

Abstract 47121

Dictionary-Learning reconstruction for accelerating PSF mapping for EPI distortion correction

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Purpose/Introduction

Echo-planar images (EPI) present geometric distortions due to static field inhomogeneities. Several approaches have been developed for correction including direct B0 [1] and Point Spread Function (PSF) mapping [2]. To measure the PSF, an extra encoding gradient is added in the phase encode direction prior to the EPI readout and the sequence is repeated for each PSF step. Although PSF correction has been shown to be more robust compared to B0 mapping [3], the long acquisition times required have limited its dissemination.

Previous approaches to accelerate PSF acquisition include Parallel Imaging (PPI) [4] and reduced field of view (rFOV) acquisitions [5]. Here we explore the option of using the K-SVD Dictionary Learning (DL) algorithm [6] to recover the PSF from under-sampled data using a DL-compressed sensing framework.

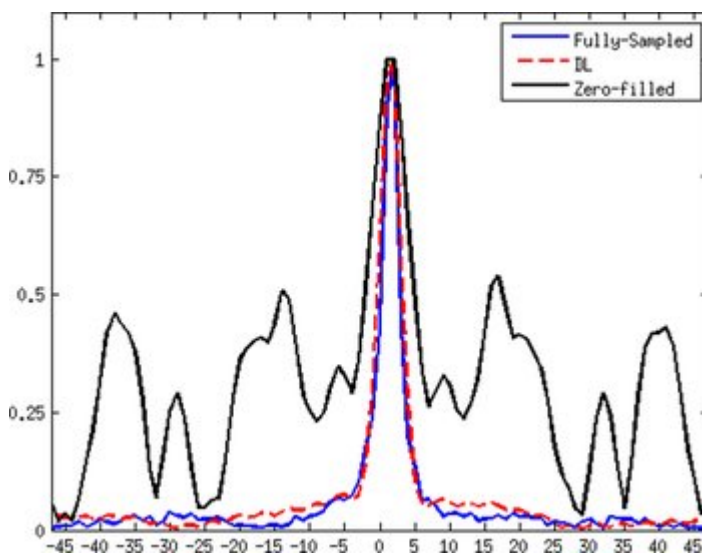
Subjects and Methods

Images were acquired on a volunteer on a 3.0T Philips Achieva. Image resolution 2.5x2.5x4.0 mm³, matrix 96x95, 95 PSF encoding steps, 24 slices, TE/TR = 35/3000 ms. An EPI image was reconstructed using the non-PSF encoded repeat, while a gradient echo (GE) image was obtained by taking all central lines of the EPI readout. Under-sampling was simulated along the PSF encoding direction. K-SVD was implemented using one dimensional patches; using as initial estimate the PSF obtained from the zero-filled under-sampled data, a dictionary is learnt at each iteration and a new estimate of the PSF obtained. At this point the k-space is updated so as to be consistent with the acquired data and the whole process repeated until convergence is achieved.

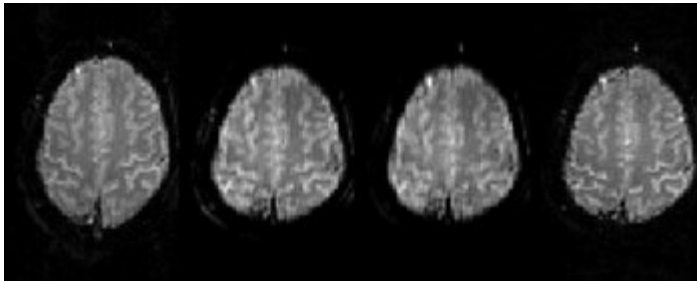
The EPI image was corrected for distortion using both the fully-sampled and estimated PSF. The correction was performed as described in [5].

Results

It was possible to recover the PSF with an acceleration factor of 9.5 – Fig. 1.



Successful distortion correction was achieved with comparable images obtained using the original and reconstructed PSF – Fig. 2.



Discussion/Conclusion

With the current protocol, the achieved acceleration factor would reduce the PSF acquisition time to only 30 seconds. To further reduce scanning times combination of DL with PPI should be investigated. The sampling schemes should also be optimised.

References

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