Machine Drawing Simulation: RNN

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https://vimeo.com/328992912
Repository: https://github.com/CandyDong/ArtML_Project3

Concept

In this project, we simulated a digital drawing machine that is able to synthesize an artist's art style and generate abstract paintings with learned semantic context from Paul Gauguin's artworks and re-created with digital brushstrokes. We think it is extremely important to explore the capacity of machine creativity, by exposing it to an artists style and then letting it derive its own style based off its own interpretation. It allows for a new style to be created while also paying homage to the artist who influenced the style, in this case, Gauguin, this is very much how human make art, they get influenced by other artists and then derive their own styles. With most human artists though it is sometimes not as easy to pinpoint who the influencers are in a painting unless the background of the artist is known or a well trained art-critic can define the similarities in brush stroke, color and texture.

Technique

We collected a dataset of 300 artworks of Paul Gauguin, and trained it with DRAW (a recurrent neural network for image generation) for about 400 epochs. We then used RNN to draw out a new image with the artist's style, in this case, Gauguin. Since RNN progresses over time it let us see the whole process of artwork being created from scratch. After the training process, we produced a temporal sequence of the drawings from RNN. We picked one of the blurred mixtures generated by the dataset we did training on and then picked one that had the right context for recreation.

Process
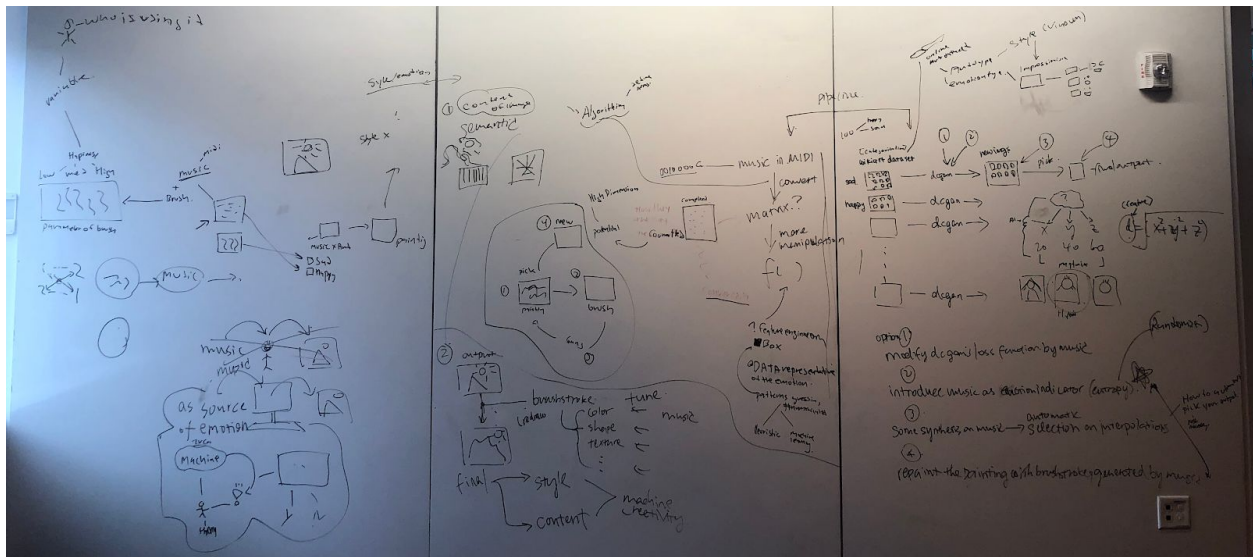
Above you see a diagram we created in the span of three intensive hours, to detail out final project and the preliminary research to do in project three. We were mapping our process in deciding what the final project would be like. We went over the high level and low level details of our project, and then decided we would focus on machine creativity based on style and content. (Below is the connection between project 3 and the final repot)
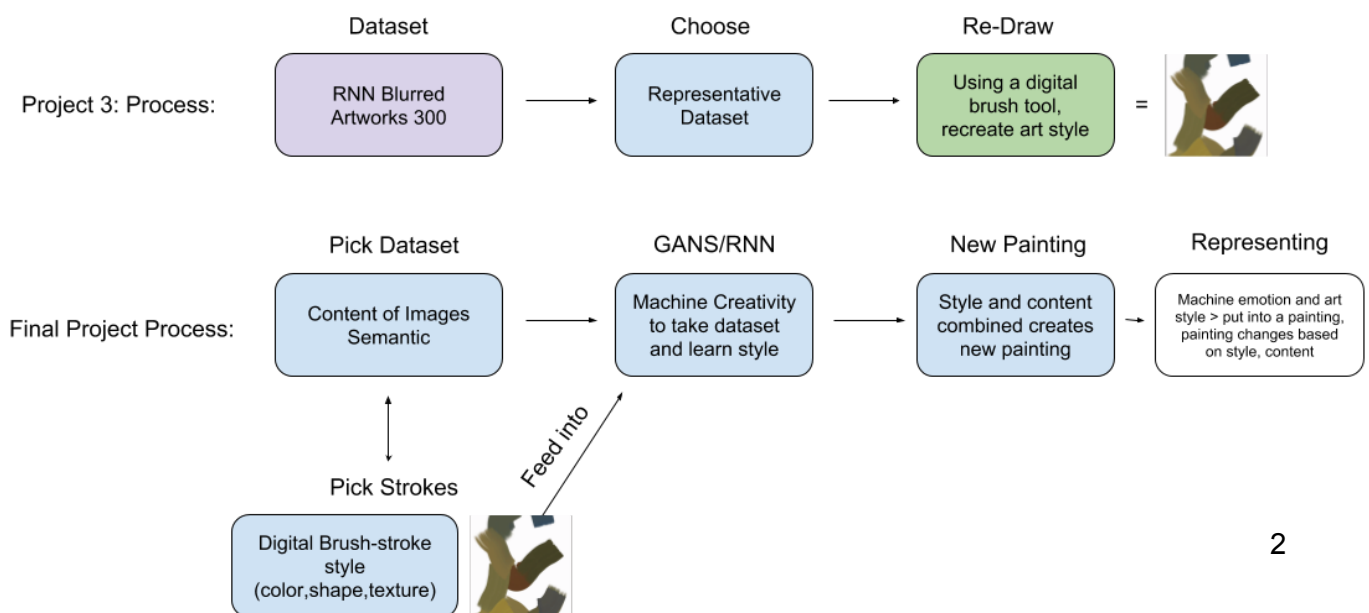
Our Results
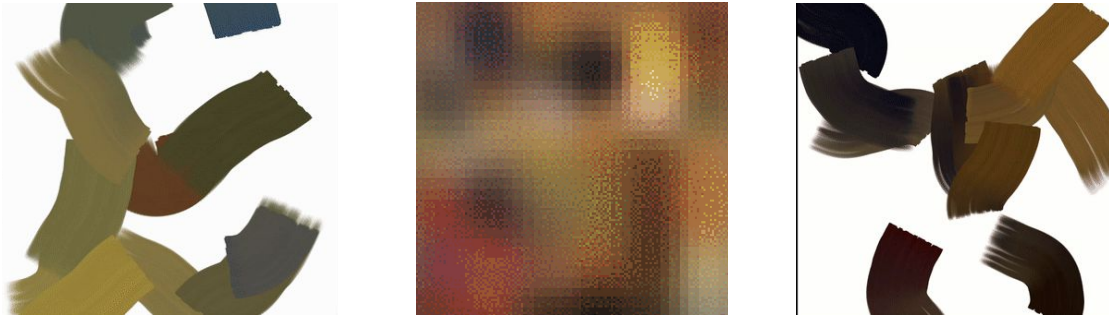
Our final result was turned into a gif. For the 21 seconds it plays, it shows the Gauguin's brushstroke style reinterpreted by the RNN network and then mapped onto a canvas by a computer. Even though the style that the machine has re-interpreted is based off of a specific artist, so it is not yet its "own" style, it shows that the machine has some independence in defining where to populate the brush stroke on the canvas and what direction it is applied. We will look to integrate the concept of an "emotive brush stroke," and try to classify styles based on emotion, and then have the machine generate its own style and from that derive its own "somewhat artificially created" emotional state, that is the ultimate goal.

Reflection

We realized that the dataset was not as ideal as we wanted it to be, and we were not as satisfied with some of the results it generated. It was interesting though through these results we realized that RNN is good at analyzing color instead of lines and edges and that is why the output is blurred to some extent. Due to this we decided to move to a dataset with more abstract colors, and where there were not too many lines or edges that could be interpreted. We decided to use Paul Gauguin's dataset, because his paintings represented a style we appreciated and it had the characteristics we needed to create the desired result.

We used project three's results to test what techniques and methods we could potentially employ for the final project. We were able to figure out how to have a machine generate brushstrokes based on a specific artist's dataset and style, and now we have to figure out how to build our own style. We want to able to show not only the significance of an artist's creativity but how a machine can help enhance and improve the appreciation of artwork in general. Although there are lots of applications for music visualization and machine creating artworks, we found that there are very few people focusing on the emotional contents presented in an artwork or a music piece, which is indeed the most important message conveyed from artworks.

Individual Contributions

- **Vera** - Documentation, Video - Giphy transformation (editing, smoothing, etc), technical diagramming flow.
- **Qingyi** - Ideation, dataset preprocessing, DRAW algorithm refactoring
- **Zhuona** - Ideation, dataset collection, painting re-creation with digital brush strokes, video production.

References

[1] DRAW: A Recurrent Neural Network For Image Generation
https://arxiv.org/pdf/1502.04623.pdf

[2] (White, Tom, University of Wellington School of Design, Title: Perception Engines)
https://medium.com/artists-and-machine-intelligence/perception-engines-8a46bc598d57

[3] (Elgammal, Ahmed; Liu, Bingchen, Art & AI Laboratory - Rutgers University, Title: CAN: Creative Adversarial Networks Generating "Art" by Learning About Styles and Deviating from Style Norms)
https://arxiv.org/pdf/1706.07068.pdf

[4] (Sundararajan, Louise, Journal of Creative Behavior, Title: Mind, Machine, and Creativity: An Artist's Perspective)
https://pdfs.semanticscholar.org/4301/ce4e95a902e96838b831eee70d2c9b81f9a7.pdf

[5] (Campos-Bueno, J. J., Spanish Journal of Psychology (2015) Title: Emotional Dimensions of Music and Painting and their Interaction)
https://pdfs.semanticscholar.org/b0a2/dca488cbcb3a0d2a4ce5b24d62538e63fd43.pdf