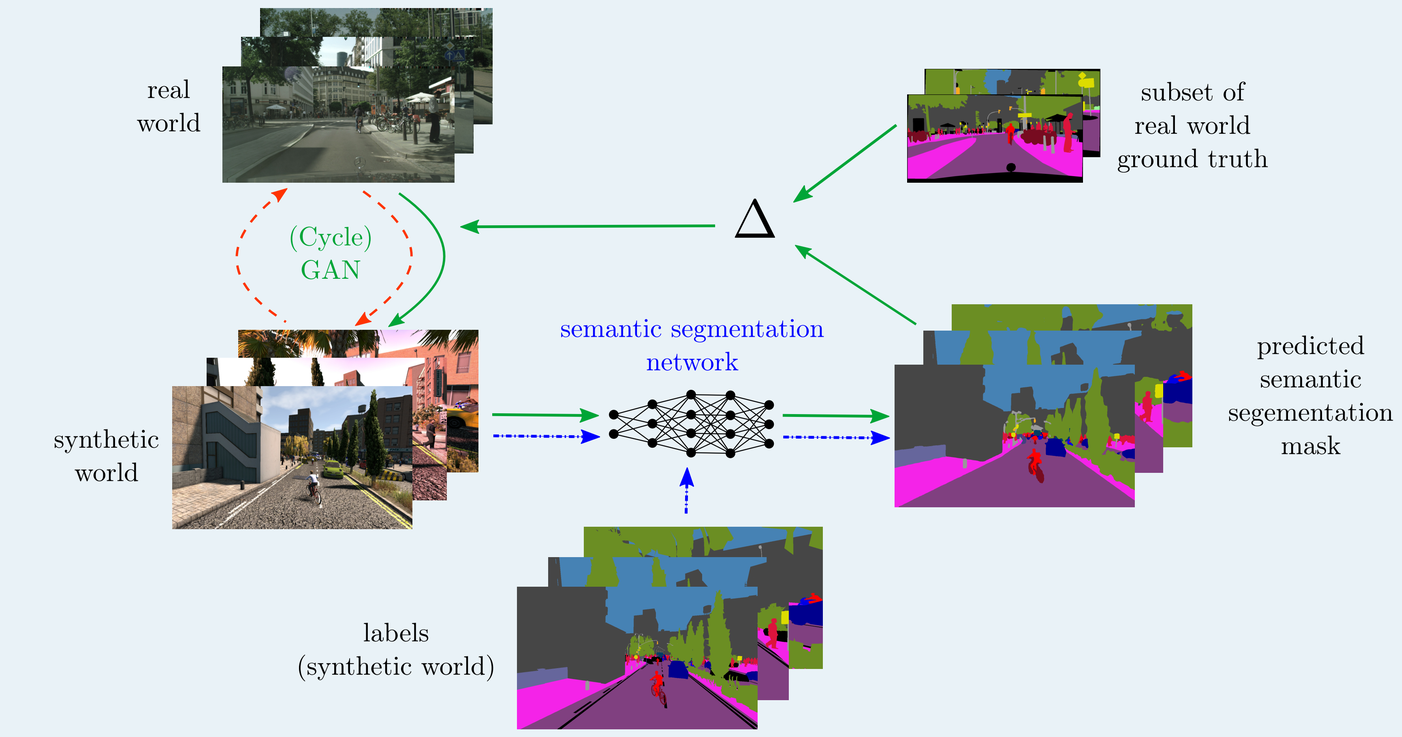
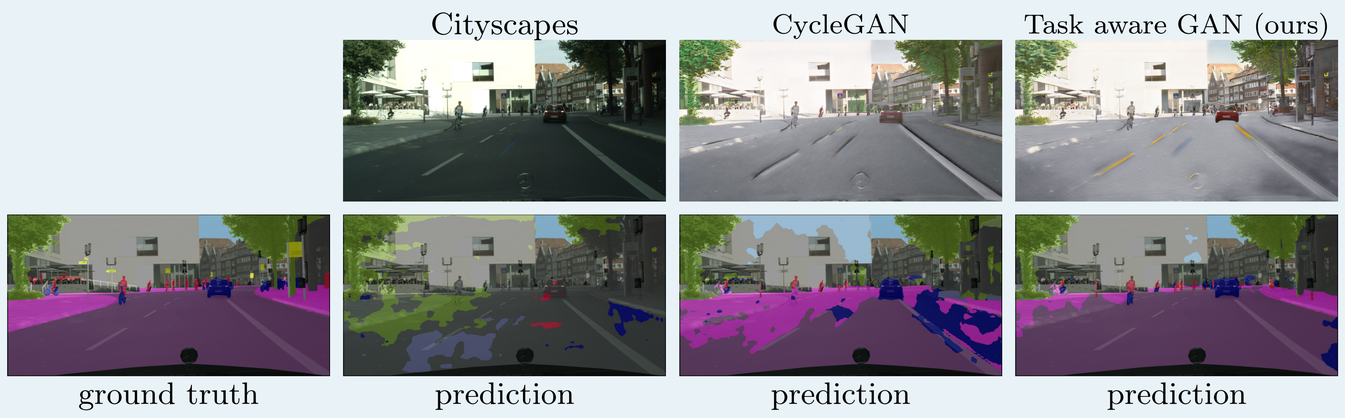
Concept of Task Aware Generator [3] (Real2Sim)

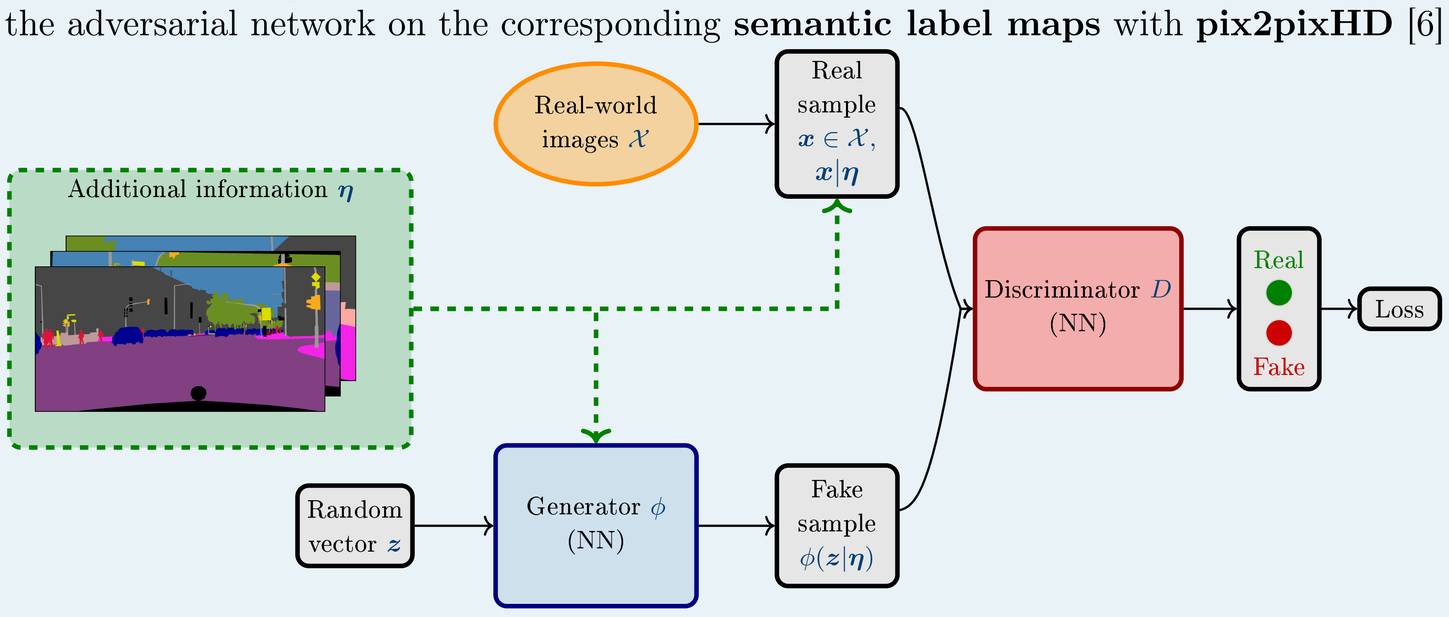


Real2Sim – Results on Semantic Segmentation



Enhancement of synthetic images (Sim2Real)

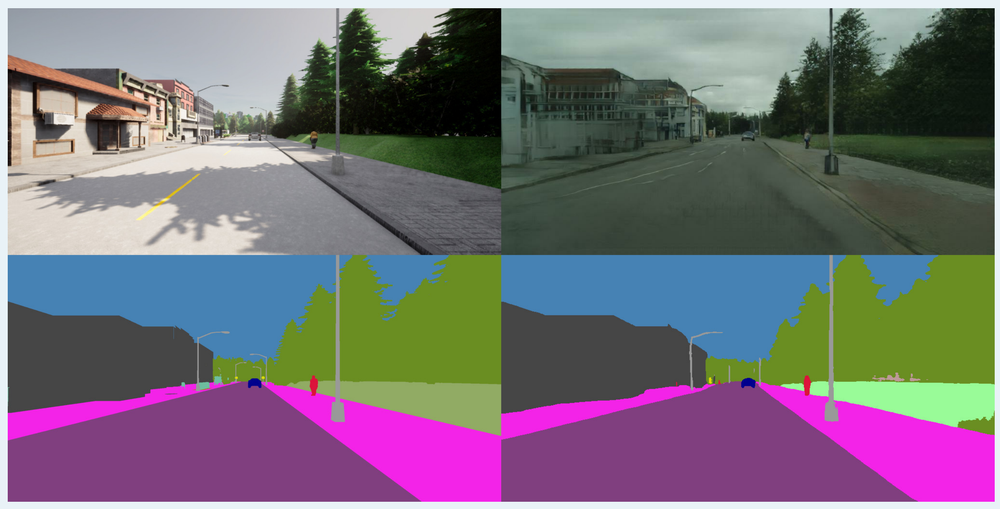
Generation of **high-resolution photo-realistic** images by **conditioning** the input of the adversarial network on the corresponding **semantic label maps** with **pix2pixHD** [6]



Architecture of conditional GAN. According to: [7].

Sim2Real – Results on Semantic Segmentation

Network: Deeplab V3+ with WideResNet38 backbone [8] trained on Cityscapes [9]



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