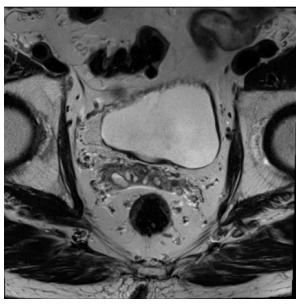
Introduction

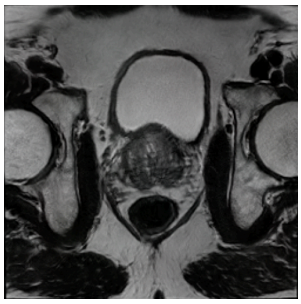
Prostate cancer is one of the most prevalent cancers among men worldwide, and Magnetic Resonance Imaging (MRI) is a critical tool for its detection and diagnosis. However, acquiring high-quality MRI images can be time-consuming and expensive. Recent advancements in deep learning techniques offer the potential to synthesize realistic MRI images, which can aid in overcoming these challenges. The synthesized images will closely resemble real MRI scans and can be used for various applications, including training deep learning models and augmenting datasets.

Objective of the project

A previous project developed within the Image and Video Processing Group at UPC has shown the ability of StyleGAN [1] to synthesize realistic MRI prostate images. See next Figure for examples.



Real MRI Image



Synthetic MRI image

In this project, we will go one step farther, by using the StyleGAN's ability to learn complex image representations, which allows to explore novel features and patterns in MRI data. Our aim is to control specific features of the generated images using latent space manipulation. By analyzing the latent space of the StyleGAN model, we can identify latent directions corresponding to specific image features and investigate their significance in the context of Prostate MRI analysis.

In particular, we will explore the possibility to control certain characteristics of the synthesized images, such as contrast, noise levels, and anatomical structures, by adjusting the input latent vectors. This control can be beneficial for generating images with desired properties for augmentation of existing MRI datasets in order to improve the performance of deep learning models trained on Prostate MRI data.

A second objective will be to use the projection of real MRI images into the latent space to generate new images which combine features from two original MRIs. This approach has been used to interpolate or produce morphing between two natural images [2]. We will explore its usage for interpolating images between two MRI sections from a 3D MRI and to combine features from different MRI to enrich our database.

Financing:

This project is developed in the context of the European Project FLUTE and will be funded with a collaboration grant. You can contact us for more details.

[1] Tero Karras, Samuli Laine, and Timo Aila. A style-based generator architecture for generative adversarial networks. In 2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), pages 4396–4405, 2019.

[2] Wulff, Jonas, and Antonio Torralba. "Improving inversion and generation diversity in stylegan using a gaussianized latent space." *arXiv preprint arXiv:2009.06529* (2020).