Array Compression for 3D Cartesian Sampling

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INTRODUCTION

Array compression (AC) [1, 2] is a technique to reduce data size and reconstruction computation for large coil arrays: the original data can be compressed into fewer virtual coils by a linear combination. Reconstruction performed on the virtual coils is much faster than that on the original coils. To achieve fast autocalibrating parallel imaging [3] (ACPI) reconstruction for 3D Cartesian datasets, a slice-by-slice AC (SBSAC) is proposed in this work.

METHOD

SBSAC can minimize the compression loss for 3D datasets. The major steps of SBSAC are shown in Fig. 1. Compression matrices alignment leads to smooth sensitivities of the virtual coils. Without proper alignment, 3D calibration would fail. ACPI reconstruction, such as GRAPPA [3], ARC [4] and SPIRiT [5], can be performed directly on the virtual coils to achieve fast reconstruction.

RESULTS AND DISCUSSION

SIMULATION A fully-sampled 32-channel dataset was used for simulation in the following comparison: (a) single array compression (SAC), the same compression matrix was used for all the slices; (b) SBSAC. 6 virtual coils were chosen after compression. The results (Fig. 3) show that SBSAC has much less compression loss than SAC. An example of SBSAC before and after compression matrices alignment is shown in Fig. 4.

RECONSTRUCTION TIME COMPARISON Two datasets were reconstructed by ARC [4] and ℓ₁-SPIRiT [6, 7] with and without SBSAC. The reconstruction time in two cases is shown in Tab. 1. ARC reconstruction was approximately accelerated by a factor of 16, and ℓ₁-SPIRiT by a factor of 15.

CONCLUSION

The proposed SBSAC method can effectively compress data from large number of coils into fewer virtual coils (e.g., 32 to 6). With proper alignment of the compression matrices, ACPI reconstruction on the virtual coils can achieve very similar image quality to that on the original coils. The computation can be greatly reduced using the proposed SBSAC.


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