Investigation of Lightness Illusions in Artificial Neural Networks
Supplemental Material

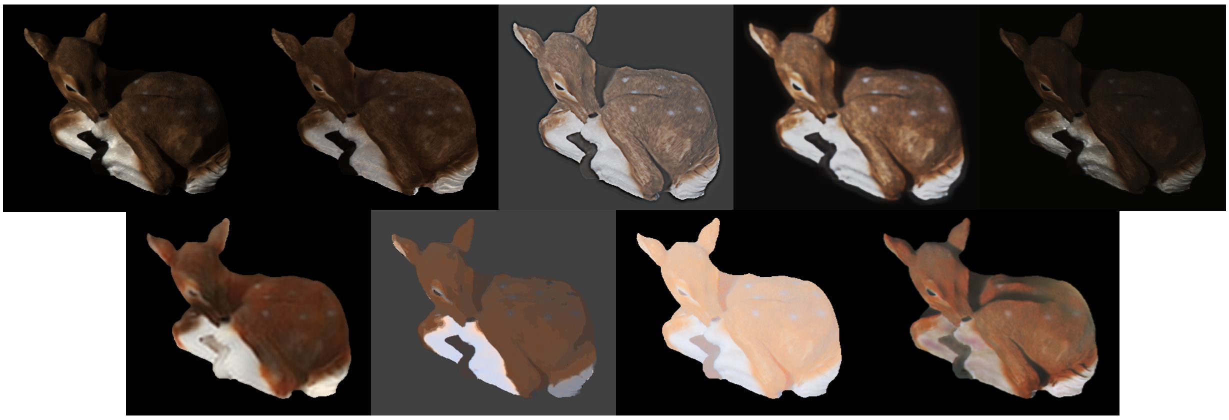

Figure 1: Overview of the investigated artificial neural networks. The images show the estimated albedo values for the task of image decomposition. Top l.t.r: Input image, ground truth information, Corney[1], [1] trained with the MIT dataset[2], our CNN trained on the same images as [1]. Bottom l.t.r: Narihira[3], Zhou[6], Nestemeyer[4], Shi[5]. Note that these results may be further refined in post-processing steps, which we do not include as we only focus on the ANNs output.

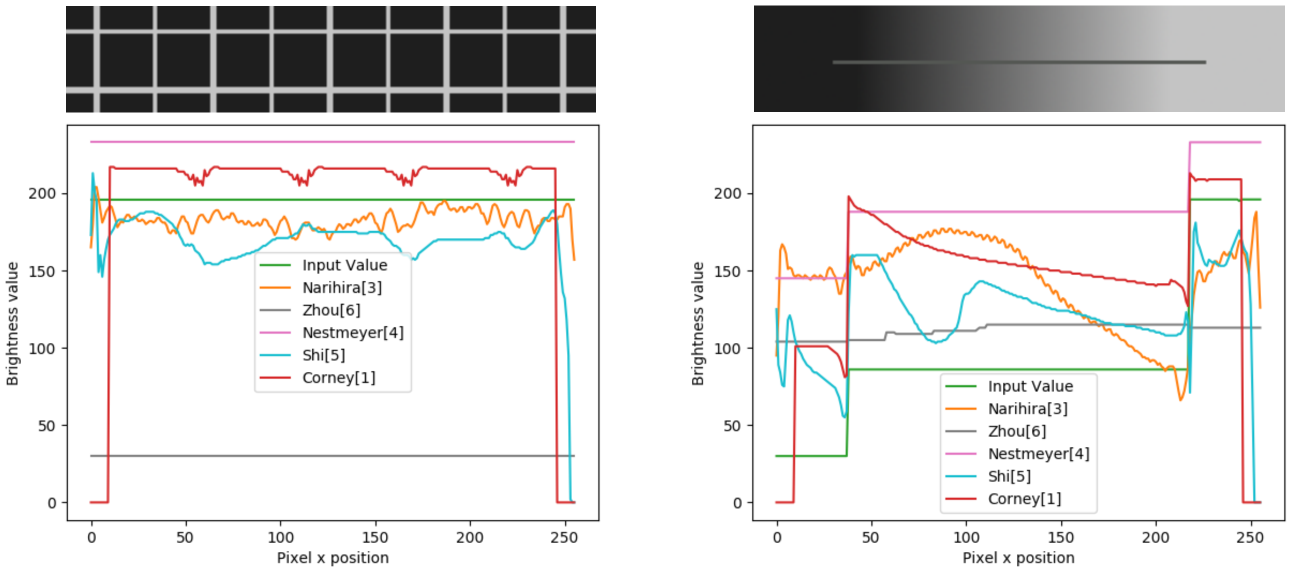

Figure 2: Left: Plot of the brightness values for the Herman grid illusion aligned on one of the in between lines. While the lines of the grid have constant intensity values, humans usually perceive darker spots at the intersections of the lines. The ANN of Corney[1] also shows this behavior, as the estimated brightness values drop at these positions. However, the other tested CNNs do not show this effect. [4] and [6] were trained on the same dataset and both estimate a constant intensity value.
Right: Plot of the brightness values for the Mach band illusion with a small line of constant intensity in the center region. Human observers usually see a gradient on this line that has the opposite direction of the background. Again, the artificial neural network of Corney[1] shows a similar behavior to humans, while [4] and [6] do not react to the illusion. In contrast, [3] and [5] perceive a gradient on the line that does not fully align to that of a human observer.

[1] Corney, David, and R. Beau Lotto. "What are lightness illusions and why do we see them?." PLoS computational biology 3.9 (2007): e180.
[2] Grosse, Roger, et al. "Ground truth dataset and baseline evaluations for intrinsic image algorithms." Computer Vision, 2009 IEEE 12th International Conference on. IEEE, 2009.
[3] Narihira, Takuya, Michael Maire, and Stella X. Yu. "Direct intrinsics: Learning albedo-shading decomposition by convolutional regression." Proceedings of the IEEE International Conference on Computer Vision. 2015.
[4] Nestmeyer, Thomas, and Peter V. Gehler. "Reflectance Adaptive Filtering Improves Intrinsic Image Estimation." arXiv preprint arXiv:1612.05062 (2016).
[5] Shi, Jian, et al. "Learning non-lambertian object intrinsics across shapenet categories." 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR). IEEE, 2017.
[6] Zhou, Tinghui, Philipp Krahenbuhl, and Alexei A. Efros. "Learning data-driven reflectance priors for intrinsic image decomposition." Proceedings of the IEEE International Conference on Computer Vision. 2015.