Classifying Paintings with a Convolutional Neural Net

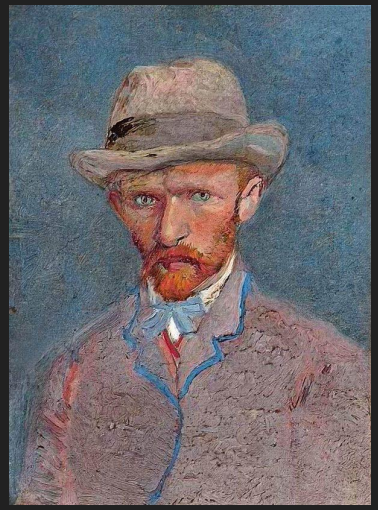
Isaiah King

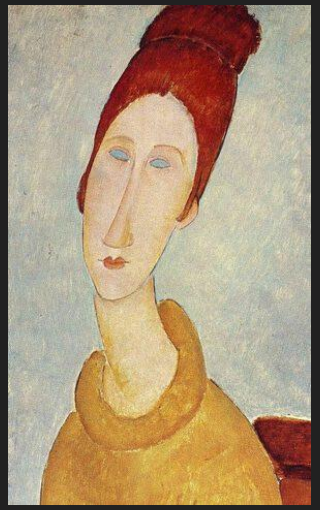
Picasso, P. (1937). Painting of a Lover in a Beret [Painting]. Estate of Pablo Picasso.

El Greco. (C. 1600). Portrait of a Man [Painting]. Metropolitan Museum of Art, New York.

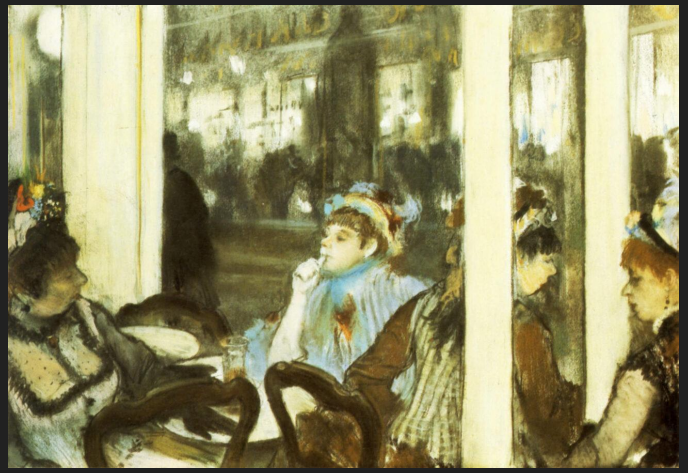
Problem Description

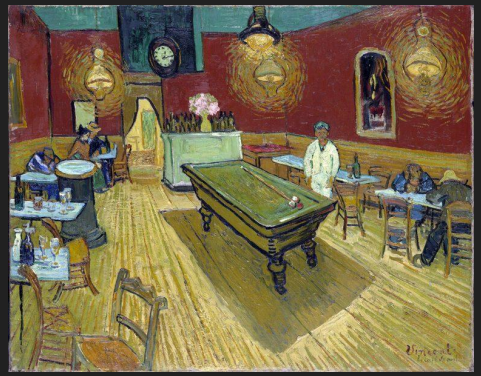
The Best Artworks of All Time Dataset



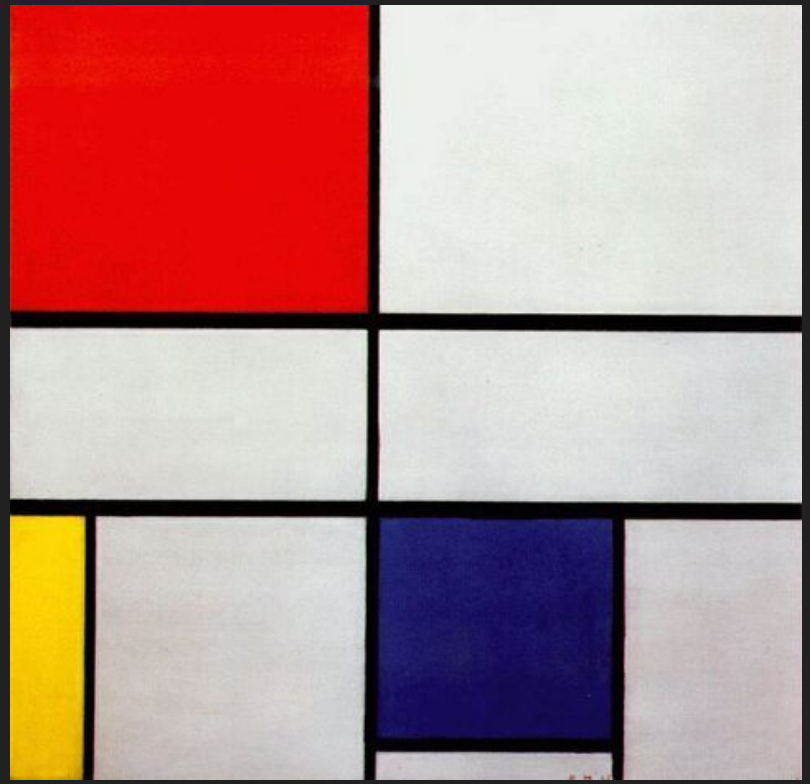


Issue: What is an art genre?





Neoplasticism (150 samples)



Composition C., Piet Mondrian

Renaissance (150 samples)

Sistine Chapel, Michelangelo

Methods

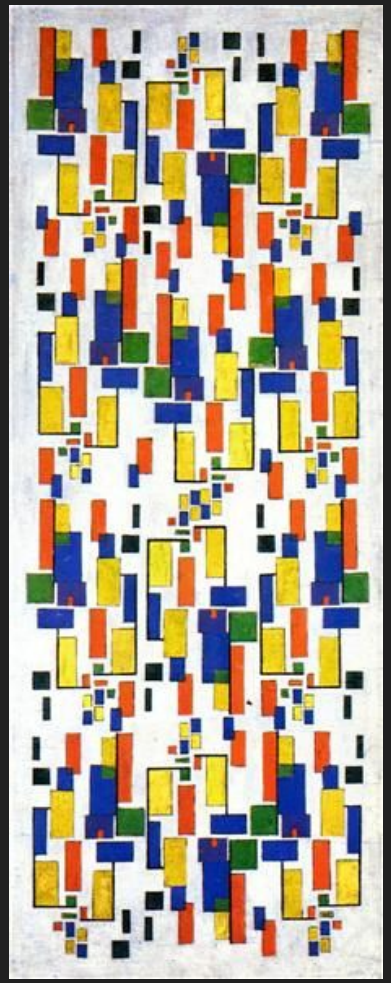
Data Preparation

- Noisy
- Poorly organized
- Not enough samples
- Subjective labels
- Imbalance

Mondrian also painted very realistic portraits sometimes

Colour Design for a Chimney
by Theo van Doesburg,
an neoplasticist artist not
included in the *Best Artworks of All Time* dataset.

Retrieved from WikiArt



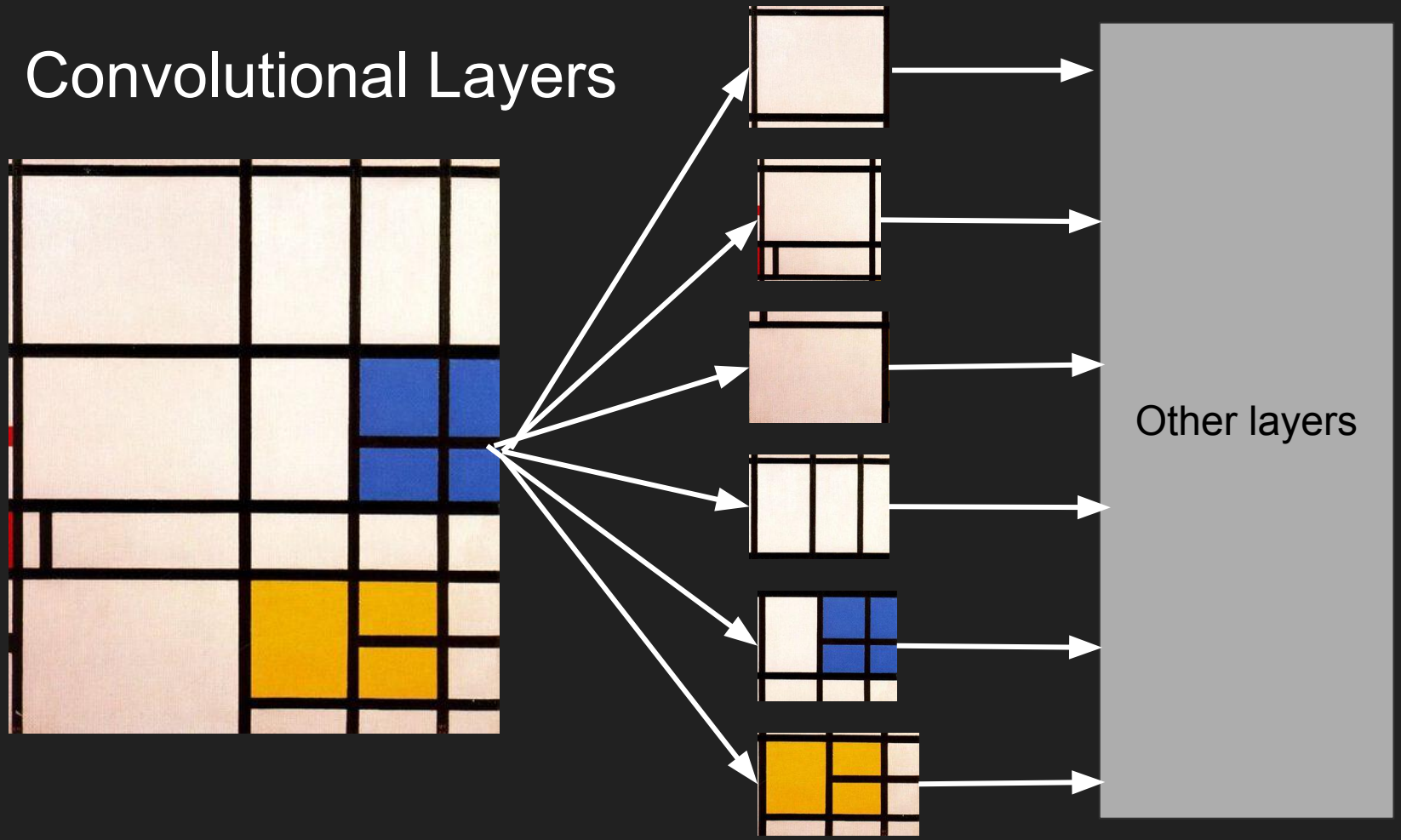
Pre-processing: Data Augmentation

“weight decay and dropout may not be necessary for object recognition if enough data augmentation is introduced.” -- Hernández-García and König, 2018

Specific augmentations:

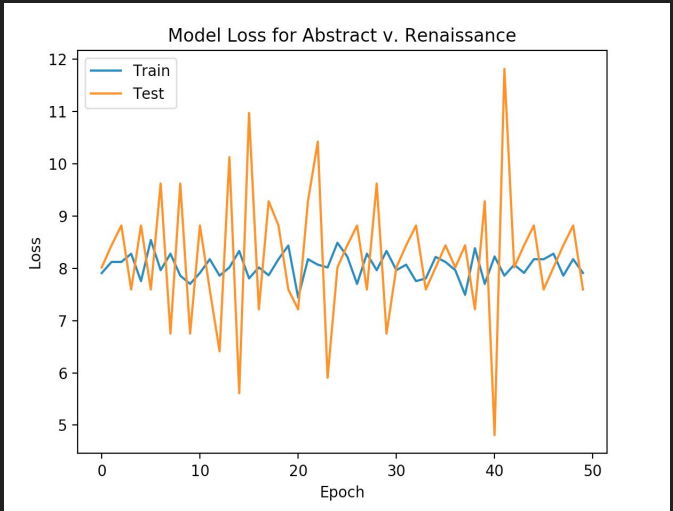
- H, V flip
- Up to 180* rotation
- Hue Shift
- Zoom up to 20%

Convolutional Layers

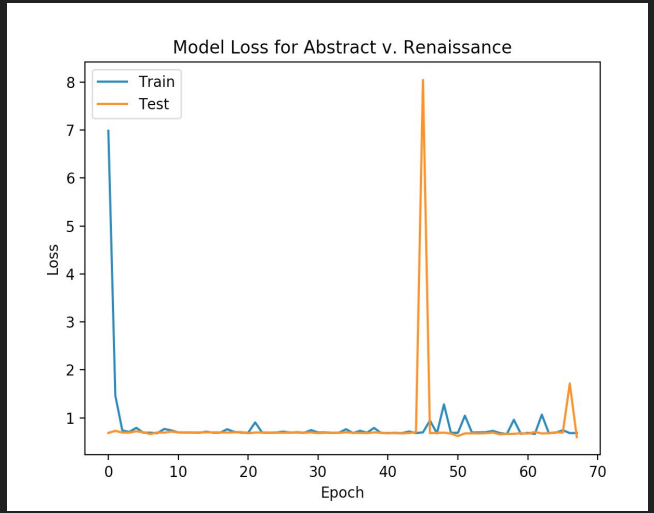


Optimiser selection

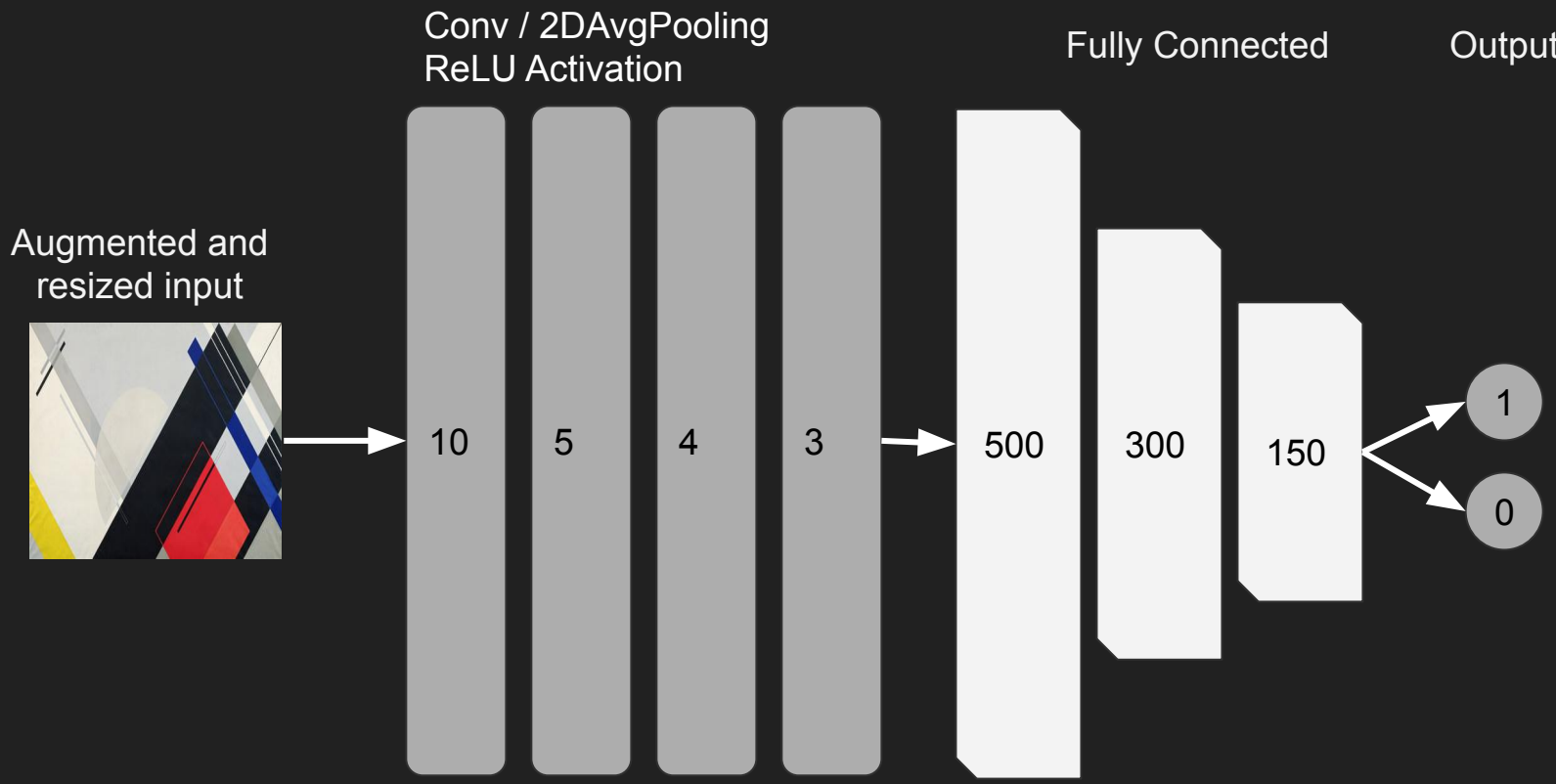
- Default is SGD
  - Resulted in very little improvement,
  - Or too much “swinging”



- AdaDelta
  - Optimised for small datasets
  - Dynamically changes learning rate as it goes



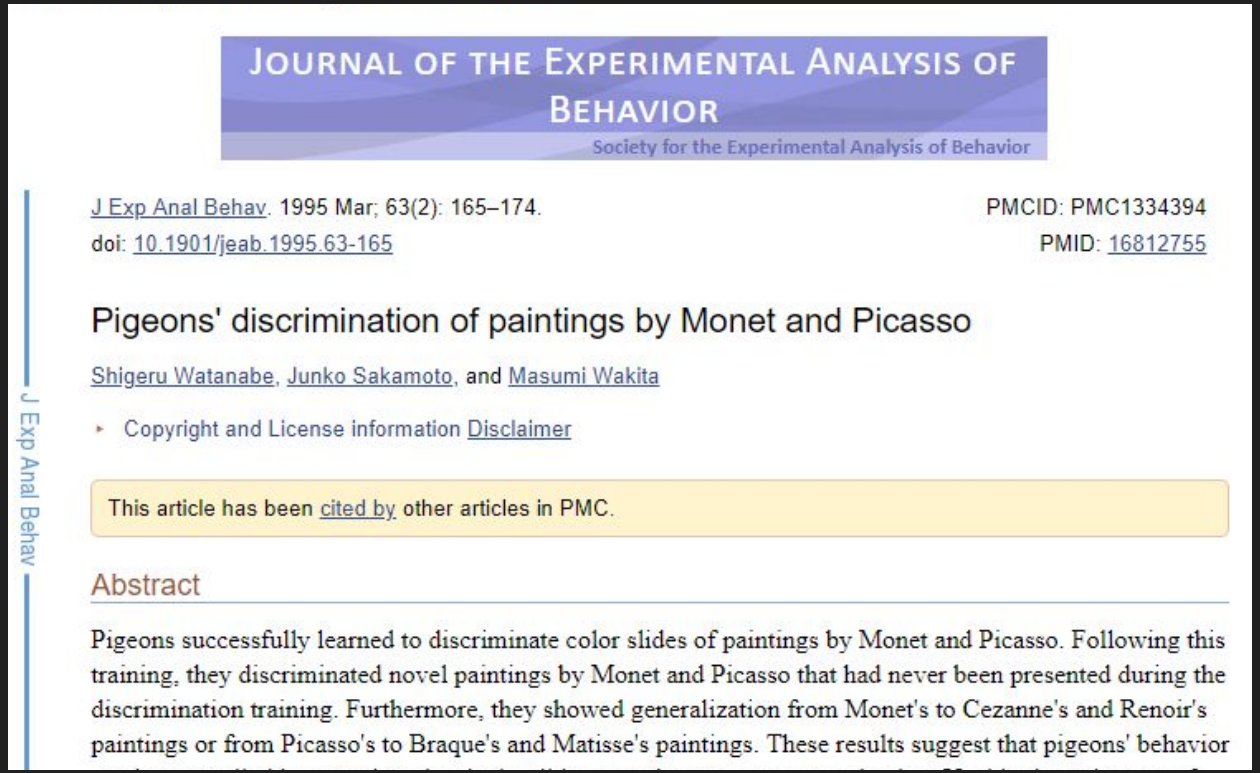
Full Architecture



Results

Accuracy: 82%

A Quick Aside:



JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR
Society for the Experimental Analysis of Behavior

J Exp Anal Behav. 1995 Mar; 63(2): 165–174.
doi: 10.1901/jeab.1995.63-165

PMCID: PMC1334394
PMID: 16812755

Pigeons' discrimination of paintings by Monet and Picasso

Shigeru Watanabe, Junko Sakamoto, and Masumi Wakita

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Abstract

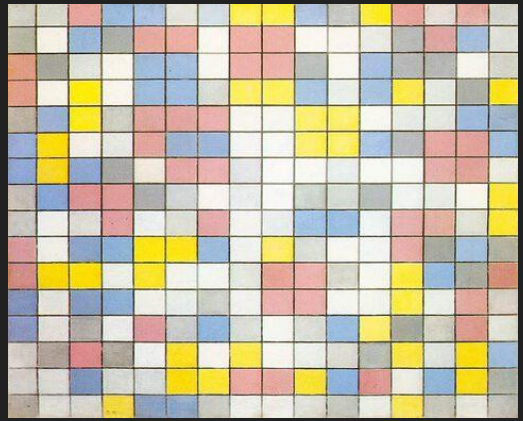
Pigeons successfully learned to discriminate color slides of paintings by Monet and Picasso. Following this training, they discriminated novel paintings by Monet and Picasso that had never been presented during the discrimination training. Furthermore, they showed generalization from Monet's to Cezanne's and Renoir's paintings or from Picasso's to Braque's and Matisse's paintings. These results suggest that pigeons' behavior

J Exp Anal Behav

Anyone remember the “Monkey Classifier” from the midterm?

Places I Could Improve

- Size of dataset(s)
  - Need probably 1,000 of each class (Brownlee, 2018)
- Problem Complexity
  - The human brain is amazing

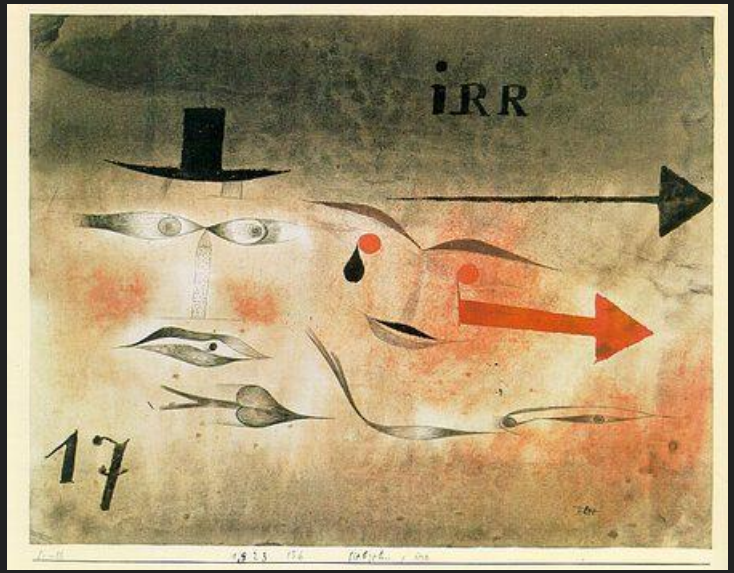


Future Improvements

- Collect more data
- Transfer learning
- Apply better preprocessing

Interesting Results

It works better than random for Abstract v. Realistic art in general (58%)



Paul Klee

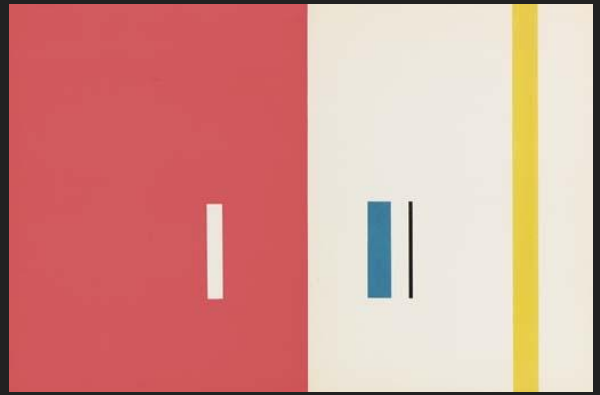
Rembrandt

Conclusion

What Did I Mine?

ANNs are a black box, but my best guesses are:

- Specific colors within the images that were not overshadowed by hue shifting
- The variance in the image
- The self-similarity of the image



What Lessons Did I Learn?

- How to build an ANN
- How conv. layers work
- The benefits and drawbacks of data augmentation
- Don’t underestimate the difficulty of “easy” problems for humans (and pigeons)

I also learned Van Gogh is bad at drawing babies

Works cited

All images of paintings used are public domain and, unless otherwise specified, from the *Best Artworks of All Time* dataset by Kaggle user Ikarus777

A. Hernandez-Garcıa and P. Konig, “Do deep nets really need weight decay and dropout?” CoRR, vol. 1802.07042, 2018. [Online]. Available: http://arxiv.org/abs/1802.070423.

Watanabe S, Sakamoto J, Wakita M. Pigeons' discrimination of paintings by Monet and Picasso. J Exp Anal Behav. 1995;63(2):165–174. doi:10.1901/jeab.1995.63-165

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