Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3593** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Deep-Learning Based segmentation of 3D Isotropic Hyperpolarized 129 Xe Lung MRI for Generating vADC for a Large Patient Population Studied with The Use of Transfer learning

Monday 19 June 2023 14:30 (15 minutes)

Introduction: Hyperpolarized 129Xe lung MRI is an efficient technique used to investigate and assess pulmonary diseases. However, the longitudinal observation of the emphysema progression using hyperpolarized gas MRI-based Apparent Diffusion Coefficient (ADC) can be problematic, as the disease-progression can lead to increasing unventilated-lung areas, which likely excludes the largest ADC estimates. One solution to this problem is to combine static-ventilation and ADC measurements following the idea of 3He MRI ventilatory ADC (vADC). We have demonstrated this method adapted for 129Xe MRI to help overcome the above-mentioned shortcomings and provide an accurate assessment of the emphysema progression.
Methods: Ten study-subjects with written informed consent provided to an ethics-board-approved study protocol, underwent spirometry and 3He/129Xe MRI scanning. 129Xe imaging was performed at 3.0T (MR750, GEHC, WI) using whole-body gradients (5G/cm maximum) and a commercial 129Xe quadrature-flex RF coil (MR Solutions, USA).1 Hyperpolarized 129Xe gas (polarization=35%) was obtained from a turn-key, spin-exchange polarizer system (Polarean-9820 129Xe polarizer). VDP was generated using the DL. We used 2-D U-Net architecture for segmentation and ResNet-152 as the backbone network that was trained on the ImageNet and a low-resolution MRI dataset. The segmentation masks were compared to ground truths using dice similarity coefficient.
Results: Fig.1 shows the acquired static-ventilation images (top-panel), matched voxel-size unweighted (b=0,) images (middle-panel) and correspondent ADC maps (bottom-panel) in coronal view for a representative study-subject demonstrating a good- match between static-ventilation and matched resolution unweighted-slices. Table 1 shows the demographic, PFTs, mean VDP, ADC, and vADC estimations for all study-subjects.
Discussion and Conclusion: In this proof-of-concept-study, we showed that the emphysema-progression can be potentially quantified with using the pulmonary static-ventilation and diffusion-weighted images of hyperpolarized 129Xe utilizing the ventilatory ADC approach powered by the DL-segmentation.

Keyword-1

Lung, Deep-Learning

Keyword-2

Hyperpolarized Xenon-129 MRI

Keyword-3

Primary author: BABAEIPOUR, Ramtin (The University of Western Ontario)

Co-authors: Prof. OURIADOV, Alexei (The University of Western Ontario); Ms RAGURAM, Keeirah (The University of Western Ontario); Ms MIHELE, Maria (The University of Western Ontario); FOX, Matthew (Lawson Health Research Institute)

Presenter: BABAEIPOUR, Ramtin (The University of Western Ontario)

Session Classification: (DPMB) M2-3 MRI I | MRI I (DPMB)

Track Classification: Technical Sessions / Sessions techniques: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)