Controllable Artistic Text Style Transfer via Shape-Matching GAN

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**Problem: Controllable Text Style Transfer**

- **Input:** style image, target text, deformation degree $\ell$
- **Output:** artistic text
- **Large $\ell \rightarrow$ more **artistry**; less **legibility**: balance?

![Input and Output Diagram](image)

- Input: style image, target text
- Adjust the stylistic degree of glyph
- Controllable output

Parameter $\ell$

$0 \rightarrow$ Increasing deformation degree $\rightarrow 1$
Problem: Controllable Text Style Transfer

- Bidirectional shape matching
  - **Backward structure transfer**: prepare training data
  - **Forward structure transfer**: learn shape deformation

![Diagram showing the process of controllable text style transfer with stages and bidirectional shape matching.](image-url)
Aim and Challenge

Problem: Controllable Text Style Transfer

Challenge

- **Limited Data**: one style image to train the network?
- **Controllable**: one network for fast forward multiple scales
05 Proposed Method

● Framework

Stage I: Input preprocessing (Backward Structure Transfer)

- Structure map of $Y$: Photoshop or image matting
- Train Sketch Module to obtain a sketchy version of $X$

CHALLENGE I: Limited Data

- Generate training data: random cropping $\tilde{X}$, $X$, $Y$

Input $Y$ → Structure $X$ → Sketch Module $G_B$ → Sketchy structure $\tilde{X}$ → cropping → $\tilde{x}$, $x$, $y$
Backward Structure Transfer ($G_B$)

- Gaussian blur to maps $T$ and $X$ into a smooth domain
- Train CNN to map the smoothed image back to the text domain

Proposed Method

- Gaussian blur to maps $T$ and $X$ into a smooth domain
- Train CNN to map the smoothed image back to the text domain
Backward Structure Transfer ($G_B$)

- **CHALLENGE II:** Fast Multi-Scale Transfer
  - The standard deviation of *Gaussian kernel* is controlled by $\ell$
Backward Structure Transfer ($G_B$)

- **CHALLENGE II:** Fast Multi-Scale Transfer
  - Multi-scale training data generation
  - More blurry $\rightarrow$ More sketchy $\rightarrow$ Higher deformation degree

![Style image](image1.png) ![Structure map](image2.png) ![Sketchy Structure map](image3.png)

- Style image
- Structure map
- Sketchy Structure map
Framework

- Stage II: Forward Structure Transfer
  - Conditional image-to-image translation framework
  - Training: learn to map $\tilde{x}_\ell$ with different deformation degrees back to $x$
Forward Structure Transfer ($G_S$)

**CHALLENGE II: Fast Multi-Scale Transfer**

- **Controllable Resblock**: linear combination of 2 ResBlocks weighted by $\ell$
- $\ell = 0/1$: solely deal with greatest / tiniest structure deformation
- $\ell \in (0,1)$: compromise between the two extremes
**Forward Structure Transfer (Gₜₛ)**

- **Stage II: Forward Structure Transfer**
  - Conditional image-to-image translation framework
  - Test: transfer the shape style of $x$ onto $T$, producing $T_\ell^X$
  - Glyph loss: text legibility preservation
Proposed Method

Stage II: Forward Texture Transfer

- Standard image-to-image translation framework
- Train: learn to map $x$ to $y$
Forward Texture Transfer ($G_T$)

- Standard image2image translation framework
  - Test: render the texture in $Y$ onto $T^X_{\ell}$ to yield the final artistic text $T^Y_{\ell}$
  - Style loss: enhance texture details
Framework

Stage I: Input Preprocessing (Backward Structure Transfer)

Stage II: Forward Style (Structure and Texture) Transfer
Comparison with Other Methods

<table>
<thead>
<tr>
<th>Input style</th>
<th>Target text</th>
<th>Image Analogy\textsuperscript{1}</th>
<th>NST\textsuperscript{2}</th>
<th>Doodle\textsuperscript{3}</th>
<th>T-Effect\textsuperscript{4}</th>
<th>UT-Effect\textsuperscript{5}</th>
<th>Ours</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Input style 1" /></td>
<td><img src="image2.png" alt="Target text 1" /></td>
<td><img src="image3.png" alt="Image Analogy 1" /></td>
<td><img src="image4.png" alt="NST 1" /></td>
<td><img src="image5.png" alt="Doodle 1" /></td>
<td><img src="image6.png" alt="T-Effect 1" /></td>
<td><img src="image7.png" alt="UT-Effect 1" /></td>
<td><img src="image8.png" alt="Ours 1" /></td>
</tr>
<tr>
<td><img src="image9.png" alt="Input style 2" /></td>
<td><img src="image10.png" alt="Target text 2" /></td>
<td><img src="image11.png" alt="Image Analogy 2" /></td>
<td><img src="image12.png" alt="NST 2" /></td>
<td><img src="image13.png" alt="Doodle 2" /></td>
<td><img src="image14.png" alt="T-Effect 2" /></td>
<td><img src="image15.png" alt="UT-Effect 2" /></td>
<td><img src="image16.png" alt="Ours 2" /></td>
</tr>
</tbody>
</table>

\textsuperscript{1} A. Hertzmann, C. E. Jacobs, N. Oliver, B. Curless, and D. H. Salesin. Image analogies. SIGGRAPH. 2001
\textsuperscript{3} A. J. Champandard. Semantic style transfer and turning two-bit doodles into fine artworks. Arxiv. 2016
\textsuperscript{4} S. Yang, J. Liu, Z. Lian, and Z. Guo. Awesome typography: statistics-based text effects transfer. CVPR. 2017
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Scale-Controllable Style Transfer

Reference style

Target text

Adjusting glyph deformation degree
Scale-Controllable Style Transfer

Reference style

Target text

Adjusting glyph deformation degree
Applications

- **dynamic text generation**
  - By adding random noises
  - By adding interpolated noise

- **diverse structure/texture mixture**

- **stroke-based art design**
Bidirectional Shape Matching
- Training data generation
  - Backward structure transfer
  - Image cropping
- Fast forward multi-scale structure transfer
  - Smoothness-based sketch module
  - Controllable Resblock

Experimental Results
- Impressive results compared with other state-of-the-arts
- Applications
Project

Poster Info:

Poster # 02
Poster 3.1 (Hall B)
Thursday, 10:30 – 13:00