FMRI 3D registration based on Fourier space subsets using neural networks

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Abstract

In this work, we present a neural network (NN) based method designed for 3D rigid-body registration of FMRI time series, which relies on a limited number of Fourier coefficients of the images to be aligned. These coefficients, which are comprised in a small cubic neighborhood located at the first octant of a 3D Fourier space (including the DC component), are then fed into six NN during the learning stage. Each NN yields the estimates of a registration parameter. The proposed method was assessed for 3D rigid-body transformations, using DC neighborhoods of different sizes. The mean absolute registration errors are of approximately 0.030 mm in translations and 0.030 deg in rotations, for the typical motion amplitudes encountered in FMRI studies. The construction of the training set and the learning stage are fast requiring, respectively, 90 s and 1 to 12 s, depending on the number of input and hidden units of the NN. We believe that NN-based approaches to the problem of FMRI registration can be of great interest in the future. For instance, NN relying on limited K-space data (possibly in navigation echoes) can be a valid solution to the problem of prospective (in frame) FMRI registration.

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- Magnetic Resonance Imaging
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