Symmetry in the Eye of the Beholder

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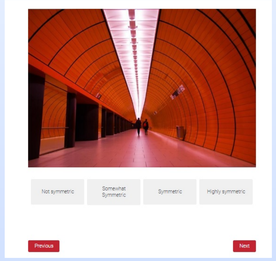
Introduction

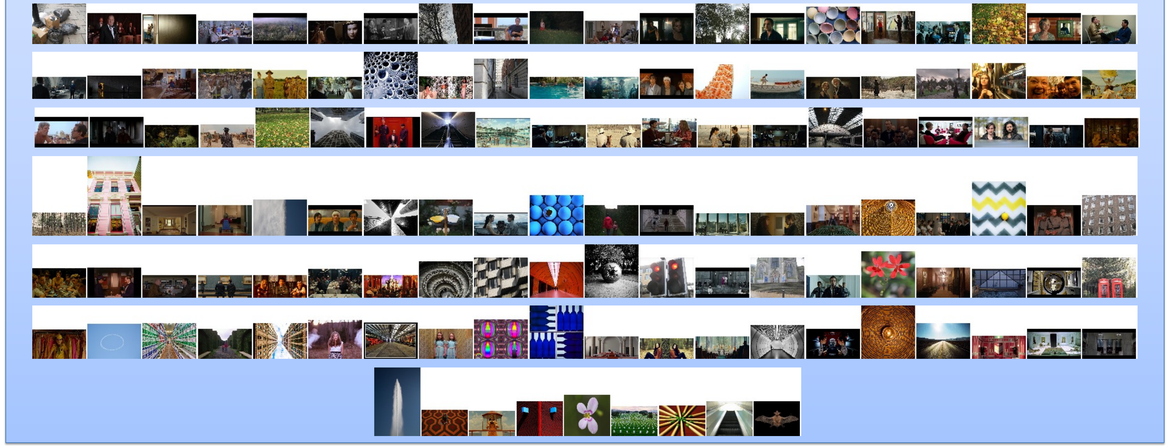
- We model the subjective perception of symmetry using features at different levels of neural nets.
- We collect a subjective performance dataset of bilateral symmetry.
- We predict one of the four symmetry judgments based on multi-level symmetry scores.

Subjective Test

- 149 images from photographs and frames.
- 50 random selections evaluated per session.
- 200 participants.
- Observers asked to rate symmetry in 4 options:
  - Not symmetric
  - Somewhat symmetric
  - Symmetric
  - Highly symmetric

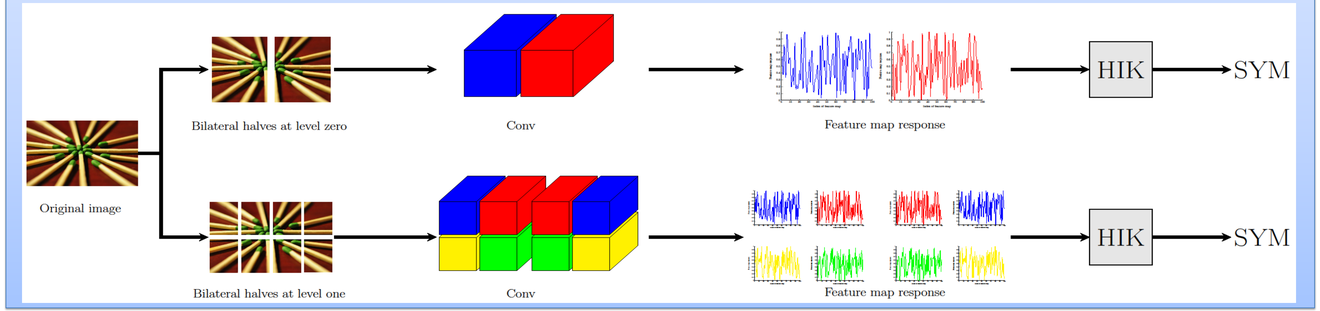


- All 149 images evaluated by human subjects, sorted from the least (top left) to the most (bottom right) symmetric based on overall subjective scores.



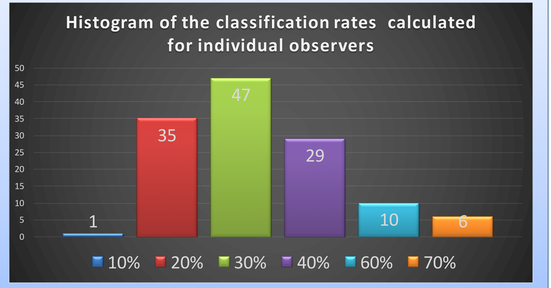
Proposed Approach

- In our calculations we use a similar approach to [1] which was introduced to calculate the similarity between two images for an image quality metric to calculate the bilateral symmetry of a given image.
- In the proposed approach, using a pre-trained AlexNet model [2] on the ImageNet dataset [3], we extract feature maps of the two vertical halves of the image at multiple layers.
- The similarity of the feature maps are then compared at each layer.
- Such similarity scores are then pooled across layers to obtain an overall symmetry scores.



Experimental Results

- Our symmetry classifier has a very low (less than 20%) accuracy for predicting all observers' responses equally well on individual images.
- Classification accuracies increase dramatically when each observer is modeled separately suggestion that **symmetry is in fact in the eye of the beholder**:
- While some observers focus on high-level object semantics, others prefer low or mid level features in their symmetry assessment.



References

[1]Amirshahi, Seyed Ali, Marius Pedersen, and Stella X. Yu. "Image Quality Assessment by Comparing CNN Features between Images." *Journal of Imaging Science and Technology* 60, no. 6 (2016): 60410-1.

[2] Krizhevsky, A., Sutskever, I., & Hinton, G. E. (2012). Imagenet classification with deep convolutional neural networks. In *Advances in neural information processing systems* (pp. 1097-1105).

[3] Deng, J., Dong, W., Socher, R., Li, L. J., Li, K., & Fei-Fei, L. (2009, June). Imagenet: A large-scale hierarchical image database. In *Computer Vision and Pattern Recognition, 2009. CVPR 2009. IEEE Conference on* (pp. 248-255). IEEE.