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Color is not an efficient carrier of information in natural images

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The visual system summarizes complex scenes to extract meaningful features (Barlow, 1959; Marr 1976) by using image primitives (edges, bars), encoded physiologically by specific configuration of receptive fields (Hubel & Wiesel, 1962).

We recently proposed a pattern-filtering approach, based on the principle of most efficient information coding under real-world physical limitations (Punzi & Del Viva VSS-2006). The model was a good predictor of an early stage of visual analysis. The model, applied to black and white images, predicts from very general principles the structure of visual filters that closely resemble well-known receptive fields, and identifies salient features, such as edges and lines. A comparison of model performance to that of human observers found that human sensitivity closely follows the model predictions (Del Viva & Punzi VSS-2006).

Here, the model was applied to a set of colored natural images in order to consider the role of color in the initial stages of image processing and edge detection. Again, the model identified salient features in these more complex, realistic images with both color and luminance information. The model predicts, however, that color information is used in a very different way from luminance information. The results showed that equiluminant patterns are far from being efficient coders of information: they are either too common (uniform colored regions) or too rare and therefore are discarded by our approach. The results showed also that luminance information alone gives an efficient, compact summary of visual images.

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