

A Deep Learning Approach to Synthesize Virtual CT based on Transmission Scan in hybrid PET/MR

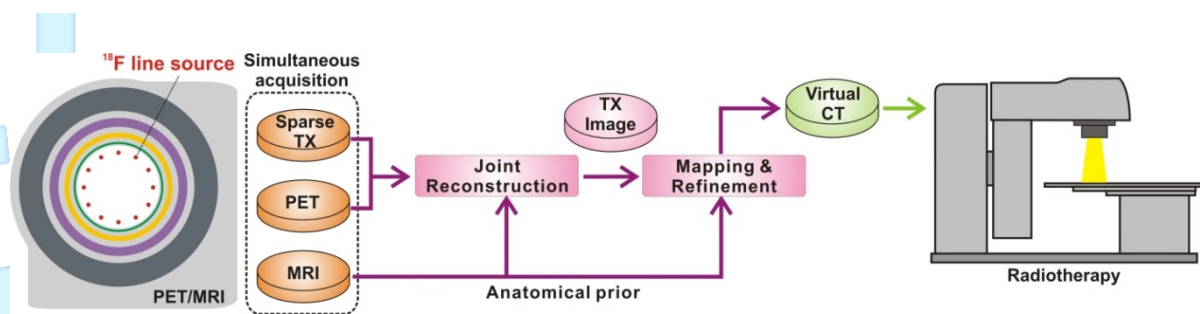
Master Thesis in CAMP and Dept. Nuclear Medicine, Klinikum r. d. Isar

Contact: Sailesh Conjeti, Email: sailcon.131@gmail.com

Dr. Kuangyu Shi, Email: shi@lrz.tum.de

Computed Tomography (CT) is a mandatory imaging modality for radiation treatment planning while magnetic resonance imaging (MRI) and positron emission tomography (PET) have advantages in tumor delineation and dose prescriptions. With the advent of PET/MRI, this hybrid imaging modality has advantages of simultaneous acquisition of soft tissue morphological imaging and molecular imaging, which provides advanced information supporting clinical diagnosis and therapy planning (1). To avoid multiple scanning and additional high radiation doses, a new concept was proposed to integrate low dose transmission scan (TX) into a PET/MRI machine for the synthesis of virtual CT (VCT) for treatment planning (2). However, TX is usually extremely noisy with artifact spots and it is necessary to smooth the sinogram to obtain interpretable images. This leads to consequently blurred low resolution images.

The proposed Master thesis project will aim to synthesize high resolution virtual CT planning based on low resolution transmission scan in integrated PET/MRI. This VCT is aimed to substitute CT scans in several applications such as radiotherapy treatment planning and attenuation correction. In particular, this project will develop advanced deep learning approach to achieve imaging super-resolution.



The student is expected to have good knowledge in machine learning and visualization. Advanced skill in Matlab programming is required. Basic knowledge in medical imaging would be beneficial.

References

1. Delso G, Fürst S, Jakoby B, et al. Performance Measurements of the Siemens mMR Integrated Whole-Body PET/MR Scanner. *J Nucl Med*. 2011;52(12):1914-22.
2. Shi K, Cheng X, Navab N, et al. PET/MRI/VCT: Restoration of Virtual CT from Transmission Scan on PET/MRI using Joint-Anisotropic Diffusion. *Computational Methods for Molecular Imaging*: Springer; 2015.