

Master Thesis / HiWi

Generative Models for PET Image Reconstruction

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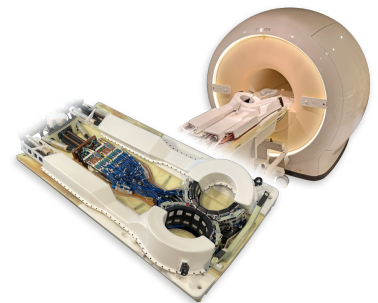
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Background

Positron Emission Tomography (PET) is a vital medical imaging modality used for diagnosis and monitoring of diseases. However, PET image reconstruction faces significant challenges, such as Poisson noise with high variance and a wide dynamic range, often leading to artifacts or lower resolution.

Recently, Generative Models have demonstrated state-of-the-art performance in medical image reconstruction tasks [1]. This thesis focuses on adapting and applying these powerful generative models to PET imaging to overcome its specific challenges and improve reconstruction quality.



Tasks

- Literature Review on Generative Models (e.g. Diffusion Models and Score-Based Generative Models) and PET reconstruction techniques.
- Get familiar with the existing frameworks and reproduce the results of the baseline works.
- Implement reconstruction using anatomical guidance (e.g., MRI data).
- Evaluate robustness on out-of-distribution data (e.g., anomalies or lesions).

Required Qualifications

- Strong programming skills (Python, C++, or a comparable programming language)
- Deep learning and machine learning experience
- Knowledge of medical image processing or reconstruction (helpful but not required).
- Version control (e.g. Git, GitHub, GitLab)
- Familiarity with libraries such as Pytorch, Pytorch Lightning, Numpy

What We Offer

Our institute has state-of-the-art IT infrastructure that can quickly handle computationally intensive tasks. As a supervisor, I will accompany and guide the work, through regular meetings and discussions with you. At the end of the thesis/HiWi job, your work can be published in a top-tier conference/journal. If you are interested, feel free to contact me via the following email Rueveyda.Yilmaz@lfb.rwth-aachen.de including your latest CV and the transcript of grades.

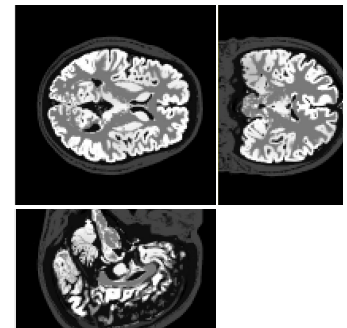


Figure: The HypMed breast PET insert for MRI devices and a PET Phantom

[1] Singh, Imraj RD, et al.
"Score-Based Generative Models for PET Image Reconstruction." arXiv preprint arXiv:2308.14190 (2023).