Abstract: Revealing Hidden Potentials of the q-Space Signal in Breast Cancer

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Mammography screening for early detection of breast lesions currently suffers from high amounts of false positive findings, which result in unnecessary invasive biopsies. Diffusion-weighted MR images (DWI) can help to reduce many of these false-positive findings prior to biopsy. Current approaches estimate tissue properties by means of quantitative parameters taken from generative, biophysical models fit to the q-space signal under certain assumptions regarding noise and spatial homogeneity. This process is prone to fitting instability and partial information loss due to model simplicity. We reveal unexplored potentials of the signal by integrating all data processing components into a convolutional neural network (CNN) architecture that is designed to propagate clinical target information down to the raw input images. This approach enables simultaneous and target-specific optimization of image normalization, signal exploitation, global representation learning and classification. On a multicentric data set of 222 patients we demonstrate that our approach significantly improves clinical decision making with respect to the current state of the art, preventing 63 out of 100 unnecessary biopsies. Notably, this work has previously been published at MICCAI 2017 [1]. Subsequent experiments including automated lesion detection and a comprehensive comparison to conventional radiomics approaches will be part of an extended presentation.

References

1. Jäger PF, Bickelhaupt S, Laun FB, et al.; Springer. Revealing hidden potentials of the q-space signal in breast cancer. Proc MICCAI. 2017; p. 664–671.