Research Proposal

Title	Exploiting synthetic images for real-world image recognition
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Background of the research	Deep learning has revolutionized visual object recognition. Thanks to huge datasets and fast hardware (GPUs) current object recognition approaches can compete with near-human accuracy. With recent progress in graphics, it has become more tractable to train models on synthetic images, potentially avoiding the need for expensive annotations. However, learning from synthetic images may not achieve the desired performance due to a gap between synthetic and real image distributions. Does the use of Generative Adversarial Networks (GANs) to enhance synthetic images, e.g. by making them more realistic, improve the performance of the detector when training on this enhanced synthetic data?

Summary of the proposed research	- Replicate the network as described in 'Unsupervised Pixel–Level Domain Adaptation with Generative Adversarial Networks' using MNIST
	- Replicate the network as described in 'Domain-Adversarial Training of Neural Networks' using MNIST
	- With normal MNIST, low training data MNIST, unbalanced MNIST:
	  - test with synthetic data
	  - test with real data
	  - test with synthetic + real data
	  - test with converted synthetic data
	  - test with converted synthetic + real data
	- Validate on different dataset

Research question	What is the effect on training deep nets on data synthesised using Generative Adversarial Networks based on real training data?
Subquestions	- Does data synthesised in this way help reduce the impact of having little real training data? - Does data synthesised in this way help reduce the impact of having unbalanced training data?
Planning of the research project	1. Setup, literature research 2. Research proposal draft, literature research, start implementation GAN 3. Final research proposal, literature research, MNIST training full data 4. MNIST training reduced data 5. MNIST training unbalanced data 6. Validation on different data 7. Validation on different data, first draft 8. Validation on different data, second draft 9. Preparing presentation 10. Presentation on research, final paper

Outline of the thesis	Introduction Related Work Model Experiments Evaluation Result
References for this research proposal	doi:10.1109/CVPR.2017.18 - Unsupervised Pixel-Level Domain Adaptation with Generative Adversarial Networks doi:10.1109/CVPR.2017.241 - Learning from Simulated and Unsupervised Images through Adversarial Training doi:10.5244/C.28.82 - From Virtual to Reality: Fast Adaptation of Virtual Object Detectors to Real Domains arXiv:1505.07818v4 - Domain-Adversarial Training of Neural Networks doi:10.1.1.94.777 - Effects of training set expansion in handwriting recognition using synthetic data