COMPARISON OF UNET AND DC-UNET MODELS FOR AN EFFICIENT SEGMENTATION AND VISUALIZATION OF RODENT HEPATIC VASCULAR NETWORK FROM X-RAY PHASE CONSTRAST IMAGING

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This study proposes deep neural methods and tools for the extraction and visualization of vascular systems, through SR-PCT images (synchrotron radiation X-ray phase-contrast tomography) of murine liver. This imaging modality allows us to visualize the hepatic vasculature without specific sample preparation such as sectionning or injection of agent contrast. Despite the vessel visualization capabilities of phase contrast imaging (PCI), few studies focused on the analysis and processing of vasculature. To the best of our knowledge, this is the very first time that such segmentation has been achieved by deep models with different parametrizations and compared for vessel segmentation using this imaging modality. Moreover, we propose to apply pre-processing steps (CLAHE, sigmoid and Gaussian filtering) in order to improve the contrast of raw data and we have performed data augmentation through rigid transformations to increase the amount of data and to prevent overfitting of the models. Training and validation step has been performed on a small set of 10 manually segmented images. We show that the best performance is obtained thanks to a DC-UNet model, learnt with these improved images. With this complete pipeline, we were able to segment and visualize in 3D the complete liver vasculature within a volume of more than 1000^3 voxels.

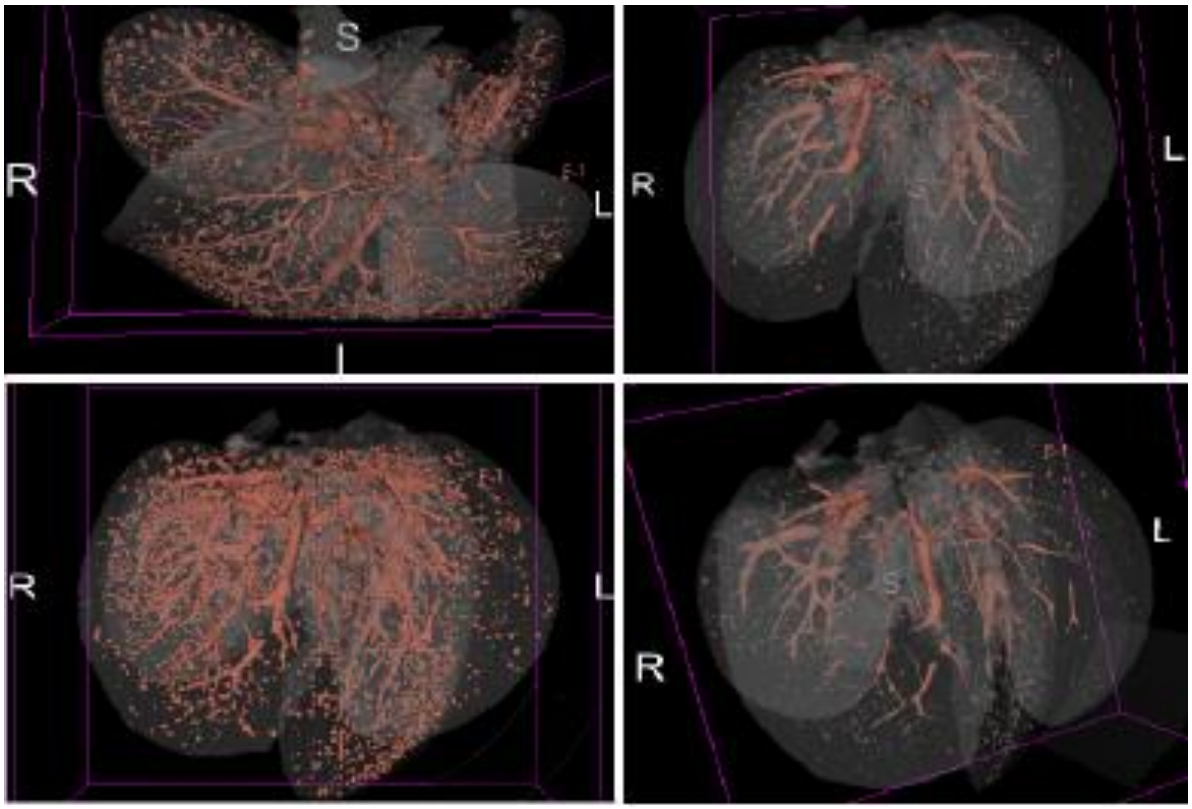

Figure 1:Output of the vessel segmentation of the full volume