

# Master Thesis

## Incorporating Attention Mechanism in Deep Generative Models

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### Background

Generative modeling using neural networks has been a dominant trend in the past decade of the deep learning era. Since their advent, generative models have significantly impacted various domains, specifically in the medical field, aiding in compensating for medical data scarcity. Recently, diffusion models have gained popularity as powerful generative models, demonstrating one of the compelling topics in computer vision that has shown promising results. Fundamentally, diffusion models perturb training data by successive addition of gaussian noise and then learn to reconstruct the data by reversing this noising process through a neural network. In addition, attention mechanism has become an integral concept in neural networks that has been researched within diverse application domains resulting in remarkable success in many visual tasks, including image classification, semantic segmentation, and object detection, to name a few. Therefore, developing an efficient neural network that carefully incorporates an attention mechanism can be beneficial to guide the process more effectively, which can be advantageous for different tasks, including missing modality, image-to-image translation, image generation, etc. [1]. In this research, we aim to explore adopting attention mechanisms in diffusion models as its guidance to generate more realistic images. The method will be evaluated on medical image datasets.

### Tasks

- Literature review
- Implement and evaluate the baseline methods
- Investigate the solution for the literature limitations
- Evaluate the performance in different settings
- Write a paper (we will completely guide)

### Your profile

- Student of RWTH Aachen with Faculty 6
- Strong programming skills (Python)

- Knowledge in computer vision and deep learning
- Experience in deep learning framework (Pytorch)
- Strong writing skill

## Our Offer

Our institute features an ultra-modern computer infrastructure, including a remotely accessible cluster for training the deep learning networks with dozens of GPUs. Throughout the thesis period, you will be supervised with a regular meetings and guidance.

## References

1. Hong, Susung, et al. "Improving Sample Quality of Diffusion Models Using Self-Attention Guidance." arXiv preprint arXiv:2210.00939 (2022).

If you are interested, please send a short email to [azad@lfb.rwth-aachen.de](mailto:azad@lfb.rwth-aachen.de) with your resume and current transcript.