Detection and Repair of Transient Artifacts in fMRI Data
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Cognitive processes in the frontal lobes have small BOLD activations (often less than 1%), consequently, large data artifacts can make these activations disappear or cause false activations to appear. Artifacts may arise from sudden motions, deep breaths, swallowing, or electrical noise. One approach to correct outliers is to diagnose statistically-normal events in the data [Luo and Nichols [1]]. Another method is to screen for statistical outliers on a voxel-wise basis and repair them automatically [Cox [2]]. Our objective is to automatically detect physically-based artifacts, and provide user-friendly tools to repair large amounts of data.

Automated and semi-automated algorithms were built to detect and repair volume artifacts, and detect and repair slice artifacts. Visualization with contrast images helps identify the physical sources of the artifacts. Movie viewing of the contrast images allows for rapid user review of intensity changes in each voxel over time.

Volume Repair
All points with z-score values above threshold are marked by a vertical line. Bad volumes can be repaired by interpolation or replacement by the mean image. During model specification, the bad scans can be removed from the analysis.

Slice Artifacts and Slice Repair
Slice artifacts in EPI data
RF Coil Noise in spiral data [4]
After bad slice repair
Slice repair screens all data for bad slices and writes BadSlice logfile. Repairs by interpolation with adaptive threshold for each slice. Bad slices (and single voxel noise) can also be repaired by 3-point median filter in time.

Artifact Software Package

http://qg.lab.stanford.edu/tools.htm