QIBA fMRI Biomarker Committee (BC) Call

Wednesday, May 6, 2020 at 11 a.m. CT

Call Summary

In attendance			**RSNA staff**
Feroze Mohamed, PhD (Co-chair)	Cathy Elsinger, PhD	Ho-Ling (Anthony) Liu, PhD	Joe Koudelik
David Soltysik, PhD (Co-chair)	Ping Hou, PhD	Nancy Obuchowski, PhD	Susan Stanfa
Jay Pillai, MD (Co-chair)	Ichiro Ikuta, MD, MMSc	James Voyvodic, PhD	
Shruti Agarwal, PhD	Andrew Kalnin, MD	Zhiyue Jerry Wang, PhD	

Review of Previous Call Summary

- The 04.15.2020 call summary was approved as presented

Update on Head Motion DRO Study/Article (Dr. Voyvodic)

- Dr. Voyvodic to revise his motion DRO manuscript to include modeling spin-history artifacts, and resubmit it to *Neuroimage* for publication
- Physics-Oriented Simulated Scanner for Understanding MRI (Possum) software to model DROs was determined to be unfeasible due to the time required
- Spin history calculations were added into Dr. Voyvodic's own software, and he is preparing to generate several thousand additional DROs

Language Reproducibility Study Update (Dr. Voyvodic)

- Dr. Voyvodic is comparing the 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
- Discussion re: different algorithms for clustering activations, identifying which clusters are in salient language areas and comparing clusters in different maps
- The plan is to generate measurements using ROI masks vs. ROI masks with voxels (activation cluster analysis)
- The locations of individual clusters will be identified and the closest comparable clusters of two different activations (in terms of size/location/laterality) will be determined
- Reproducibility data for all the ROIs and clusters are needed
- The methodology was explained
    - Consensus maps made from 1,300 language scans
    - Determined mean activation of those doing sentence completion tasks
    - Looked at how many activation clusters there were in particular language regions based on peak signals, and used that information to generate language and activation ROI maps
    - The ROI maps are being used to analyze activation clusters of those who performed sentence completion tasks twice within the same scanning session
    - The smallest clusters were excluded

Discussion re: Soltysik D. **Optimizing data processing to improve the reproducibility of single-subject functional magnetic resonance imaging.** *Brain Behavior*. 2020.

*Some information has been taken from presentation slides

- Referenced the follow article that includes public test-retest fMRI data using ten subjects, five tasks: Gorgolewski KJ, Storkey A, Bastin ME, Whittle IR, Wardlaw JM, Pernet CR. **A test-retest fMRI dataset for motor, language and spatial attention functions**. *Gigascience*. 2013 Apr 29;2(1):6.

- Conducted five runs, including three language tasks, one motor and one visual (all well-established through group studies and have potential use for presurgical cortical mapping):
    - Overt word repetition task
    - Covert verb generation task
    - Overt verb generation task
    - Finger, foot, lips motor task
    - Line bisection task

- Fairly common or easy-to-apply methods were chosen, including motion correction, spatial smoothing, regression methods, and thresholding methods
- Activation analysis was conducted with Analysis of Functional NeuroImages (AFNI) software
- Region of Interest (ROI) activation masks were created
- For each run:
    - Warped each subject brain to MNI atlas
    - Combined 800 activation maps X 10 subjects (or 8000 maps) in MNI atlas space
    - Counted voxels that were active in 10% (~800) runs
    - This created the ROI mask in MNI atlas space
    - Warped the ROI mask to each subject space

- Automated cluster identification/matching was used
- Test-retest metrics were discussed
    - Percent Difference in Activation Volume (PDAV) between test/retest runs: lower value indicates more reproducibility
    - Difference in the Center-of-Mass (DCM) between test/retest runs: lower value indicates more reproducibility
    - Dice Similarity Coefficient (DSC): higher value indicates more reproducibility

- Analysis was described
    - Computed test/retest metrics for all identified cluster pairs
    - Computed distributions/means of the test-retest metrics
    - Compared distributions/means across the following methods: motion correction, spatial smoothing, regression and thresholding

- Statistical tests and plots comparing motion correction methods were explained
- Discussion to continue during an upcoming meeting
- Staff to distribute the link to Dr. Soltysik's paper

Next call: Wednesday, May 20, 2020 at 11 a.m. CT (1st & 3rd weeks of each month)

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