# Abstract: Multi-Scale GANs for Memory-Efficient Generation of High Resolution Medical Images

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Generative adversarial networks (GANs) have shown impressive results for photo-realistic image synthesis in the last couple of years. They also offer numerous applications in medical image analysis, such as generating images for data augmentation, image reconstruction and image synthesis for domain adaptation. Despite the undeniable success and the large variety of applications, GANs still struggle to generate images of high resolution. A reason for that is the fact that generated images are easier to distinguish from real ones at higher resolutions, which hinders the training process. Further reasons are computational demands and memory requirements of current network architectures.

We propose a memory-efficient multi-scale GAN [1] approach for the generation of high-resolution medical images in high quality. Our approach combines a progressive multi-scale learning strategy with a patch-wise approach, where low-resolution image content is learned first, and image patches at higher resolutions are conditioned on the previous scales to preserve global intensity information.

We demonstrate the ability to generate realistic images of unprecedented sizes on thoracic X-rays of size $2048^2$ and 3D lung CTs of size $512^3$. We also show that in contrast to common patch-based approaches, our method does not cause patch artifacts. Also, an experiment is designed to show that w.r.t. the growing side length of an isotropic 3D image, the memory requirements for popular GANs grow cubical, while they stay constant for any image size using our approach, making its application on arbitrarily large images computationally feasible.

## References

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