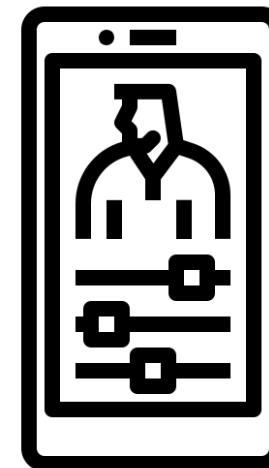


Neural Style Transfer of Paintings to Portraits and Selfies

*CS 464 – Final Presentation
Group 7*

MOTIVATION

- Selfie editing applications are quite popular.
- Latest applications utilize AI-based technologies.



PARTICULAR FOCUS

- NST of classical paintings to portraits and selfies



NEURAL STYLE TRANSFER

- Blending the style and content of two images



Figure 1: Content Image
(Hayley Williams)



Figure 2: Style Image
(Angle of Love)

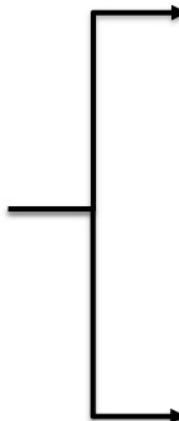


Figure 3: Target Image
with 1500 iterations



Figure 4: Target Image
with 2200 iterations

BACKGROUND RESEARCH

- The optimizer optimizes the weighted sum of style and content losses.

$$L_{total} (i,j,k) = \alpha L_{content} (i,k) + \beta L_{style} (j,k)$$

The diagram illustrates the components of the total loss function. It starts with the equation $L_{total} (i,j,k) = \alpha L_{content} (i,k) + \beta L_{style} (j,k)$. Two arrows point from the terms $\alpha L_{content} (i,k)$ and $\beta L_{style} (j,k)$ to the labels "Content Weight" and "Style Weight" respectively. From each of these two labels, a blue arrow points to the word "Hyperparameters".

BACKGROUND RESEARCH

- The content loss function is defined as the squared difference of the content and target images.

$$L_{content} = \sum_l \sum_{i,j} (\alpha C_{i,j}^l - \alpha P_{i,j}^l)^2$$

Content Loss

Content Weight

CONTENT IMAGE TARGET IMAGE

The diagram illustrates the components of the content loss function. The formula is $L_{content} = \sum_l \sum_{i,j} (\alpha C_{i,j}^l - \alpha P_{i,j}^l)^2$. A bracket above the first summation symbol is labeled "Content Loss". Another bracket above the term $\alpha C_{i,j}^l$ is labeled "Content Weight". Below the summation symbols, blue arrows point upwards from the labels "CONTENT IMAGE" and "TARGET IMAGE" to the indices i and j respectively.

BACKGROUND RESEARCH

- The style loss function is the squared difference between the gram matrices of the style and target images.
- Gram matrices are computed multiplying style and target tensors by their transposes.

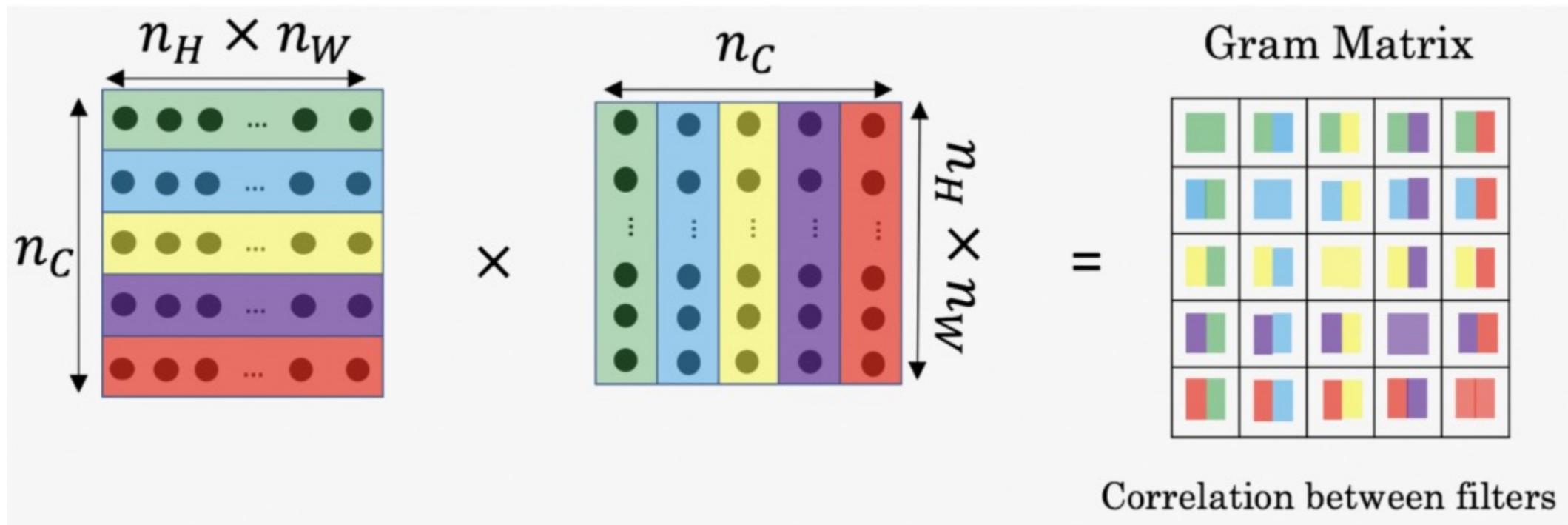
BACKGROUND RESEARCH

$$G_{i,k}^l = \sum_k F_{i,k}^l F_{j,k}^l$$

Number of layers
Original Matrix
Gram Matrix
Transpose Matrix
 $i, j = \text{feature maps}$
 $k = \text{channels}$

The computation of the Gram matrices

BACKGROUND RESEARCH



BACKGROUND RESEARCH

$$L_{style} = \sum_l \sum_{i,j} (\beta G_{i,j}^{s,l} - \beta G_{i,j}^{p,l})^2$$

Style Weight

Style Loss

Gram Matrix for Style Image

Gram Matrix for Target Image

```
graph TD; SW((Style Weight)) --> BG[β G_{i,j}^{s,l}]; SW --> PG[β G_{i,j}^{p,l}]; SL[Style Loss] --> BG;
```

Style loss function defined with the gram matrices: $(\mathbf{Style} - \mathbf{Target})^2$

WHAT IS DONE

- VGG-19 pre-trained model was used.
- Gram matrices of the style and target were computed.
- Parameters of the target image were optimized with Adam.

WHAT IS RECENTLY DONE

- Several bugs in image and video rendering is fixed.
- The quality of the target image is enhanced by experimenting with the hyper-parameters.
- Users can now specify an artist instead of providing the style image.
- Style transitions can now be saved as a video.

EXPERIMENTS

- Different weights are given to the content and style losses.
- The learning rate and number of layers are changed.
- Various pre-trained models are considered.

THE END PRODUCT

Content Image



Style Image



Target Image

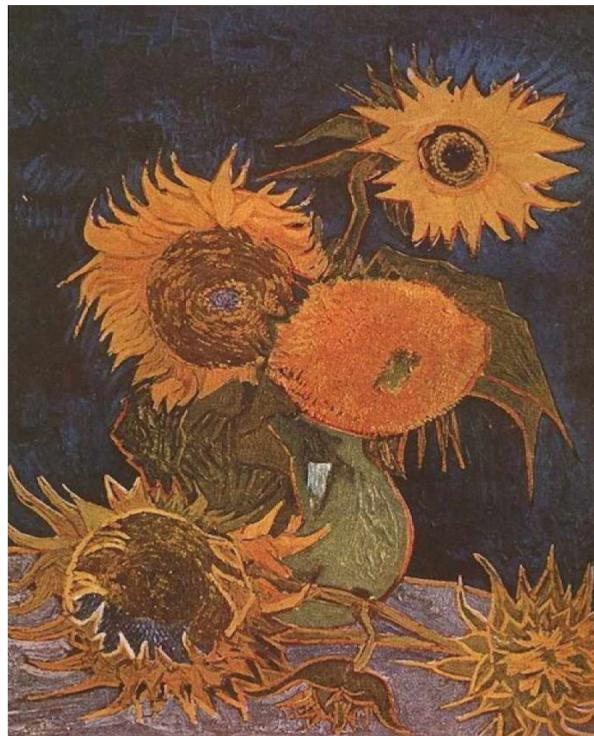


THE END PRODUCT

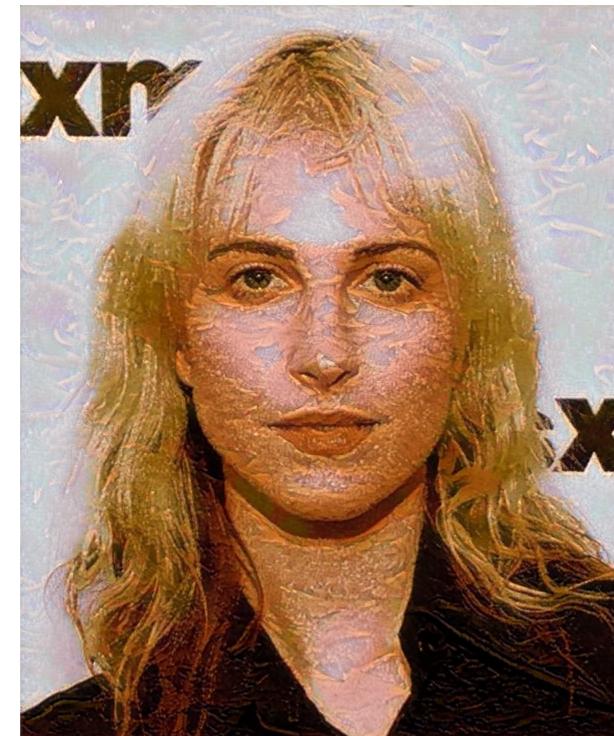
Content Image



Style Image



Target Image



THE END PRODUCT

Content Image



Style Image



Target Image

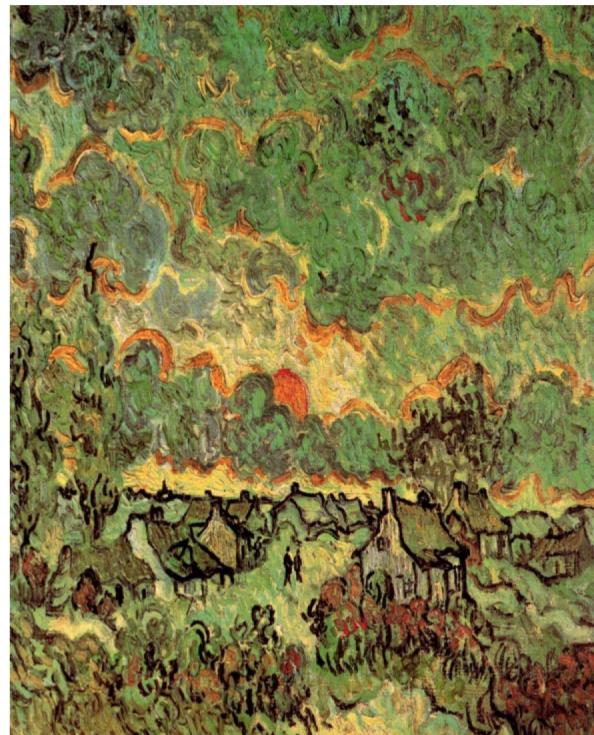


THE END PRODUCT

Content Image



Style Image



Target Image



ALPHA RATIO EXPERIMENT

Content Image



Style Image



Target with sw: 1e6



Target with sw: 1e4



Target with sw: 1e2



Target with sw: 1e1



LEARNING RATE EXPERIMENT

Will be stated in the final report.

CONCLUSION

- The algorithm we used is essentially an optimization algorithm.
- There is no training process; model parameters change for each content & style pair.
- Consequently, what we do is an image processing task.

DEMO AND VIDEO

THANK YOU