

[LBA]Late-breaking Abstracts

Wed. Jul 29, 2020 1:30 PM - 3:30 PM Poster Session

Videos are available throughout the meeting period.*[LBA-023]Emergence of color constancy in an autoencoder with biologically plausible inhibitory interneurons*****Takuto Yamamoto¹, Shigeru Kitazawa^{1,2}** (1.Faculty of Medicine, Osaka Univ, Osaka, Japan, 2.Grad Schof Frontier Biosci, Osaka Univ, Osaka, Japan)

Perceived colors of objects remain constant under a variety of illuminations. This ability of color constancy has been modeled by using deep convolutional networks that were extensively trained to estimate reflectance of objects. However, it is not likely that our brain acquires color constancy through such rigorous procedures. We here show that color constancy emerges in a simple deep convolutional autoencoder when it involves batch normalization layers. We found that batch normalization is a simple but effective method to cancel any global bias in illumination and achieve color constancy. However, it may still be argued that batch normalization layers are not physiological by itself. We thus proposed a biologically plausible replacement for batch normalization that consists of two tandem inhibitory layers, one with subtractive and another with divisional inhibitory neurons. The model is biologically plausible because there are two groups of inhibitory interneurons in the cerebral cortex, one that performs subtractive inhibition (e.g., somatostatin-expressing interneurons) and another that performs divisional inhibition (e.g., parvalbumin-expressing interneurons). Further, both types of inhibition can be achieved by adjusting parameters of an extended Hodgkin-Huxley neuron. By using the network with biologically plausible Hodgkin-Huxley neurons, we were able to achieve color constancy. We suggest that color constancy emerges as a simple consequence of normalization achieved by the two groups of inhibitory interneurons.