

## MODEL AND HUMAN OBSERVER STUDIES IN VOLUMETRIC IMAGES FOR DETECTION TASKS WITH VARYING COMPLEXITY

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The recent work of Ref. [1] is directed towards designing model observers for the treatment of 3D image data in a signal detection task. Initial model results suggest that when comparing detectability in single-slice (ss) versus multi-slice (ms) images, the differences in performance are determined by image properties or by what we called *task complexity*, as determined by the frequency content of background and signal. Specifically, the disparity between ss and ms task performance decreases for greater complexity of the detection task. In this work, we compare detection performance trends for models and human observers.

Three background types were used in the study, corresponding to three task complexities. The backgrounds are synthesized as 3D correlated Gaussian noise volumes with different kernel size. The signal is a 3D Gaussian target centered on the image volume. Human observer data are gathered for two image viewing scenarios: single-slice (viewing the central signal slice of the volume) and multi-slice (viewing multiple slices of the sequence in a stack-browsing mode). Human performance is compared to that of model observer designs. In particular, for ss-images we compute the 2D ideal observer (2D-IO) and single-slice CHO (ssCHO), while the models for ms-images comprise the 3D-IO and three variants of the multi-slice CHO (msCHO), each computed for all background types.

Overall, our preliminary results suggest agreement between human and model results in terms of the influence of the task complexity – the benefit of ms- over ss-images is greater in lower complexity tasks. On average, the absolute range of performance differences between ss- and ms-images measured by the models could be larger than those measured for humans. The image reading study is currently ongoing and more detailed analysis shall be reported in the conference talk. The details about human reader behavior shall be reported and discussed in a separate submission [2].

### References

- [1] Platisa L., Goossens B., Vansteenkiste E., Park S., Gallas B., Badano A., and Philips W., "Channelized hotelling observers for the assessment of volumetric imaging data sets," *J. Opt. Soc. Am. A.*, 2011, Doc. ID 125530 (in press)
- [2] Kumcu A., Platisa L., Platisa M., Vansteenkiste E., Badano A., Deblaere K., and Philips W., "Trends in reader behavior for a signal detection task in multi- and single-slice volumetric images," submitted to Medical Image Perception Conference XIV, August 9-12, 2011.