

## Introduction

Impressionism and expressionism are both art styles created during the XIX and the XX century, respectively. Impressionism tries to recreate real figures while focusing on accurate illumination and using small and detailed brush strokes. On the other hand, expressionism art pieces are characterized by being the representation of the artist's subjective perspective, focusing on emotions and arbitrary and powerful colours. They both seem to be contrary art styles, and it's mostly because expressionism was created as a reaction against impressionism. For this reason, it was interesting to see how computer vision tools like Convolutional Neural Networks with interpretation techniques and Generative Adversarial Networks would react to the process of being trained using samples from those art styles.

## Dataset and Method

The dataset used was the Painter by Numbers dataset, from Kaggle. It contains images of multiple paintings and information regarding the author, date, filename, etc. Only the images from impressionism and expressionism were used.

Tensorflow was used to create the models.

The first section of the project is about interpretation of a classification model that predicts if an image belongs to expressionism or impressionism. The techniques used are Class Activation Map (CAM) and grad-CAM on the last convolutional layer of the model.

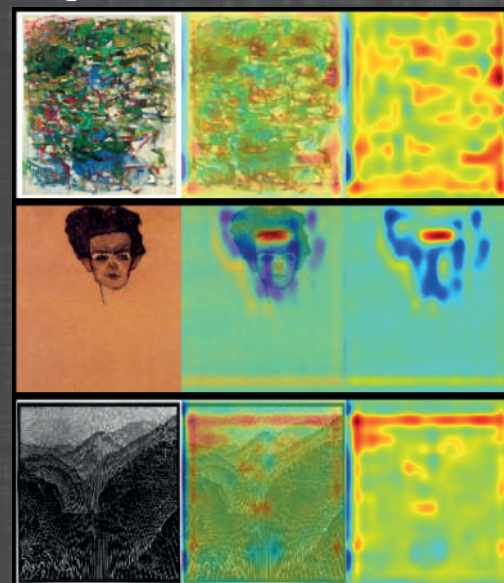
The second part is about generating new images using Generative Adversarial Networks. A Deep Convolutional GAN and a Wasserstein GAN with gradient penalty were implemented for this.

The images created during the interpretation and generation are helpful to analyze the behaviour of each model and see what features are significant in each art style.

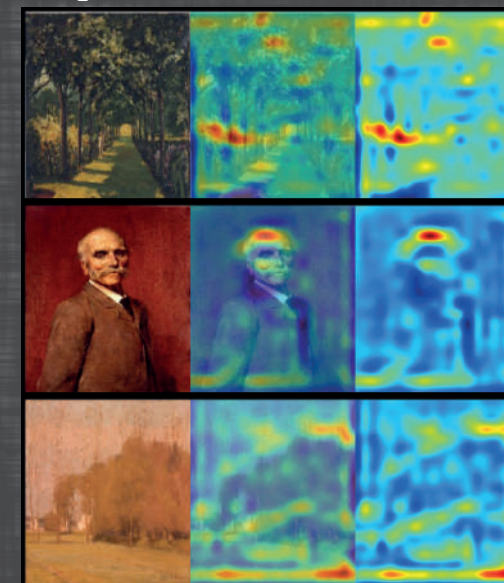
## Interpretation

Class Activation Maps:

Expressionism:



Impressionism:

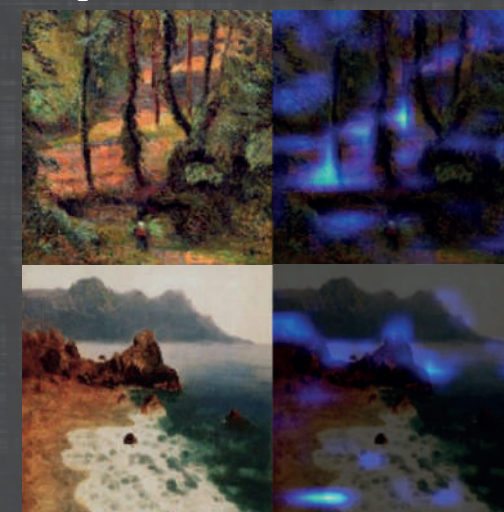


Grad-CAMs:

Expressionism:



Impressionism:



## Generation

Final model, implementing a Wasserstein GAN with gradient penalty:

Impressionism:



Expressionism:



## References:

1. Kaggle. (2016). Painter by Numbers. Retrieved from: <https://www.kaggle.com/c/painter-by-numbers/overview>.
2. Selvaraju, R., Cogswell, M., Das, A., Vedantam, R., Parikh, D., & Batra, D. (2019). Grad-CAM: Visual Explanations from Deep Networks via Gradient-based Localization. Retrieved from: <https://arxiv.org/pdf/1610.02391.pdf>.
3. Radford, A., Metz, L., & Chintala, S. (2016). Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks. Retrieved from: <https://arxiv.org/pdf/1511.06434.pdf>.
4. Gulrajani, I., Ahmed, F., Arjovsky, M., Dumoulin, V. & Courville, A. (2017). Improved Training of Wasserstein GANs. Retrieved from: <https://arxiv.org/pdf/1704.00028.pdf>