TRENDS IN READER BEHAVIOR FOR A SIGNAL DETECTION TASK IN MULTI- AND SINGLE-SLICE IMAGES

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While many studies have looked at the behavior of radiologists while diagnosing static images, few studies examine the behavior of humans observers when reading multi-slice/volumetric datasets. In a companion paper [1] we present the results of a human reader experiment for a signal detection task in single-slice and multi-slice images of varying task complexity. In this work we report on the trends in human reader behavior from the same study.

Signal-present images were generated by inserting a 3D Gaussian target of fixed size and intensity into 3D volumes of correlated Gaussian noise generated with various kernel sizes. Human observers were presented with single-slice datasets (the central slice of the volume) and multi-slice datasets (all slices of the volume viewed in a stack-browsing mode). The observers were allowed to freely scroll through the multi-slice dataset at arbitrary speed and direction. No time limit was imposed. All experiments were conducted in a standardized viewing environment [2] on a mammography display.

We investigated the relationship between reading time, browsing pattern and speed, and behavior features captured on video, to confidence scores and detection performance results for tasks of varying complexity. Preliminary results from a pilot study seem to suggest that signal and background parameters affect the human observers' performance and reading behavior. For example, as task complexity grows, the time-to-decision during scoring tends to be longer, the number of times the multi-slice stack is viewed in forward and reverse directions tends to increase, and decisions become more doubtful. In addition, the variability of most of the measured reader behavior parameters seems to grow with task complexity; for example the standard deviation of time-to-decision increases by 5 seconds (from 7 to 12 seconds). The image reading study is currently ongoing and more substantial and detailed analysis shall be made and reported in the conference talk.

References

[1]   Platisa L., Kumcu A., Platisa M., Vansteenkiste E., Gallas B.D., Badano A., Deblaere K., and Philips W., "Model and human observer studies in volumetric images for detection tasks with varying complexity," submitted to Medical Image Perception Conference XIV, August 9-12, 2011

[2]   Marchessoux C. and Kimpe T., "Specificities of a psychophysical test room dedicated for medical display applications," in International symposium, Society for Information Display, SID 2007, vol. II, (Long Beach), pp. 971-974, 2007