"Persistence"

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DESCRIPTION

Concept: There are two main motivating factors to the conceptualization of our product:
i) We wanted to present a conflict between human and the machine in a manner that was both aesthetically appealing but equally chaotic. With this we hope to underline the problems of having AI emulate the human condition, such as the emphasis of certain underlying biases and the failure of current systems in capturing the persistent yet evasive qualities of human nature.

ii) We also wanted to emphasize how the quantity of data used to train modern AI systems can obfuscate and distort perception. In this manner we chose to use masking over our principle image to hide parts of the process of style transfer and draw attention to the idea that AI is still an obscure and misunderstood process.

We chose Dalí as the subject and source of inspiration for our work as for us, his efforts to displace and challenge human understanding of art and reality, nicely align with the current challenges of machine learning. That is to say, machine learning presents somewhat of a black art, both intriguing

and frightening. It is underpinned by a conflict that encourages us to explore the possibilities it presents, whilst struggling to keep it at a distance such that humanity is retained and persists.

Technique: We used the method outlined in Gatys et. al.[1] to perform the style transfer. As Gatys et. al. discussed, we can quantify the content and style of images by first encoding them using a convolutional neural network—i.e., VGG-19. We then use the output of the high-level layers of this network as quantitative proxies for the content of the image, because the high-level layers are generally more correlated with content. We also use the output of the mid- and low-level layers of the network as proxies for the style of the image, because the mid- and low-level layers are generally more correlated with textures, colors, and style. We apply this methodology to abstract the content output from one image and the style output of another image, and then we combine these outputs into a new objective function. This new objective function measures an image's deviation from the content of one image and the style of another. Finally, we use gradient descent to progressively change an image of noise into an image that maximizes the objective function.

We then used a digital sketch pad to create a black-and-white outline of the Dalí photograph, and we recorded this sketching process (snapshot of the recording on the right). We then sampled frames from this video and binarized the pixel values to create an array of 0s and 1s to use as a bitmap to combine our photo and our style transferred result bitwise. We were able to recombine the masked frames to create a video with a mask which changed over time.


Process: Here is an abridged discussion of the ideas and methods we tried. Links to progress outputs are given, which are not included here due to the 3 page limit.

Bias. After the panel discussion, we wanted to focus on the ideas of bias and skewed representation in data. This led us to the idea of masking two representations of one image, and further a changing mask over time through a video to show the difference between an objective image (photo) and a subjective image (a stylized version of that photo, here style-transferred). We initially experimented with a number of styles we felt were underrepresented (ex. graffiti) and photographs by artists from underrepresented communities, and considered masking multiple style transfers to represent the parable of the elephant and the blind men, discussing the pitfalls of drawing conclusions from incomplete data. We ultimately decided to use photos and portraits of artists. Dalí was our most successful, intermediate output with other styles and content images can be found here.

MRF. Some of our initial trials showed texture and pattern transfer but the output did not have semantic coherence with the original content. Li and Wand[2] have shown that a Markov random field (MRF) objective can augment the style and content objectives in order to increase local coherence

during style transfer. We had success on certain image pairs (their samples) but the results were not as compelling with often darkly-colored photographs and portraits. One example of Van Gogh resulted closer to colorization, shown below.
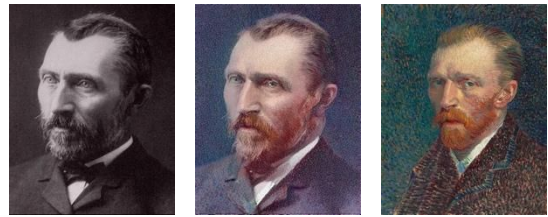
Masking motivation. The initial motivation for masking was to show multiple representations alongside each other; e.g Van Gogh made 36 different self-portraits. We ultimately decided to use two representations, a photo and a portrait, as shown above for Dalí. Other masking outputs and combinations can be found here.

Reflection: We are satisfied with our final results, as they balance aesthetics, artistic meaningfulness, and execution time. Given more time we would have liked to have further experimented with MRF style transfer. We also would like to experiment more with moving images. In future projects we would look to experiment further with more creative masking techniques including AI generated masks.

References:
1. Gatys, L.A., Ecker, A.S., Bethge, M., A. "A Neural Algorithm of Artistic Style", arxiv 2015. https://arxiv.org/pdf/1508.06576.pdf
2. Li, C., Wand, M. "Combining Markov Random Fields and Convolutional Neural Networks for Image Synthesis", arxiv 2016. https://arxiv.org/pdf/1601.04589.pdf
3. Jacq, A. "Neural Transfer Using PyTorch." https://pytorch.org/tutorials/advanced/neural_style_tutorial.html. Accessed 2/18/19.

CODE: https://github.com/nvog/ArtMLProject1

RESULT: https://github.com/nvog/ArtMLProject1/output/final_video.mp4

CONTRIBUTIONS:
Liz Salesky
- Ran style transfer used for final submission.
- Wrote and ran code to conduct masking and generate videos.

Craig Stewart
- Conceptualized initial ideas around biases and masking.
- Refactored code for initial prototyping.
- Digitally sketched masks for Van Gogh and Salvador Dalí.

Lawrence Suh
- Sketched intermediate masks.

Kevin Tran
- Conceptualized ideas about elephant parable, Van Gogh, and other unfinished ideas.
- Wrote first draft of report.

Nikolai Vogler
- Conceptualized idea about style transfer between self-portrait paintings and photos of the artists to understand the stylistic disparities between the artist's self-representation
- Found, experimented, and evaluated MRF as a means of style transferring.