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## **WITHDRAWN - (U\*) Comparing Two De-Noising Methods for $^{129}\text{Xe}$ and $^{19}\text{F}$ Hyperpolarized Gas MRI**

Biomarkers are an important tool used to quantify lung disease, and are extracted from accurate, de-noised images (1). Hyperpolarized gas imaging, specifically Diffusion-Weighted (DW) and Dynamic-Ventilation (DV) are techniques used to quantify these biomarkers. However, noise is a concern, leading to over or underestimation of biomarkers (2). In this study, we aimed to compare two de-noising methods in order to improve measurements of diffusion length scale estimates ( $LmD$ ) and Mean-Linear-Intercept-Estimates ( $Lm$ ) as well as Regional-Fractional-Ventilation ( $r$ ) in patients with lung disease as these metrics are potential biomarkers candidates (3). We first acquired  $^{129}\text{Xe}$  morphometry and fractional ventilation maps, as well as  $^{19}\text{F}$  fractional ventilation maps. We then applied MP-PCA (Marchenko Pastur- Principle Component Analysis) and modified MP-PCA de-noising methods to each image and obtained the pre and post de-noising  $r$ ,  $LmD$ , and  $Lm$  metrics. MP-PCA de-noising works by first deconstructing the image signals using by projecting them onto an orthogonal base, reducing the size of noisy components, and then reconstructing the signal. Modified MP-PCA included the addition of hard-thresholding over a nuclear norm in k-space. Finally, applying a Student's T-Test, we found that the unmodified MP-PCA method was better suited to de-noise  $^{19}\text{F}$  and  $^{129}\text{Xe}$  images with no significant change between global metrics pre and post de-noising ( $p < 0.03$ ). Conversely, the modified MP-PCA method showed grossly overestimated and therefore significantly different fractional-ventilation image metrics, and should not be used to de-noise hyperpolarized  $^{19}\text{F}$  and  $^{129}\text{Xe}$  images. In conclusion, de-noising HP  $^{129}\text{Xe}$  and  $^{19}\text{F}$  image using the unmodified MP-PCA method results in better overall images, and can be used to further research biomarkers of lung disease such as  $r$ ,  $Lm$ ,  $LmD$  in longitudinal studies.

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