Realistic Eye Movements Optimize the Predictive Power of Visual Salience Models

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Abstract

When we freely view a natural scene, we make fixations in certain regions of the scene that attract our attention. Models that generate visual salience maps employing basic filtering properties of the early visual system are predictive of where we make fixations [1]; however, the current methods for interpreting the saliency maps may limit the predictive power of these models because they lack realistic eye movements. We propose an additional layer to the salience models in which a biased, correlated random walk (BCRW) interprets and predicts fixation locations during free viewing of natural scenes. The BCRW incorporates realistic eye movements into a salience model to improve the predictive power of the model. Kullback–Leibler divergence and analysis of the area under the receiver operator characteristics curve show the BCRW better predicts fixation location and fixation order than salience alone. Interestingly, the BCRW does not predict fixation locations during free viewing of familiar images. It is possible that the BCRW performs poorly for familiar images because memory for the images modulates fixation locations and biases fixations towards locations with significantly lower salience. Further investigation is required to ascertain how memory interacts with salience which would allow us to create a comprehensive model predicting both the viewing behavior during novel and familiar image.

References

1. Itti L., Koch C., and Niebur E. “A Model of Saliency-based Visual Attention for Rapid Scene Analysis.” *IEE PAMI,* **20**(11), 1254–1259 (1998).