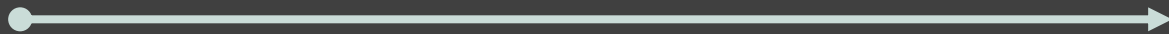


Deep learning in Computer Graphics



Computer Graphics Course, 12/21/2022

Presenter: Le Ngoc Hanh

Examples in Graphics



Sketch simplification



Colorization



Procedural modelling



Mesh segmentation



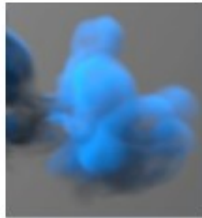
Learning deformations



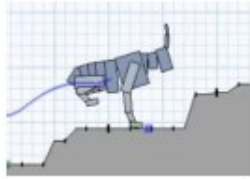
Real-time rendering



BRDF estimation



Fluid



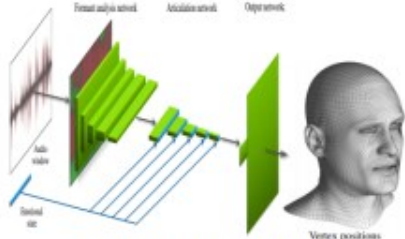
Animation



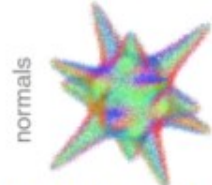
Boxification



Denosing



Facial animation



PCD processing

Style Transfer

from an early stage to a mature topic

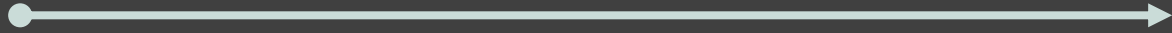


Content

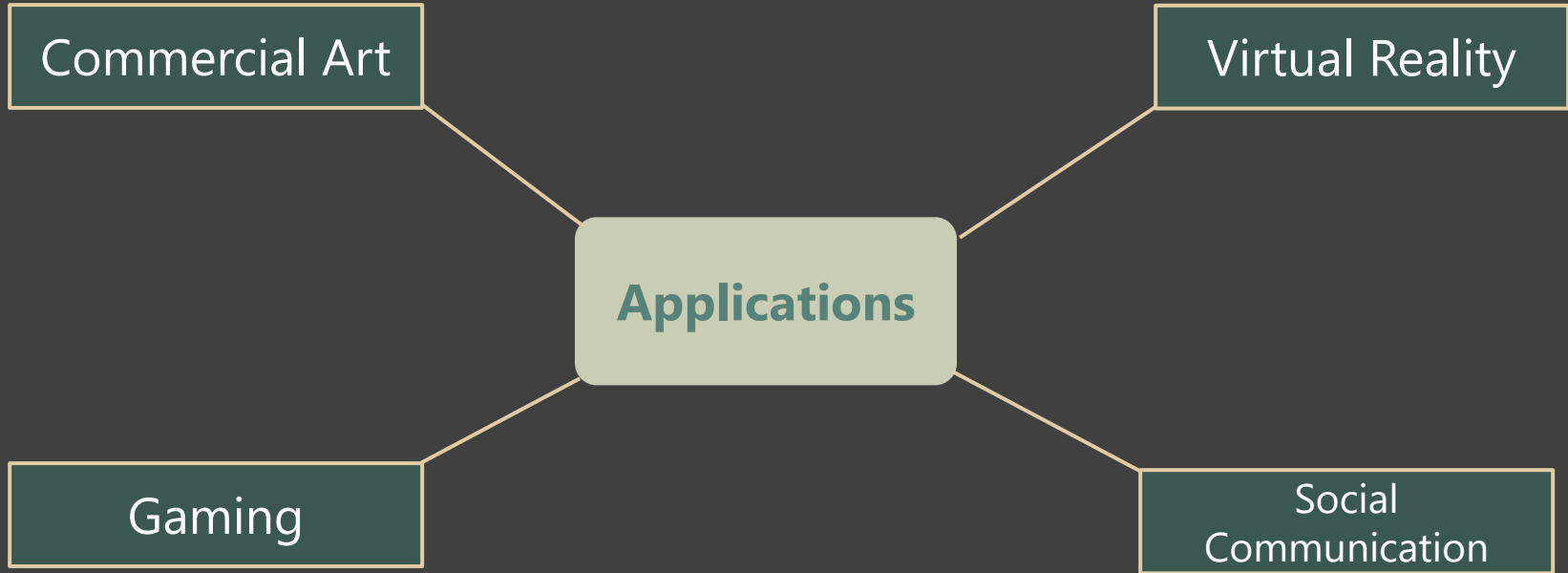
1. Commercial **benefits** of Style Transfer
2. **Algorithms** used in Style Transfer
3. Style Transfer on other medium, i.e., **Map Art** styles
4. **Challenges** and **Future work** of Style Transfer.



Why Style Transfer?



Applications



Commercial Art

TECH / ARTIFICIAL INTELLIGENCE / CULTURE

Christie's sells its first AI portrait for \$432,500, beating estimates of \$10,000



Photo: Christie's

/ The image was created using a machine learning algorithm that scanned historical artwork

By JAMES VINCENT

Oct 26, 2018, 1:03 AM GMT+8 | [0 Comments](#)

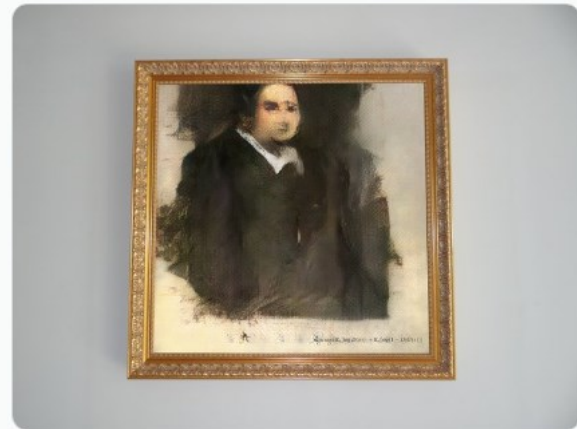


Christie's

@ChristiesInc · Follow



#AuctionUpdate The first AI artwork to be sold in a major auction achieves \$432,500 after a bidding battle on the phones and via ChristiesLive bit.ly/2PVN2ly



11:22 PM · Oct 25, 2018



1.9K Reply Share



Slide 7

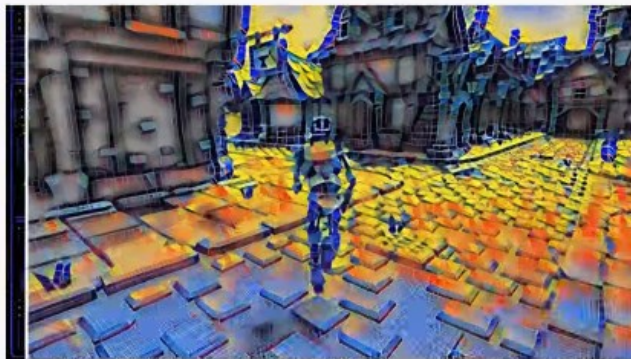
Google's Stadia uses Style Transfer ML to manipulate video game environments

Kyle Wiggers

@Kyle_L_Wiggers

March 19, 2019 11:17 AM

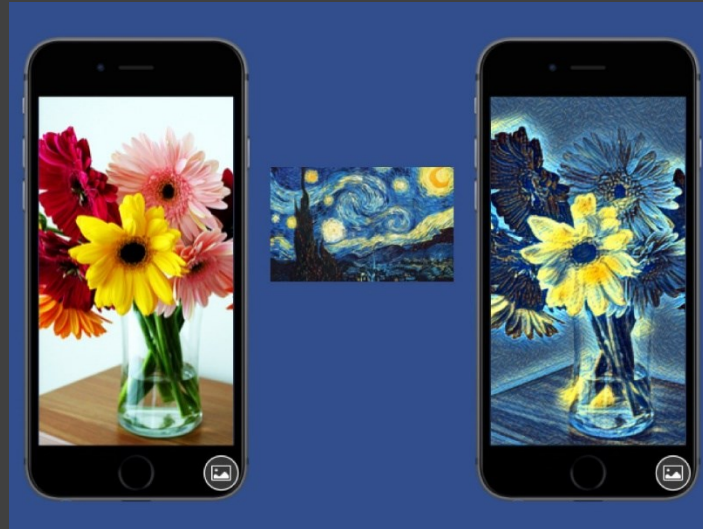
f  in



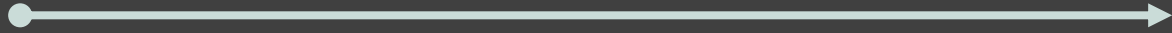
Virtual reality



Social communication



How does Style Transfer work?

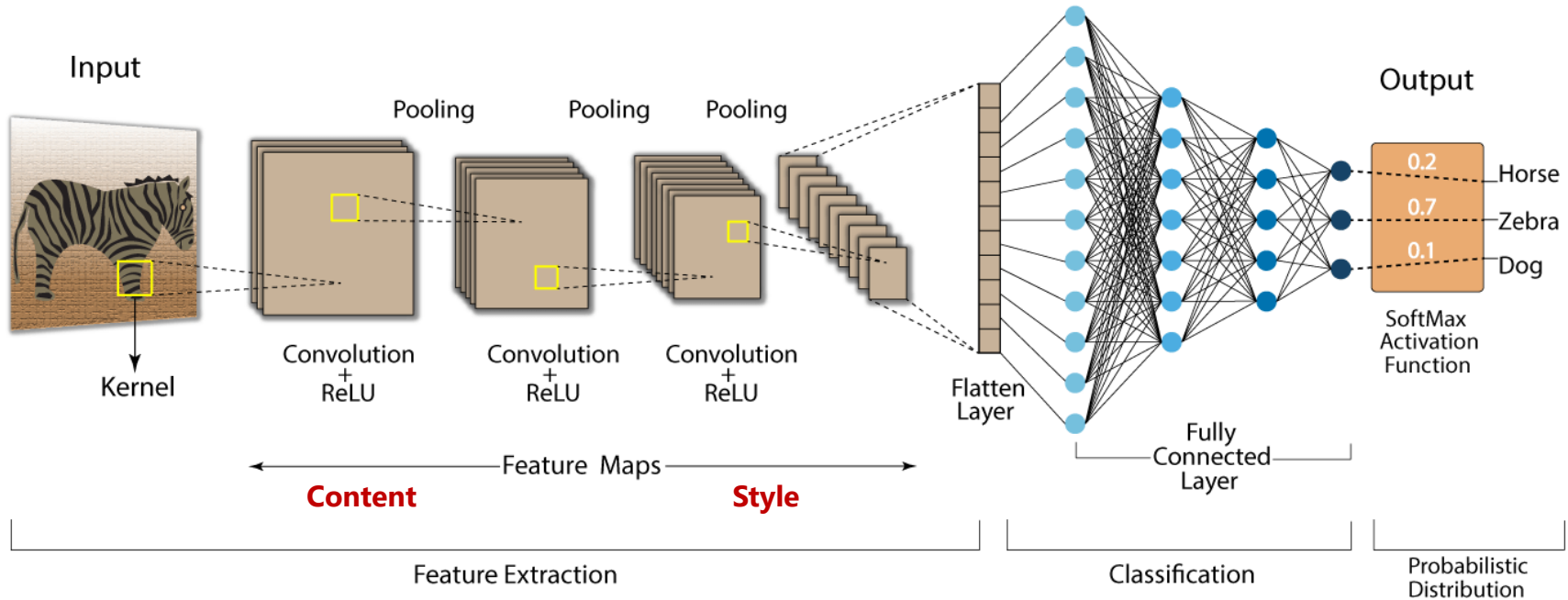


How Style Transfer methods work?

Style Transfer **with** and **without** neural network.

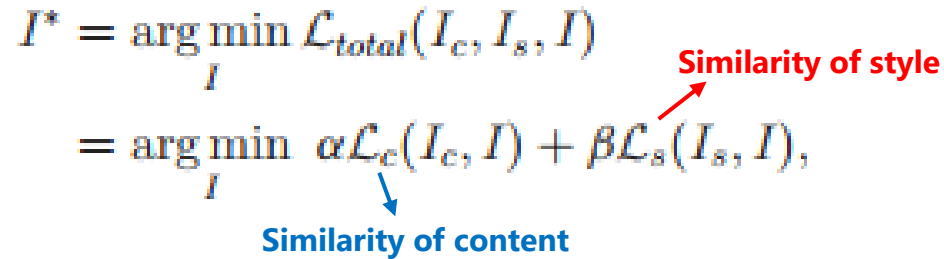
Model-Optimization-Based Online Neural Methods

Convolution Neural Network (CNN)



Style Transfer without Neural Networks

$$\begin{aligned} I^* &= \arg \min_I \mathcal{L}_{total}(I_c, I_s, I) \\ &= \arg \min_I \alpha \mathcal{L}_c(I_c, I) + \beta \mathcal{L}_s(I_s, I), \end{aligned}$$



Source: [Gatsy et a.]

Derivation of Neural Style Transfer

$$\begin{aligned} I^* &= \arg \min_I \mathcal{L}_{total}(I_c, I_s, I) \\ &= \arg \min_I \alpha \mathcal{L}_c(I_c, I) + \beta \mathcal{L}_s(I_s, I), \end{aligned}$$

Speed ↓

Computation ↑



$$\theta^* = \arg \min_{\theta} \mathcal{L}_{total}(I_c, I_s, g_{\theta^*}(I_c)), \quad I^* = g_{\theta^*}(I_c).$$

$$\theta^* = \arg \min_{\theta} \mathcal{L}_{total}(I_c, I_s, g_{\theta^*}(I_c)), \quad I^* = g_{\theta^*}(I_c).$$

Per-style-per-Model

Multiple-style-per-Model

Arbitrary-style-per-Model

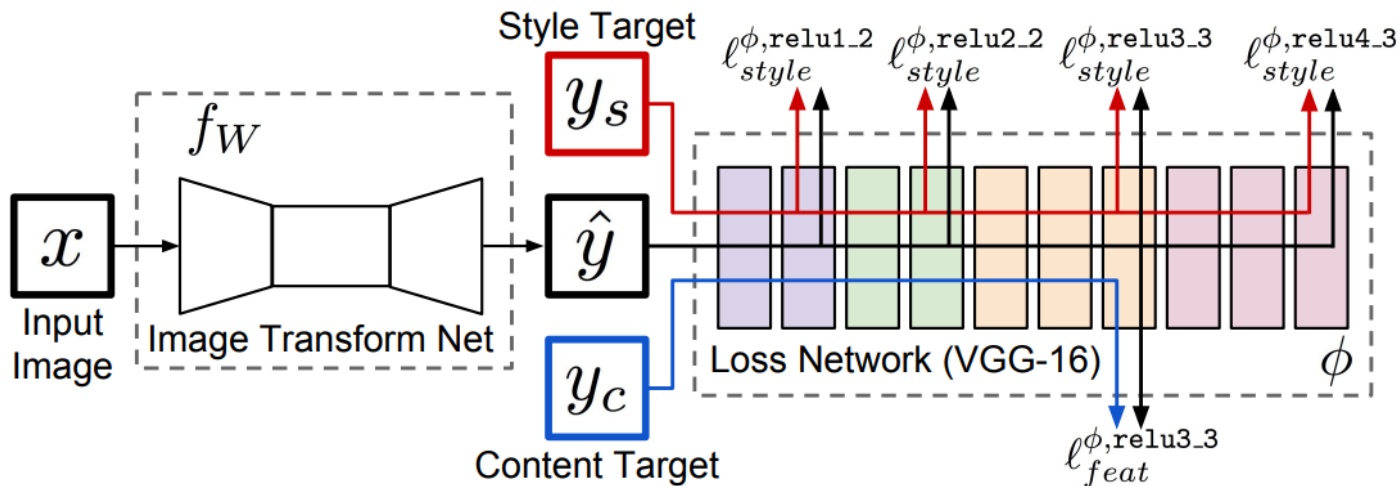


Per-Style-Per-Model (PSPM) Neural Methods

Perceptual Losses for Real-Time Style Transfer and Super-Resolution

Justin Johnson, Alexandre Alahi, Li Fei-Fei
{jcojohns, alahi, feifeili}@cs.stanford.edu

Department of Computer Science, Stanford University



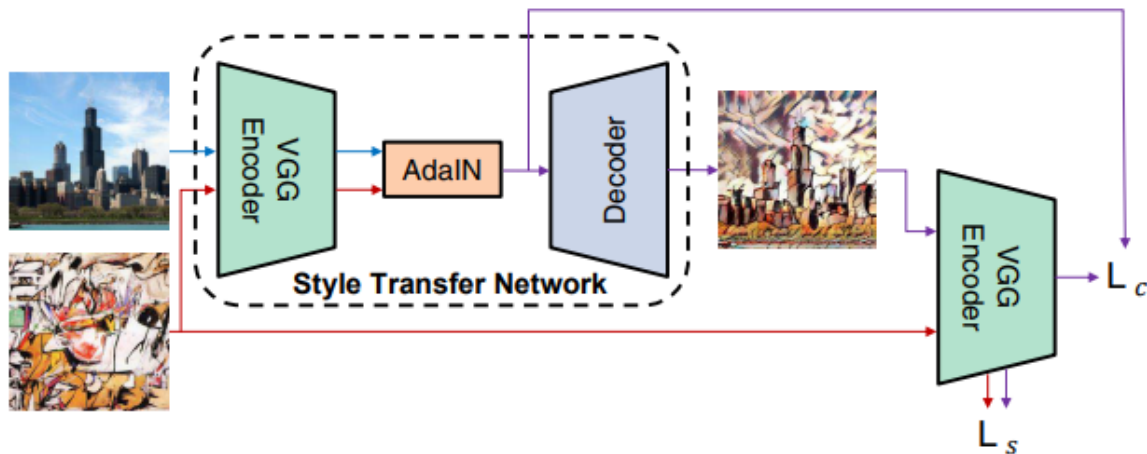
Arbitrary-Style-Per-Model (ASPM)

Arbitrary Style Transfer in Real-time with Adaptive Instance Normalization

Xun Huang Serge Belongie

Department of Computer Science & Cornell Tech, Cornell University

{xh258, sjb344}@cornell.edu



Extensions and Variations of NST

- Doodle Style Transfer [65]
- Stereoscopic Style Transfer [70]
- Portrait Style Transfer [71]
- Video Style Transfer
- Character Style Transfer [78, 79, 80]
- Photorealistic Style Transfer [81, 82]
- Fashion Style Transfer [86]
- Audio Style Transfer [87, 88]



Extensions and Variations of NST

- Doodle Style Transfer [65]
- Stereoscopic Style Transfer [70]
- Portrait Style Transfer [71]
- **Video Style Transfer**
- Character Style Transfer [78, 79, 80]
- Photorealistic Style Transfer [81, 82]
- Fashion Style Transfer [86]
- Audio Style Transfer [87, 88]



Artistic style transfer for videos

Manuel Ruder, Alexey Dosovitskiy, Thomas Brox*

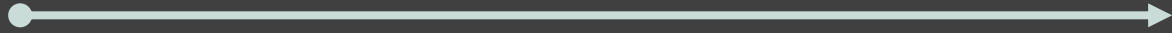
Department of Computer Science
University of Freiburg

{ruder, dosovits, brox}@cs.uni-freiburg.de

Freiburger Münsterplatz



Other medium of art

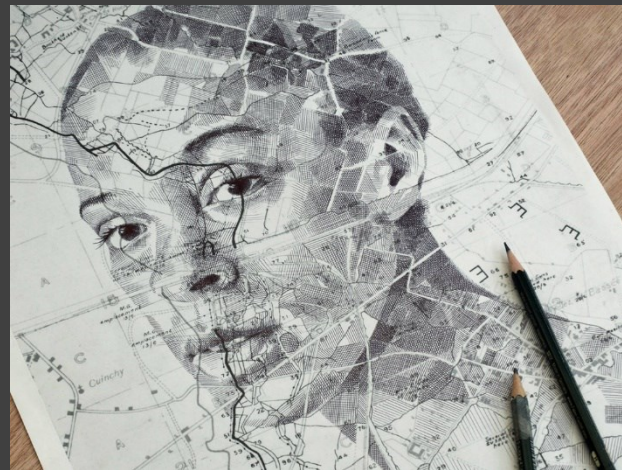


What is Painting?

Painting is characterized by colors and designs. Painting is of different types such as painting on canvas, oil painting on canvas, watercolor painting, acrylic painting and the like. You make use of turpentine oil in the case of painting. You need to have a palette while painting on canvas using oil colors. Oil colors, **acrylic** and types of pigments are used in the art of painting.

Painting needs sufficient time to dry. **Oil painting** and acrylic cannot be very easily erased or altered. You need to have different kinds of brushes with different bristles in the case of painting.

A person who paints is called either an artist or a painter. It is also interesting to note that there is a market value for both drawing and painting works. Works of painting have a greater market value than the works of pencil and charcoal drawing. This is one of the reasons why painting is considered a very expensive **hobby**. The painting equipment is expensive to buy when compared to drawing equipment. It is interesting to note that any art exhibition would hold both the types of artworks, namely drawings and paintings. This explains that there is a clear difference between drawing and painting. Now let us summarize the difference as follows.



What is Drawing?

It is important to know that drawing is characterized by lines and shades. Drawing is of different types such as line drawing, shade drawing and object drawing. A person who draws is called an **artist**. Drawing needs no turpentine oil, unlike painting. Pencil, crayons, and charcoal can be used in the art of drawing. You need not use a palette while drawing an object or a human figure.

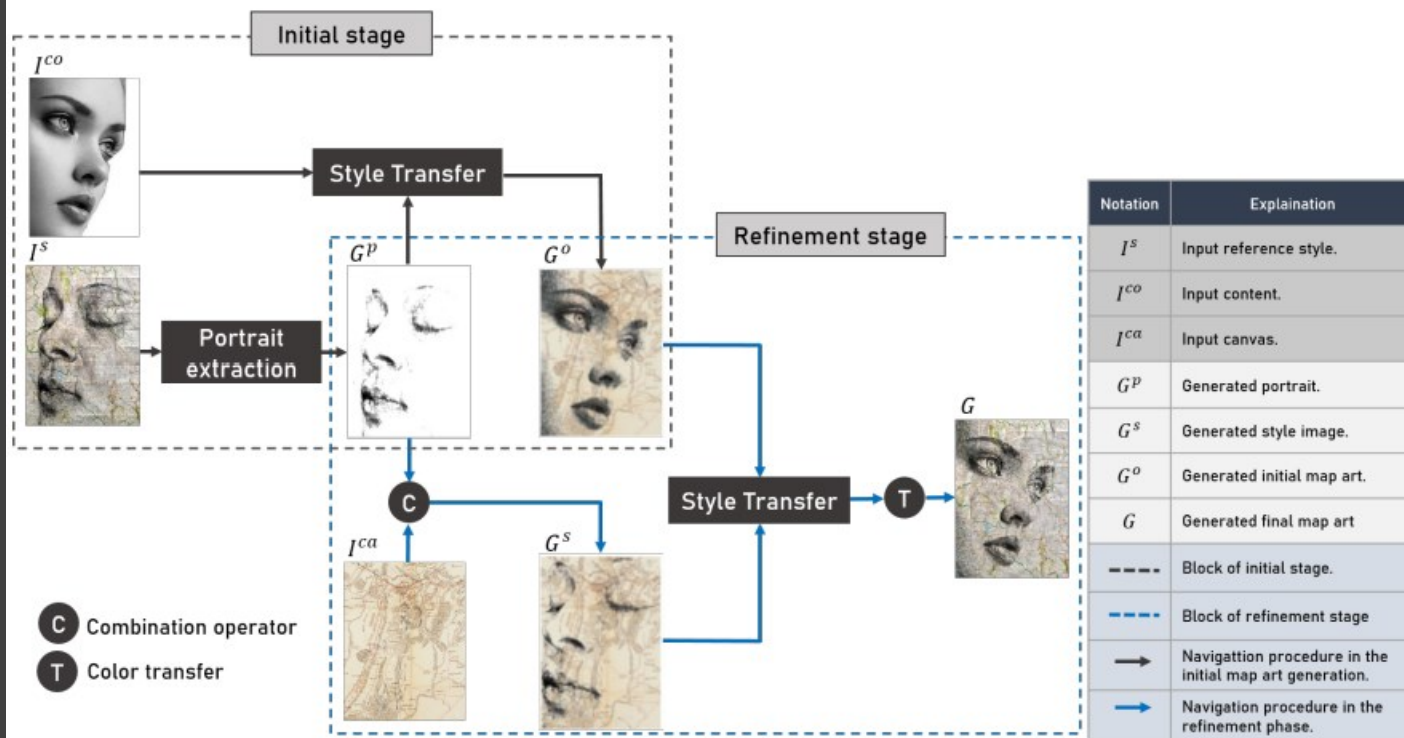
Drawing needs no time to dry. Pencil drawings can be rubbed and redone quite easily because graphite can be easily erased. You need not use brushes in the case of drawing. As a matter of fact, scale and other measuring equipment are used in the case of drawing.

Painting vs Drawing



Map art style transfer with multi-stage framework

Chiao-Yin Shih, Ya-Hsuan Chen & Tong-Yee Lee 



Portrait Map Art Generation by Asymmetric Image-to-Image Translation

Yuxin Zhang, *Fan Tang, †Weiming Dong, ‡Thi-Ngoc-Hanh Le, §
Changsheng Xu, ¶ and Tong-Yee Lee ‖

May 10, 2022

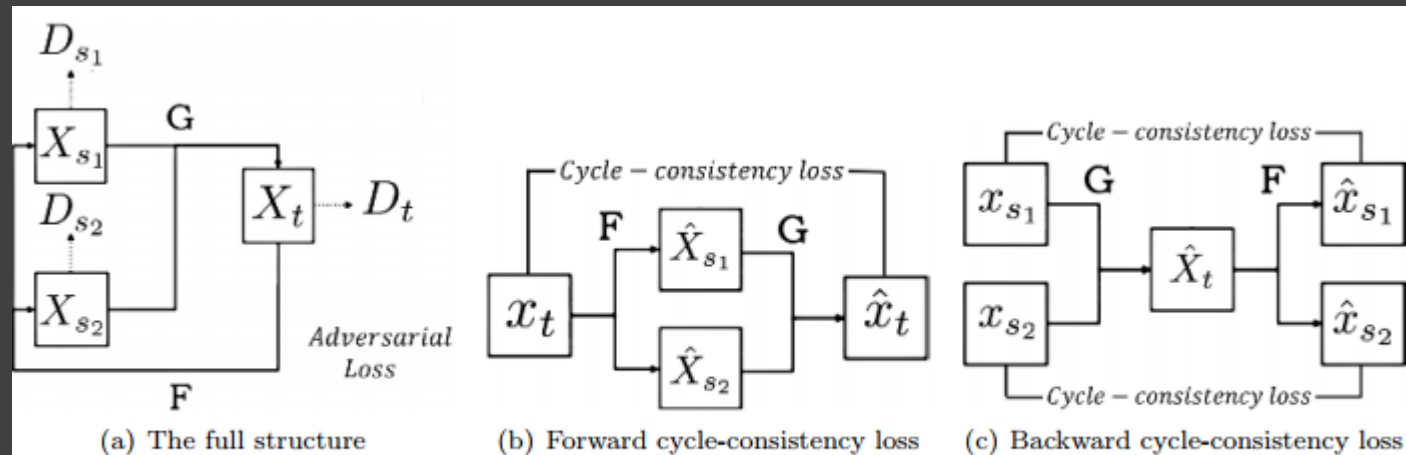
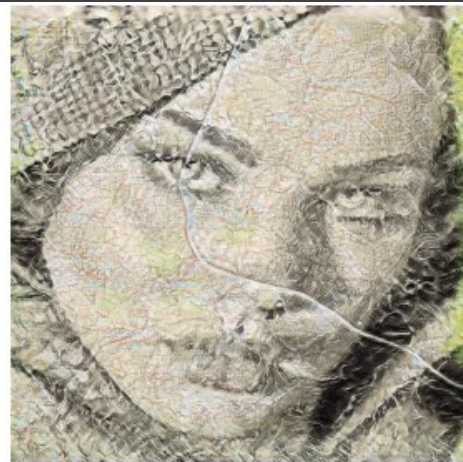


Fig. 2: Overview of our asymmetric image-to-image translation model structure.



(e) PMA results generated by our model

Structure-aware Video Style Transfer with Map Art

Just Accepted

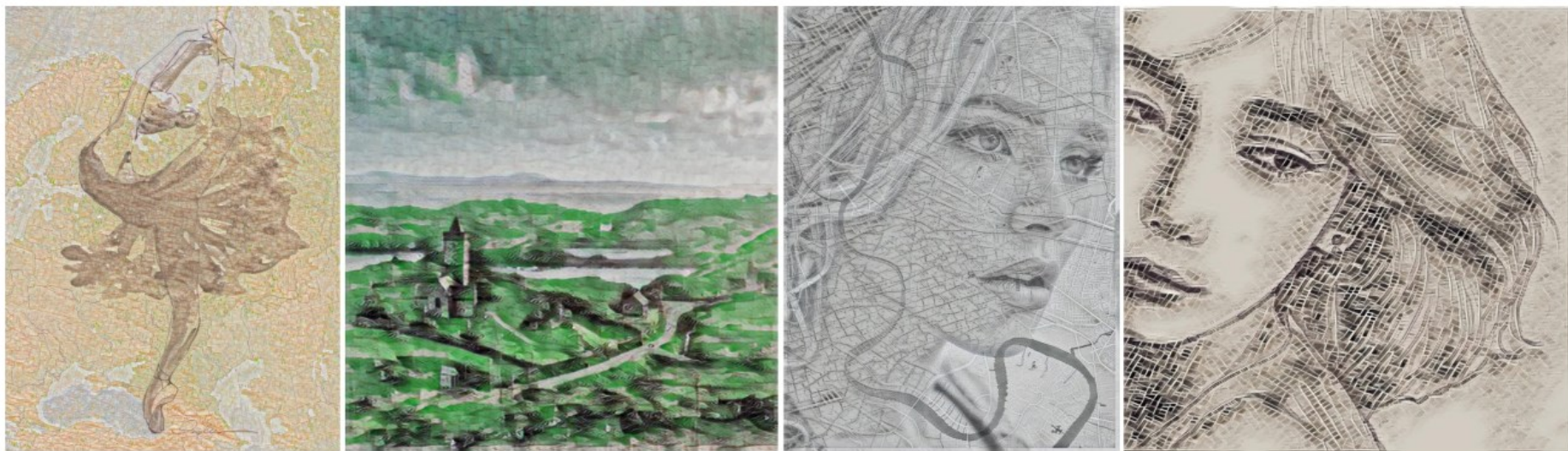
Authors:  [Thi-Ngoc-Hanh Le](#),  [Ya-Hsuan Chen](#),  [Tong-Yee Lee](#) [Authors Info & Claims](#)

ACM Transactions on Multimedia Computing, Communications, and Applications • Accepted on November 2022

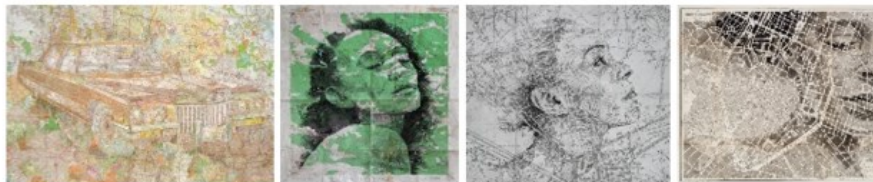
- <https://doi.org/10.1145/3572030>

Published: 23 November 2022 [Publication History](#)





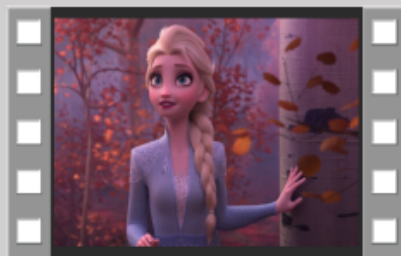
Map art by ours



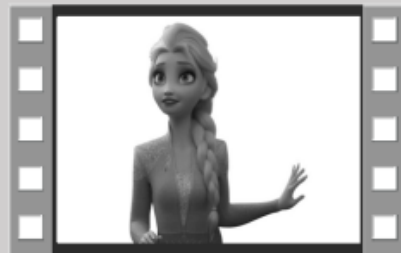
Map art by artists

Fig. 1. Our proposed model can transfer the map art styles from artists on various contents.

m-Vi generation



Input video



Object segmentation



Input map



m-Vi

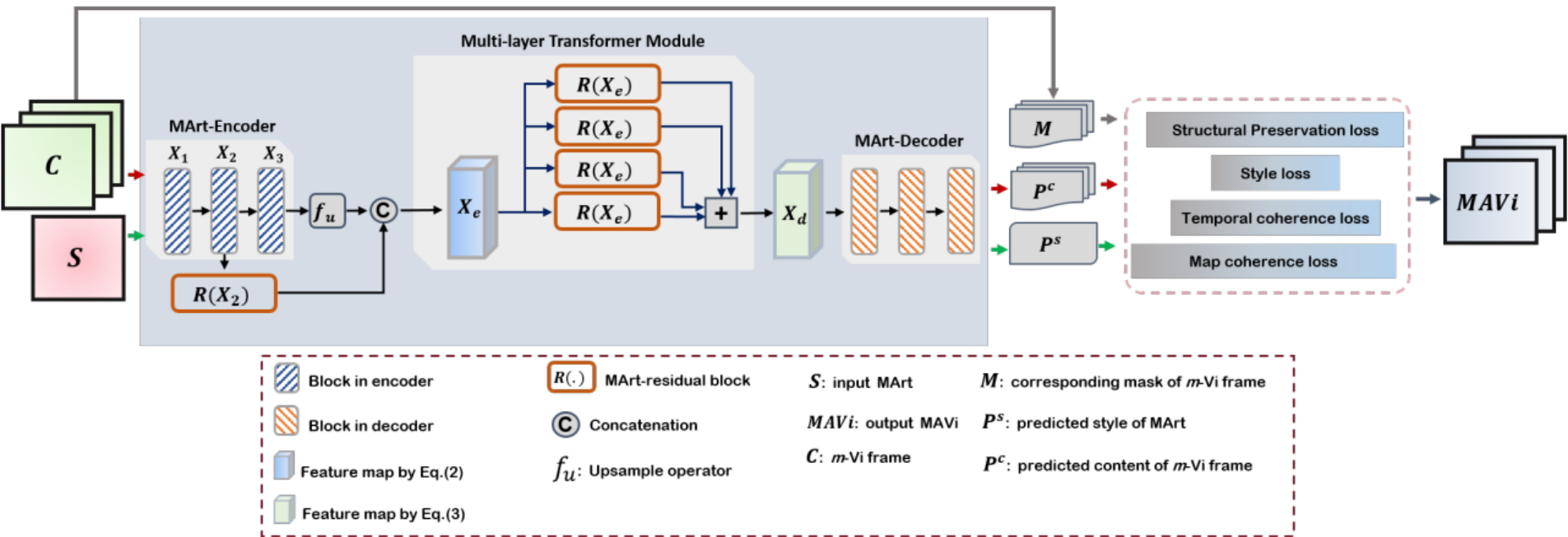
Stylization



Input MArt



Output MAVi



Stylizing video with Map art style



Future Challenges

- Evaluation methodology
- Interpretable Neural Style Transfer.



Potential future work

- 3D surface stylization

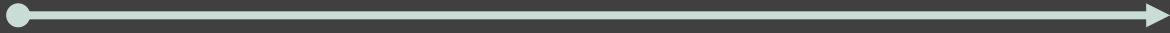


Potential Future work

- **Not imitate** but **create new** form of AI-created Art!



End.



Hope you enjoy!