Artistic Stylization of Face Photos Based on a Single Exemplar

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Outline

- Introduction
- Background
- Method
- Results
- Conclusion
- Reference
Introduction

Style Transfer

Stylization of Faces

Non-photorealistic Rendering

Challenge

Region-specific

Viewers’ Sensitivity to face

Variation of faces
Style-specific methods

Figure 1: Given a natural image (shown in (a)), our method has two main steps to produce the stroke layer and tonal texture, as shown in (b)-(c). They naturally represent respectively shape and shading. Our final result (d) is an algorithmic combination of these two maps, containing important structure information and mimicking a human drawing style.

Pencil drawing, Lu c. et. al.

Figure 23: Flow-preserving mosaics based on our S-Method by elongated tiles. $A = 4$, with twice smoothing.

Tessellation, Li h. et. Al.

Figure 2.1: Halftoning. (a) Original image; (b) structure-aware halftoning [139]; (c) structure-aware error diffusion [19].

Halftoning, Li H. et. al.

Figure 2.2: Screening for Marilyn Monroe art. Left: image reference; right: richness-preserving Manga screening [142].

Screening, Li H. et. Al.
Data driven methods

Figure 8: We transfer the examples in the insets to the inputs in column (a). The examples in each column in (b) are from one photographer. From left to right, the three styles are low-key and high contrast, warm and soft lighting, and high-contrast black-and-white. We test on indoor scenes.

Style transfer, Shih Y. et. al.

Guided Transfer, Li H.

Data Driven Cartoonizing, Zhang Y. et. al.
Our Task

Data-driven

Style-Specific

General stylization with a single Example
Background

- Face Detection & Alignment
- Non-Photo Realistic Rendering
- Color Style Transfer
- Optimized Texture Synthesis
Framework of Our Method

Example

$I_{\text{input}}$ → **Color Transfer** → $I_{\text{color transferred}}$ → **Texture Transfer** → $I_{\text{texture transferred}}$
Framework of Our Method

Example

$I_{\text{input}}$ → Color Transfer $\rightarrow I_{\text{color transferred}}$ → Texture Transfer $\rightarrow I_{\text{texture transferred}}$
Framework of Our Method

\[ I_{\text{input}} \rightarrow \text{Color Transfer} \rightarrow I_{\text{color transferred}} \rightarrow \text{Texture Transfer} \rightarrow I_{\text{texture transferred}} \]

Example
Color Transfer

$\mathbf{I}_{\text{input}} \xrightarrow{\text{Color Transfer}} \mathbf{I}_{\text{color transferred}} \xrightarrow{\text{Texture Transfer}} \mathbf{I}_{\text{texture transferred}}$

Example
Color Transfer

320*448 image

Face landmark

label assignment

dense correspondence

\[ e_i(j) = e_{semantic}(l_i, l_j) + e_{geometry}(x_i, x_j) + e_{color}(c_i, c_j) \]

I\_color\_transferred
Texture Transfer

Example

\[ I_{\text{input}} \xrightarrow{\text{Color Transfer}} I_{\text{color transferred}} \xrightarrow{\text{Texture Transfer}} I_{\text{texture transferred}} \]
Texture Transfer

- We view the problem of Texture Transfer as Edge-Preserved Texture synthesis problem
- Optimized Texture synthesis
  - Iteratively optimizing and voting
Optimizing

- Finding the Nearest Neighbor Field
- Generalized PatchMatch

\[
\min_{s_i, e_i} \sum_{i \in S} d(s_i, e_i)
\]

\(d(s_i, e_i)\) measures the L2 distance between patch \(s_i\) and \(e_i\).
Voting

- Simply averaging the Nearest Neighbors
Pyramid

- The texture is synthesized in a pyramid manner
  - Coarse to fine
  - 10 scales (ratio 1.5)
Preserve the edges

- Pyramid Edge Map
  - Using edge maps as the preserving mask
The final synthesized image
Experiment Result
Comparison
Fig. 4: Comparison to other methods. (a) Examples. (b) Input. (c) Image Melding initiated with our SDCT. (d) Shin et. al. (e) Our SDCT + Image Quilting. (f) Our SCDT + enhanced Image Quilting. (g) Ours.
Conclusion

- **Strength**
  - Robust to gender, skin color, hair style, face accessories, beards, glasses, slight variation in poses, lightening condition
  - Able to transfer wide varieties of styles (pencil drawing, sand drawing, oil painting, mosaic, screening, water color painting, Chinese painting and Pyrography)

- **Limitation**
  - Time consumption (over 40 mins to process one image)
  - Unable to handle stylization which involves geometry exaggeration
  - Tend to blur textures with long curve patterns.