Medical Image Perceptions and Observer Performance

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The medical image perception discipline seeks an improved understanding of the perceptual factors that underlie the creation and interpretation of medical images. The biennial conference of the Medical Image Perception Society (MIPS) brings together radiologists, psychologists, physicists, engineers, and statisticians who have had diverse approaches to the common issue of medical image perception. The MIPS XVII Conference was held July 12–15, 2017, in Houston, Texas, United States. The meeting featured 38 oral presentations covering a wide range of medical image perception topics. Highlights of the conference included a keynote presentation on image perception in ophthalmology by Drs. Helen Li and Boaxin Li and a medical history presentation on "Medical Care of Allied Prisoners of War in WWII Germany" by Dr. Tamara Miner Haygood, in which she highlighted some of the things that may happen when clever POWs deliberately obscure medical truth. Our next meeting, MIPS XVIII, will be held in Utah on July 14–17, 2019. Information is available on the MIPS website: http://mips.ws.

MIPS is strongly committed to fostering the next generation of medical image perception researchers. Since 1995 the Society has sponsored trainees' attendance at the biennial meeting. Thanks to the support of NIBIB/NCI R13EB024389 as well as donations for this purpose made by Society members, the Society once again provided financial support for trainees to attend the meeting. Nine MIPS Scholars representing eight institutions from three countries were selected to participate in the MIPS XVII Conference: Koos van Geel (Maastricht University), Amareswararao Kavuri (University of Houston), Kristina Landino (George Washington University), Lucie Leveque (University of Hull), William Nesbitt (University of Houston), Krista Nicklaus (University of Texas, Austin), Sean Rose (University of Chicago), Lauren Williams (University of Utah), and Hanshu Zhang (Wright State University). All 9 Scholars attended the conference and presented papers. Several of the senior researchers participating in MIPS XVII were themselves former MIPS Scholars, which demonstrates the long-term effectiveness of the Society's commitment to medical image perception education. MIPS XVII provided numerous opportunities for the 2017 Scholars and other trainees to interact with senior researchers in medical image perception.

This special section of the *Journal of Medical Imaging* (JMI) provides peer-reviewed articles on selected medical image perception topics including expertise in medical image interpretation and implications for medical education; sources of error in medical image interpretation; quantification and automation in medical image interpretation; and statistical methods for research studies of medical image interpretation. Half of the papers in the special section are extensions of work presented at MIPS XVII.

Expertise and Education. Kelly et al. used eye-tracking to demonstrate that differences in radiological expertise are not associated with differences in perception of nonmedical images. This research strengthens the evidence that expertise in radiological image interpretation, like other types of expertise that have been extensively studied,[1] does not easily transfer to other domains. Salkowski and Russ explored the similarities and differences in experts and novices in correlating anatomy and medical imaging. They discuss ways in which their observations could be used to improve medical education. Auffermann et al. demonstrated that search pattern training enabled participants to more accurately identify malpositioned catheters. In addition to the obvious implications for improving central line positioning, this research highlights the potential of using knowledge of medical image perception to improve education for all healthcare professionals who rely upon medical images, not limited to physicians.

Sources of Error. Drew et al. investigated the impact of interruption during diagnostic radiology interpretation. While more work is needed on this interesting topic, this study suggests that radiologists develop effective approaches for compensating for interruptions. Alamudun et al. showed that previous perceptual behavior can be a significant predictor of current diagnostic decisions. Further research is needed to elucidate the role of sequential context bias in clinical practice. Haygood et al. observed that radiologists consult many more prior images and medical documents than they cite in their reports. This study calls into question the common assumption that interpretation errors can often be explained by a failure to consult prior records, which is often inferred from the lack of citation of prior records.

Quantification and Automation. Smith et al. present a method for estimating patient-specific detectability indices from patients' CT images. This study lays the groundwork for automated image quality tracking. Samei et al. report a new approach for assessing the quantification of lung nodule volumes on CT. This work contributes an efficient tool for optimizing clinical protocols for an important biomarker, lung nodule volume. Asem et al. introduce an algorithm for segmenting blood vessels on wide-field retinal images. Segmentation of retinal blood vessels is a critical precursor for computer-aided detection and diagnosis of a wide range of diseases that can impact the retinal vasculature.

Statistical Methods. Chen et al. demonstrated that paired split-plot designs may allow for more efficient utilization of resources in some multireader, multicase (MRMC) receiver-operating characteristic studies than the conventional fully crossed design. This paper discusses practical guidance on the choice of MRMC study design relative to study constraints, such as the availability of cases and readers.

We hope you enjoy this JMI special section on medical image perception, and we look forward to seeing you at MIPS XVIII in Salt Lake City in the summer of 2019.

References

1. K. A. Ericsson et al., Eds., *The Cambridge Handbook of Expertise and Expert Performance*, 2nd ed., Cambridge University Press, United Kingdom (2018).