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Automated multimodal segmentation of paraspinal muscles based on chemical shift encoding-based water/fat-separated images

P01.25

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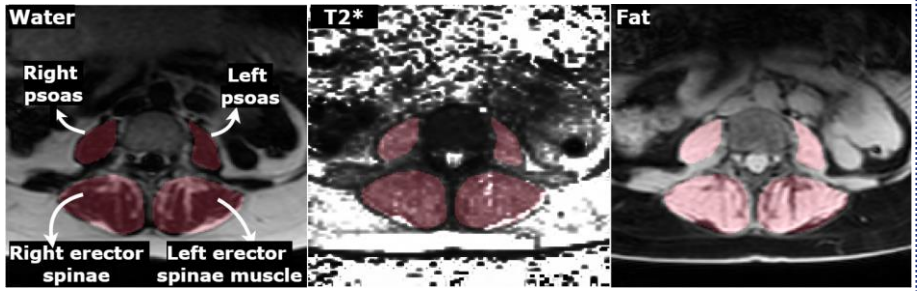
INTRODUCTION

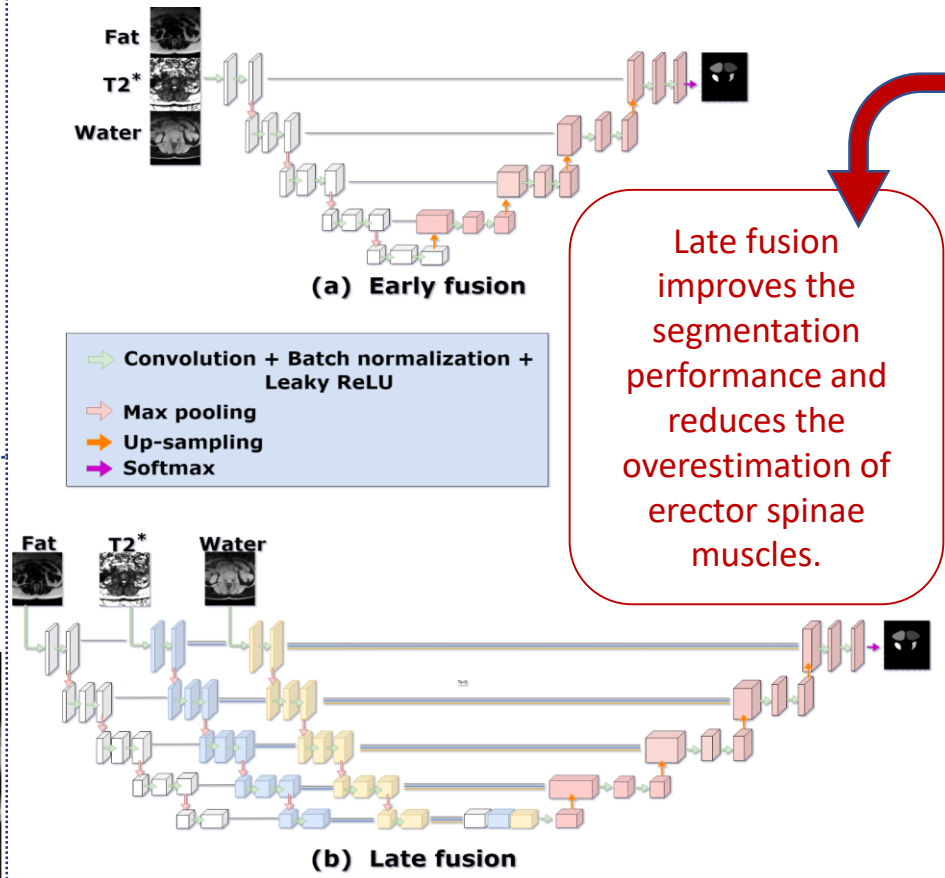
- **Chronic lower back pain (LBP)** is the most prevalent musculoskeletal disorder among adults [1,2]
- **Paraspinal muscle atrophy and fatty infiltration** can accurately indicate LBP through extraction of **proton density fat fraction (PDFF) maps** from **chemical shift encoding-based water-fat MRI**
- Objective: to effectively exploit **multimodal water-fat MRI data** and **deep learning** for paraspinal muscle segmentation

METHODS

Data: **54 MRI** datasets of healthy volunteers acquired from a 3T Philips Ingenia system containing axial **water, fat** and **T2*** images [3] (40/14 - train/test split)



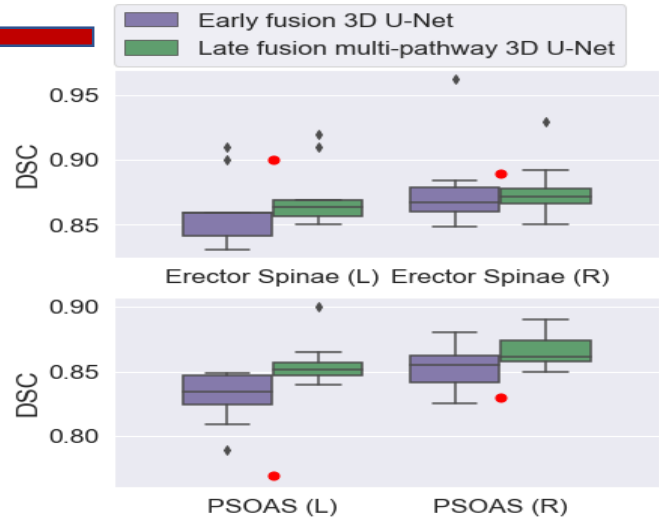
Segmentations of **right/left erector spinae** and **psoas** muscles were obtained from axial PDFF maps. All data is normalized to zero mean and unit standard deviation.



3D U-Net trained on 40 water-fat and T2* images fused into 3 channels at the input (a) compared to late fusion approach of 3 encoder paths fused at the bottleneck of the U-Net (b) to better handle multimodal data complexity.

Late fusion improves the segmentation performance and reduces the overestimation of erector spinae muscles.

RESULTS



The proposed method **outperforms** the current PSOAS segmentation results reported in the literature [4] (red dots – mean DSC).

DL-based segmentation benefits from multimodal data, where feature extraction using late fusion outperforms early data merging!

[1] Al-Kafri et al. IEEE Access, 43487–43501, 2019
[2] Panagopoulos et al. AJNR 38(9), 1826-1832, 2017
[3] Burian et al. BMC MD, 20(1), 152, 2019
[4] Baum et al. ER Exp, 2(1), 1-5, 2018