Dear Editors,

We write to submit a manuscript entitled “TITLE” for consideration as an article in the journal of vision.

In this paper, we study color constancy with a supervised learning approach using naturalistic images. Color constancy, the ability to stably perceive the color of an object in the face of variations in its surround, is a significant invariance detection ability of our visual system. Indeed, the light reflected off an object surface depends on many scene factors that are external to the object, but our visual is able to discard these variations and obtain an estimate of the object color in variant of the variations in its surround. While this ability of the visual system has significant behavioral implications, little is known about the mechanism through color constancy can be achieved.

While there is a large body of work that has attempted to understand color constancy, most of this work has been done with simple stimuli. This is because of the lack of databases that are well characterized in their spectral properties and at the same time are comparable to the variations in natural scenes. To address this issue, we developed a software to generate images of naturalistic scenes with the ability to precisely control the various aspects that define a natural scene. This has two advantage, first it gives the ability to generate large scale databases of well labeled naturalistic images, second it provides the ability to systematically vary one or several aspects of a scene, thus providing the ability to study the effect of each aspect individually and in combination. We envision that this software would be useful in study of color constancy, and vision in general.

In this work, we attempt a novel approach to understand the mechanism to achieve color constancy. We generate a large database of labelled images and apply supervised learning on these receptive fields to learn receptive fields that are optimal to estimate the color labels.

We have studied luminance constancy using Accuracy maximization analysis (AMA), which is a biologically RELEVANT supervised learning algorithm that results in receptive fields that are optimal for performing a task. AMA, thus provides insights to the biological mechanism for performing a task. Using this approach, we learnt that the receptive fields that are optimal for luminance constancy have a center surround structure with emphasis on the L and M cones of the retinal mosaic. This is consistent with prior work of luminance constancy and shows the power of the approach developed in this work.

Sincerely,

Vijay Singh

Nicolas P. Cottaris

Benjamin S. Heasly

David H. Brainard

Johannes Burge