

# Universal Style Transfer via Feature Transforms

Team Name : Udolhtrap

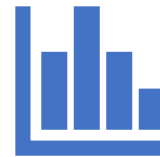
Content



**Problem  
Statement**



**Proposed  
Method**



**Results  
Expected**



**Timeline**

The background of the slide features several thin, curved lines in a light gray color, some solid and some dashed, creating a sense of motion or a stylized globe. On the left side, there is a red rectangular area with a white border and a small white triangle pointing downwards at the bottom center, resembling a speech bubble or a callout box. Inside this red area, the title is written in white text.

## Universal Style Transfer via Feature Transforms

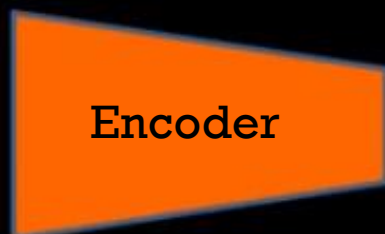
- Universal style transfer aims to transfer arbitrary visual styles to content images.
- We propose a feed forward method to realize the fast transferring for arbitrary styles.
- A pair of feature transformations, whitening and coloring is embedded in an image reconstruction network.
- We present a effective method that does not require training on any pre-defined styles.

## Method Overview

- We will use a VGG-19 network as encoder to extract features. A decoder is then trained to reconstruct original image.
- Original Image and style are both input to the encoder. The combined output is fed to a Whitening and coloring(WCT) module which transform features to match the style.
- The output from WCT is sent to the trained decoder to get the final styled image.
- For higher visual quality multi-layer pipeline is used.

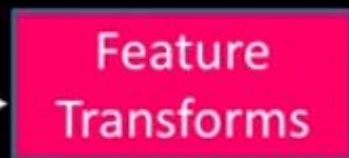


Input



Encoder

$x_c$



Feature  
Transforms



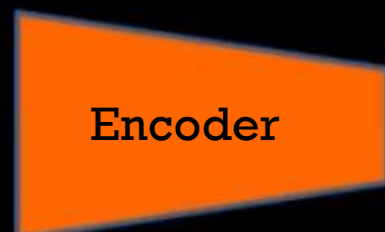
Decoder



Output



Style



Encoder

$x_s$



## WCT

- A whitening transformation or sphering transformation is a linear transformation that transforms a vector of random variables with a known covariance matrix into a set of new variables whose covariance is the identity matrix, meaning that they are uncorrelated and each have variance 1.
- A coloring transformation transforms a vector of white random variables into a random vector with a specified covariance matrix

# Whitening and Coloring Transforms (WCT)

- Whitening

$$\widetilde{x}_c = E_c D_c^{-1/2} E_c^T x_c$$

Eliminate the correlations  
between content features

$$\text{Cov}(\widetilde{x}_c) = I$$

- Coloring

$$\widehat{x}_c = E_s D_s^{1/2} E_s^T \widetilde{x}_c$$

Let the features have the same  
correlations with those of the style

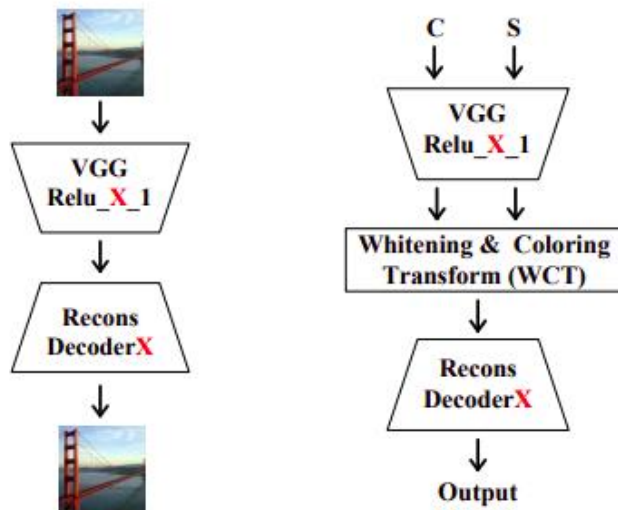
$$\text{Cov}(\widehat{x}_c) = \text{Cov}(x_s)$$

Content (or style) feature  $x^{C \times HW}$

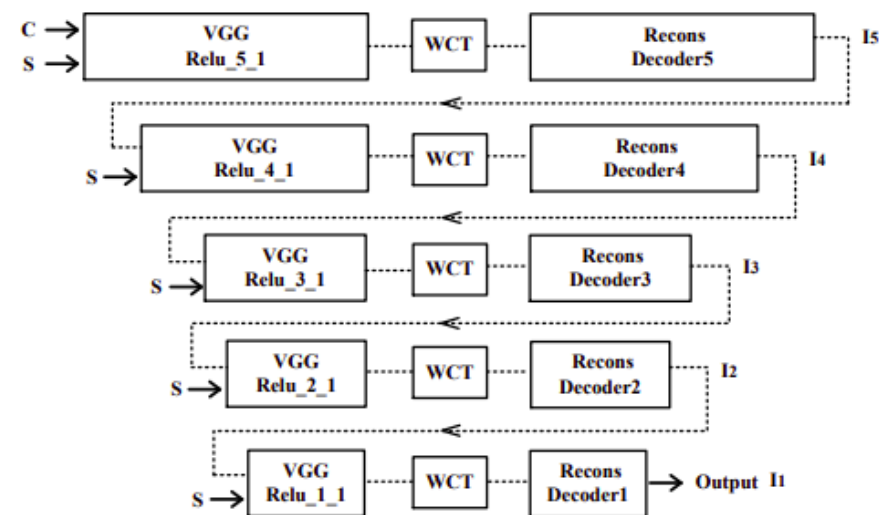
$$x^{C \times HW} \rightarrow \text{Cov}_x$$

D the diagonal matrix of its eigenvalues

E the orthogonal matrix of its eigenvectors



Single-level stylization pipeline



Multi-level stylization pipeline



The background of the slide features a series of thin, light gray curved lines that sweep across the frame, creating a sense of motion and depth. These lines are more densely packed on the left side and become sparser towards the right.

# Frameworks

We'll be using the Pytorch framework to implement the encoder and decoder models.

Input



Style



Output



Results  
Expected

# Project Timeline



Mid-March – Encoder/Decoder + Whitening module



April – Coloring module and multi-level stylization



Final Deliverable – Complete working pipeline for single-level and multi-level stylization

The background features a series of concentric circles in light gray, some solid and some dashed, creating a ripple effect. A large red speech bubble is centered on the page, containing the text 'Thank You' and 'Questions ?'.

# Thank You

Questions ?