A General Model for Medical Stimuli Synthesis Zhihang Ren¹, Min Zhou², Stella X. Yu¹, David Whitney¹

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Introduction

Medical image perception research is clearly important, but it is difficult for researchers to use authentic medical images as stimuli in a controlled manner. On the one hand, public medical image datasets are relatively uncommon, often incomplete, and the data processing and labeling required for real images can be prohibitively time-consuming. On the other hand, it is hard to find medical images which have the desired experimental attributes (e.g., lesion types, locations, etc.). Therefore, the stimuli that are used for medical perception experiments are often highly artificial. While these stimuli are easily generated and manipulated, they are routinely critiqued for being obviously unrealistic. Thus, generating authentic looking (i.e., metameric) medical stimuli is important for medical image perception research.

Methods

Here, we used the Generative Adversarial Network (GAN) to create perceptually authentic medical images. We used a variety of publicly available medical image datasets for training, including DDSM, DeepLesion, and fastMRI. Our method was capable of manipulating the stimuli to match desired experimental attributes, such as texture and shape. The resulting ROC analysis of a psychophysical experiment from untrained observers and expert radiologists revealed consistent (non-lapsing) but near chance performance, indicating that observers attended to the task but could not reliably distinguish the real radiographs from our generated ones.



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