

Colour Categorization from Colour Opponency

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Abstract:

There is a wide gap between our understanding of the physiology of the visual system and how the brain categorizes the elements that form a visual scene, reducing an extremely complex world to cognitively tractable proportions. In the colour domain, this reduction is large indeed: from nearly 2 million distinguishable colours to the near 30 categories that can be recalled by a normal subject. In this work we try to bridge this gap by presenting a parsimonious model that decodes colour opponent signals (such as those entering the visual cortex from the LGN) and constructs a set of universal chromatic categories consistent with perceptual evidence. To adjust the model we psychophysically measured the boundaries between nine categorical regions, revealing their intrinsic 3D shape in a colour-opponent space. Our psychophysical paradigm was designed to collect most data points where they are most needed: the categorical boundaries. The model itself consists of a set of ellipsoidal volumes generated by adding and weighting chromatically opponent input signals. We believe such an approach may help bridge the gap between what is known about the physiology of the visual system and current pragmatic solutions to the colour categorization problem.