Computation of Saliency Maps using Psychophysical Measurements of Colour Induction

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Abstract:

We built a low-level computational model of early processing with the aim of replicating brightness (Otazu -et al-,2008,VisRes,48,733-751) and colour (Otazu -et al-,2010,JoV,10:12,6) induction effects. The core of our model is a parametric 3-Dimensional weighting function operating on a wavelet decomposition. We call this function the Extended Contrast Sensitivity Function (ECSF), which was calibrated using psychophysically-measured chromatic induction data from an asymmetric color and luminance matching experiment. Since the ECSF integrates the output of divisive normalisation mechanisms at different scales, we integrated it into a new computational saliency model, intended to predict eye fixation data on uncalibrated colour images. Surprisingly, this new ECSF-based saliency model achieved performance (measured in AROC and KL) similar to state-of-the-art computer visión algorithms computed on Judd-et al and Bruce & Tsotsos datasets (Murray-et al-,2011,CVPR,433-440). In this work, we modified the ECSF parameters in order to optimize them with respect to the image datasets for saliency estimation. We used a genetic algorithm to search in the parameter space. Our results show that optimized parameters are virtually identical to those of the psychophysically-measured ECSF parameters. From a methodological point of view we conclude that, by adding psychophysical data that capture evolutionary advantages of the human visual system, one can improve the prediction performance of computational models of low-level visual tasks on large datasets. This conclusion is a counterpart to successful machine learning approaches that became ubiquitous in the computer vision community in the last decade, and an example of the usefulness of biologically inspired constraints.