

QIBA fMRI Biomarker Committee (BC) Call

Wednesday, October 7, 2020 at 11 a.m. (CT)

Draft Call Summary

In attendance

Jay Pillai, MD (Co-chair)

David Soltysik, PhD (Co-chair)

Shruti Agarwal, PhD

Mai-Lan Ho, MD

Ping Hou, PhD

Ichiro Ikuta, MD, MMSc

Andrew Kalnin, MD

Ho-Ling (Anthony) Liu, PhD

Nancy Obuchowski, PhD

David Scott, PhD

James Voyvodic, PhD

Francisco Zamorano, PhD

RSNA staff

Susan Stanfa

Moderator: Dr. Soltysik

Review of Previous Call Summary

- The 09.16.2020 call summary was approved as presented

Update on Round-1 DRO Project: Image Registration Issues Raised During this Study

- Dr. Voyvodic noted that Dr. Zamorano's DRO analysis results were clear and perfectly registered
- Clinical sites differed in software packages, algorithms used, and statistical thresholding methods; there was also variation among sites in the application of normalization, which may have impacted the results
- Clinical sites varied in how they aligned their EPI images with T1 images
- Some sites re-sampled images to an incorrect voxel size and there was inaccurate orientation information in the new image headers
- The location of activations that were sent back to Dr. Voyvodic were analyzed and he compared them against his truth maps; agreement between the locations of activations under different analyses was highly variable
- Dr. Voyvodic decided to present results in a couple of different ways
 - A color-coded comparison was performed; one color was used to show where there were clearly registration technical issues and a different color was used where there were none
 - Sites ignored information like obliqueness, however, this was easy to compensate for and add back in
 - Analysis issues were related to imaging registration, not thresholding, and can be reconciled using AMPLE normalization
- It was recommended that when the option is available (depending upon the platform), the first timepoint from acquisition should be retained, not discarded
- When comparing different registration algorithms, the anatomy should be used as ground truth
 - Suggestion to apply registration algorithms to steady state images with particularly good anatomy
 - Then, compare them with images that do have structural anatomy and use them as truth; this would be a way to test different registration algorithms against each other for comparison
- Suggestion to address and perhaps investigate co-registration as a groundwork project
- A head-to-head comparison of different software packages was avoided, but differences and issues among them were noted
- All sites had been sent a survey regarding their methodology, e.g., 1. What standard threshold method the site uses and, 2. If the threshold was adjusted to compensate for variability, what were the adjusted thresholds in each case?
 - Sites differed significantly in thresholding
 - AMPLE normalization reduces threshold variability
 - Some sites differ significantly in anatomical registration
 - Sites differ in use of slice orientation information

Update on Language Reproducibility Study

- Consensus maps were made from 1,300 language scans
- Dr. Voyvodic has cross-session (between subjects) and within-session (to assess within-subject variability) data for the same tasks and different tasks (mainly sentence completion or word generation)
- Metrics Laterality Index (LI), cluster location and cluster size of language activations in human subjects who have performed more than one sentence or word generation language task were compared
- The number of activation clusters in particular language regions based on peak signals was determined, and that information was used to generate language and activation ROI maps
- Each scan was scored for head motion and various other quantitative metrics, then, for each one, peaks of language activity were defined, and cluster analysis was done
- Individual clusters of activation between different language areas were identified
- There was peak of activation in four different language ROIs, including the left and right frontal and left and right temporal areas; peaks of activation were spread out
- Claims should be made about measurable biomarkers and procedures for acquisition and data qualifications that allow good scans to be differentiated from bad ones must be identified
- Maps were scored based on the amounts of activation overlap; greater overlap signifies a better scan
- Results indicate that reproducibility metrics within tasks or across sessions or across tasks is very good if the metrics are used as specified
- This study is nearly finished, and the resulting data will be used to inform Language Mapping Profile v2.0 Claims

Oct. 21 fMRI BC Call

- Discussion on the Language Reproducibility Study to be continued
- The September 29-30 QIBA Annual Meeting may be discussed
- Dr. Anthony Liu to present information regarding graph theory analysis

Next call: Wednesday, October 21, 2020 at 11 a.m. CT (1st & 3rd weeks of each month)

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