Joint MR-PET reconstruction using nuclear norm based multi-channel TGV regularization.

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Magnetic resonance (MR) imaging and positron emission tomography (PET) both are imaging techniques that are heavily used in clinical practice. In the past years, hybrid MR-PET scanners have become available, allowing the simultaneous acquisition of both MR and PET images. While the resulting data sets are obtained by measuring two fundamentally different physical tissue properties, the underlying anatomy is still the same. This motivates a joint image reconstruction framework that exploits structural similarities between the acquired images. To this aim, we propose a joint MR-PET reconstruction approach that regards the data obtained with the two modalities as different channels of a single image and employs multi-channel total generalized variation regularization. In order to promote aligned image edges while still staying in a convex setting, the gradients of the two channels are coupled via a point-wise nuclear norm. We present phantom studies as well as in-vivo experiments and compare to both standard reconstruction methods and separate regularization.