

Style Transfer Between Two Photographs

Aly Kane • Amelia Lemionet • Fjori Shemaj

Introduction

Style transfer can be used to transfer elements of a photo such as:

- Illumination
- Seasonal effects
- Time of day effect

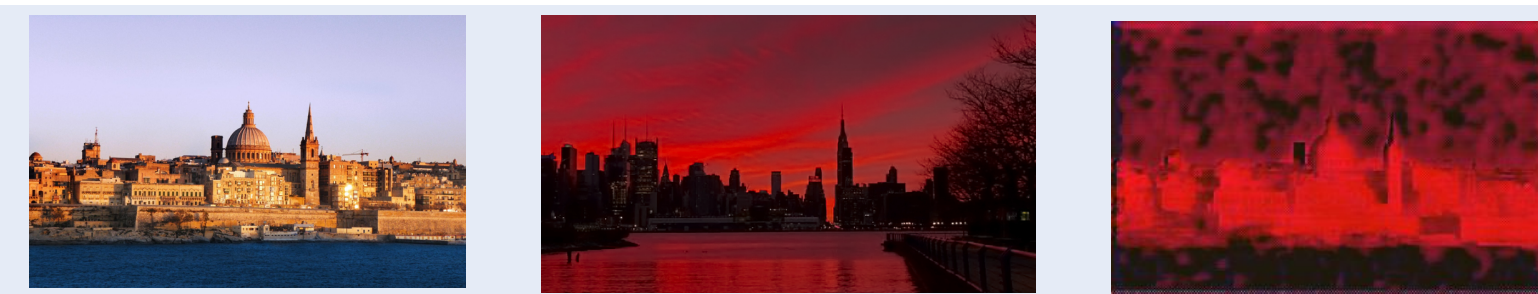
Applications include:

- Enhanced image filtering
- Tools for visualizing home updates
- Image improvement

Problem statement

Traditional style transfer methods don't generalize well to photographs

- Image distortion
- Paintings have an "overall style", while photographs have localized styles



Content Image Styling Image Output
Classic style transfer applied to two photographs

Modifications:

- Segment images to transfer style locally
- Regularization term to ensure photorealism

No objective measurement for photorealism so evaluation is based on objective appreciation

Dataset

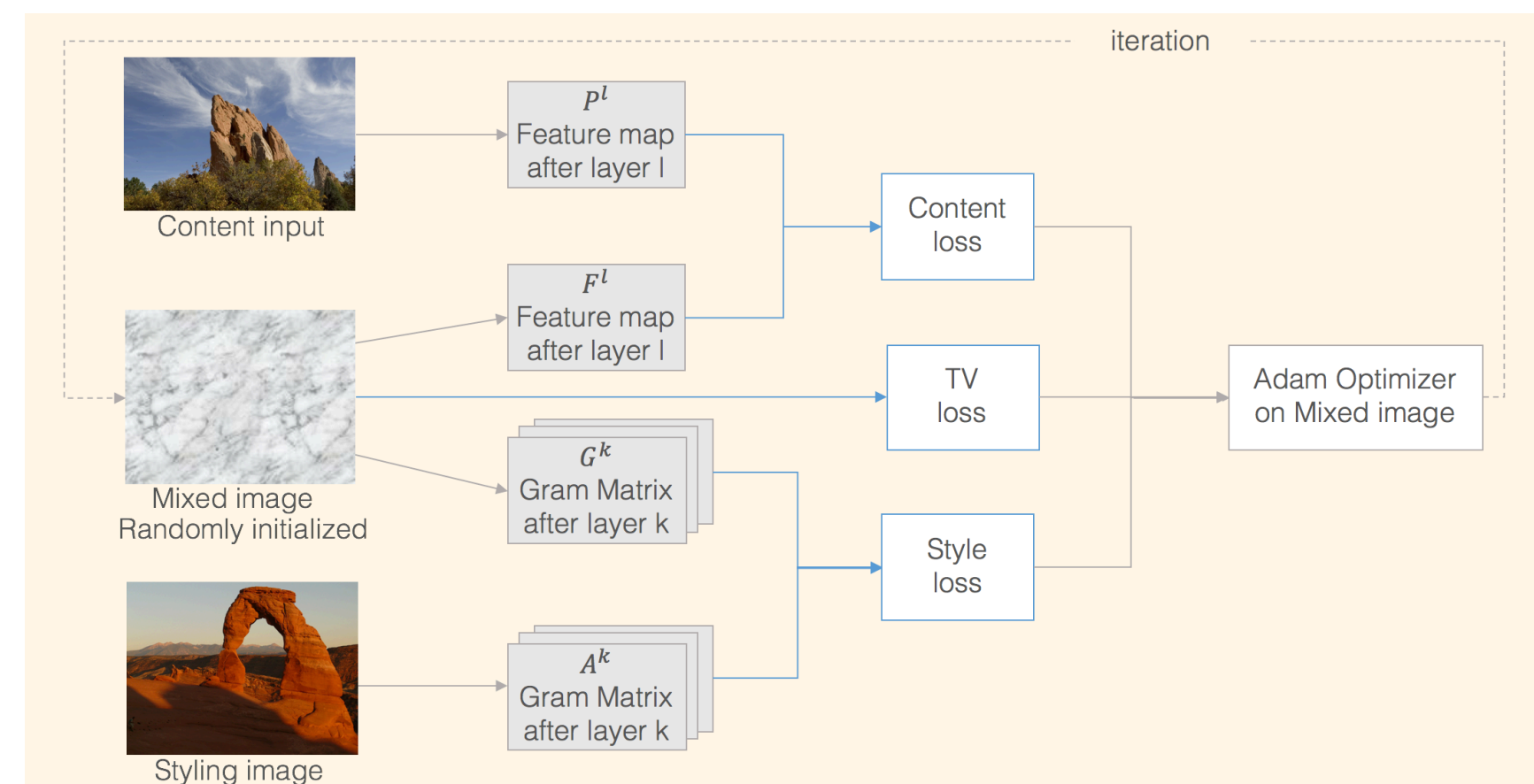
Pre-segmented images allowed us to focus on the style transfer

- 120 segmented images
- Published results used as benchmark



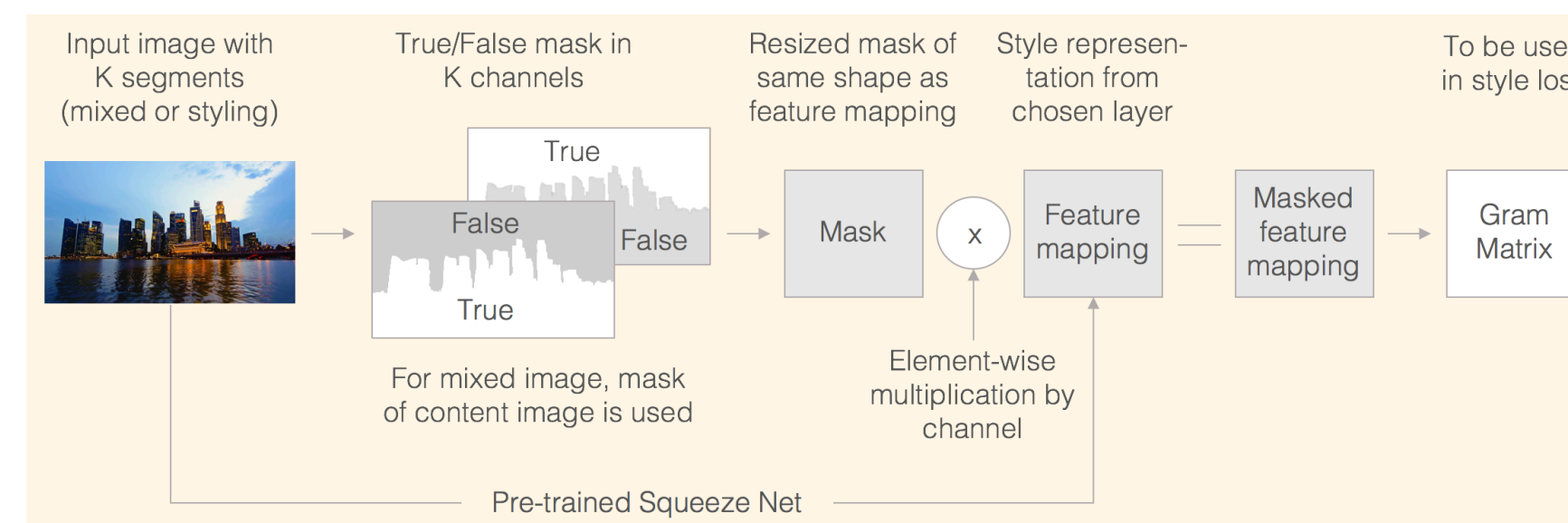
Methodology

Traditional style transfer:



Improvements:

- Modify Gram matrix computation to incorporate segmentation
- Mask from content image used for mixed image



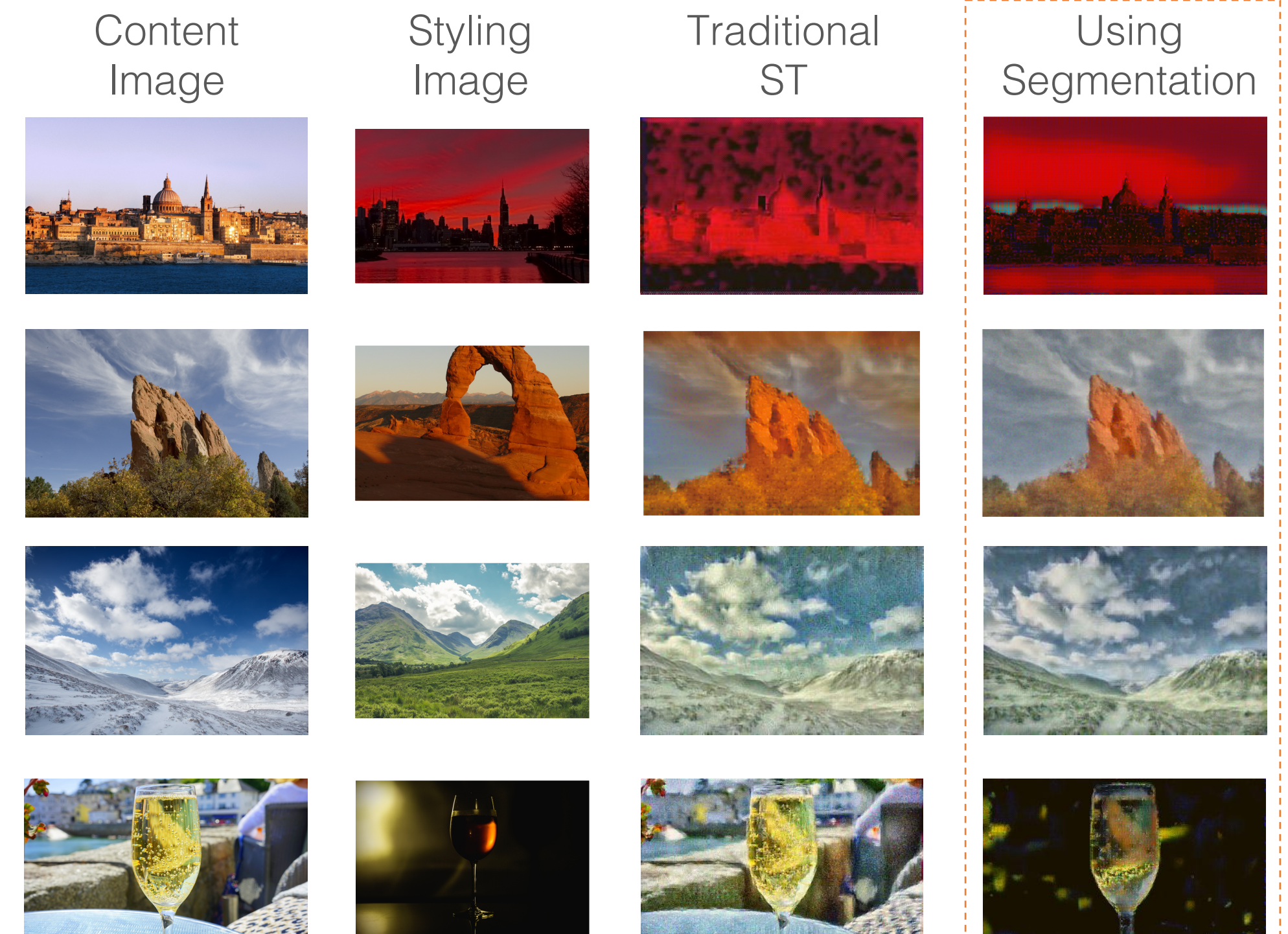
Style Loss:

$$L_S = \sum_{segments} \sum_l \sum_{i,j} (G^l - A^l)_{ij}^2$$

Total Loss:

$$L = \alpha L_C + \beta L_S + \gamma L_{TV}$$

Results



High level results:

- Optimal layers for style and content representations widely differ from image to image
- Layer weights drastically affect results
- Loss weights have a smaller impact

Next steps & Conclusions

Next Steps:

- Incorporate photorealism loss
- Create a measurement of evaluation for method standardization

Conclusions:

- Segmentation provides immediate improvement by preventing 'spillovers'
- Best results seen between style and content images with similar segmented layers

$$L_{PR} = \sum_{c=1}^3 V_c^T M V_c$$