AbstractID: 8577 Title: A universal analysis on temporal uncertainty of fMRI methods with different biophysical mechanisms

Purpose

Functional MRI (fMRI) using BOLD contrast has been widely applied to localize brain activations. However, the venous origin of the BOLD signal can cause varied temporal uncertainties in different brain regions. Besides the vasculature variations, determination of the BOLD response timing is also affected by the contrast-to-noise ratio (CNR). In this study, we propose a universal analysis to differentiate the temporal uncertainty resulted from different biophysical mechanisms. The analysis was applied to compare CBV- and BOLD-based experiments at different field strengths.

Methods

Eight normal volunteers participated in this study (3 at a 1.5T Vision and 5 subjects at a 3T Tim-Trio scanner). A GE-EPI was used for the BOLD experiment (TR/TE/FA = 1000ms/60ms/90° at 1.5T and 1000ms/35ms/64° at 3T). A non-slice-selective IR-GE-EPI sequence was used for the vascular space occupancy (VASO) experiment (TI/TR/TE/FA = 665 ms/2000ms/9.3ms/90° at 1.5T and 710ms/2000ms/12ms/90° at 3T). Each experiment contained 30 repeated trials of brief (1s) visual stimulation. CNR and response onset time were quantified for each activated voxels in the visual area.

Results

The measured CNR increased with number of trials averaged. The plot of the standard deviation of onset time ($\Delta\tau$) vs. CNR was able to differentiated VASO from BOLD results, showing less onset variations in the VASO measurements when comparing at the same CNR levels. The same two curves (BOLD and VASO) were able to describe results obtained at different field strengths, i.e. 1.5T and 3T results shared the same curves with 3T shifted to higher CNR regions.

Conclusion

We proposed to analyze temporal uncertainty of HRs measured in fMRI at different CNRs which were manipulated by averaging different numbers of repeated trials. The results demonstrated that this analysis was universal to measurements at different field strengths and able to characterize distinguished biophysical mechanisms of different fMRI methods.