Dear Editor,

We are grateful for the review of our manuscript titled “Computational Luminance Constancy from Naturalistic Images”.

We have

In this work, we have taken a supervised learning approach to understand the computation that lead to color constancy. Color constancy, the ability to stably perceive the color of an object under variations in its surround, is a significant invariance detection ability of our visual system. But the mechanism through which we achieve constancy is largely unknown. Here, we have used a biologically-inspired supervised learning method to estimate the luminance of an object. Through this method we identify receptive fields that are optimal for estimating object luminance under naturalistic variations in the color of the object, its surround and the light sources illuminating it. We show that when optimally decode, the estimates of these receptive fields are within 13% of the true value.

This paper makes two significant advances:

First, we have developed a software that can generate multispectral image of naturalistic scenes on a large scale. Supervised learning requires large databases of well labelled images, but such largescale database of naturalistic images, labeled with the spectral properties of the objects and illuminants, are not readily available. Our software toolbox is significant in this regard. The software has the ability to precisely control various factors that define a natural scene. It can be used to generate large scale databases of naturalistic images with information about the geometrical and spectral features of objects in every pixel of the image. It provides the option to systematically vary these factors, thus allowing the study of each factor individually and in combination. We envision that this software would be useful in study of color constancy, and vision in general.

Second, using a biologically inspired learning algorithm on these images, we identified receptive fields that are optimal to estimate the luminance of an object in a naturalistic scene. We show that the optimal receptive fields have a center surround structure with emphasis on the L and M cones of the retinal mosaic. This is consistent with prior work on luminance constancy and shows the power of the approach developed in this work. This biologically inspired approach, along with the software, would be significant in identifying the mechanism of visual tasks.

Color constancy is one of the several invariance detection problems that the visual system solves. An understanding of its mechanism can provide insights to other invariance detection problems. The approach developed in this work and the insights gained from studying luminance constancy will be of interest to others researchers in vision, so we request you to consider publishing this manuscript as an article in Journal of Vision.

Sincerely,

Vijay Singh

Nicolas P. Cottaris

Benjamin S. Heasly

David H. Brainard

Johannes Burge