# Multi-Style Transfer Generative Adversarial Network for Text Images


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# Introduction

- Neural style transfer have shown impressive results in deep learning.
- Recent researches have successfully completed the transition from the text font domain. to the text style domain.

Image Style Transfer Using Convolutional Neural Networks [Gatys, CVPR 2016]


Controllable Artistic Text Style Transfer via Shape-Matching GAN [Yang, CVPR2019]

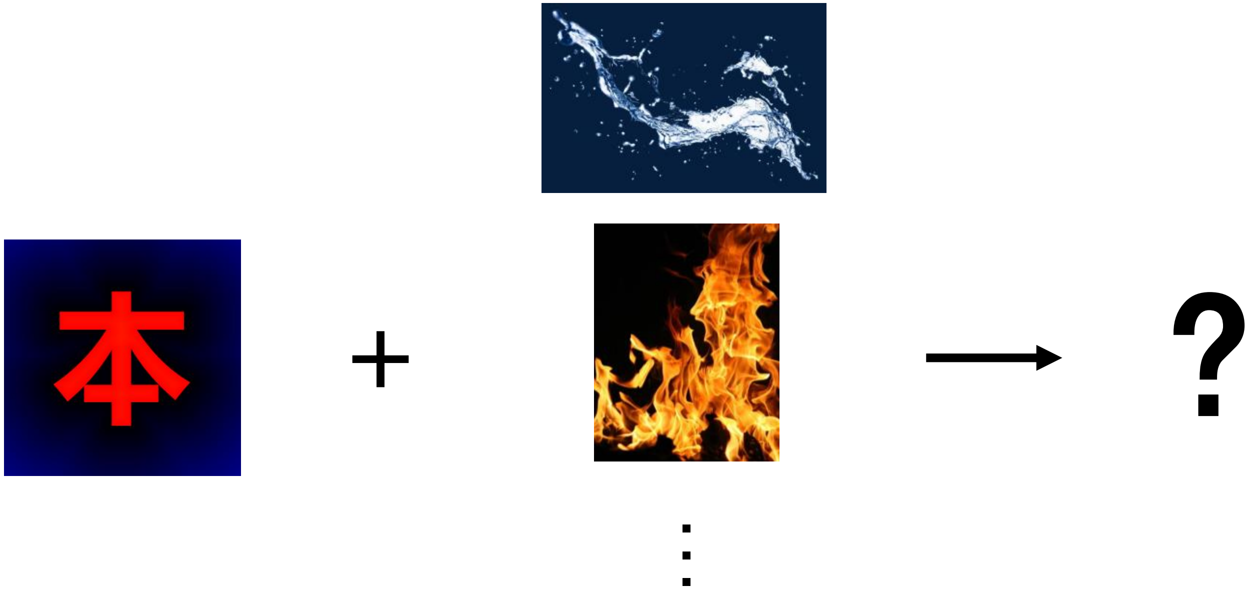
# Introduction

- However, for text style transfer, multiple style transfer often requires learning many models.

- Generating multiple styles images of texts in a single model remains an unsolved problem.

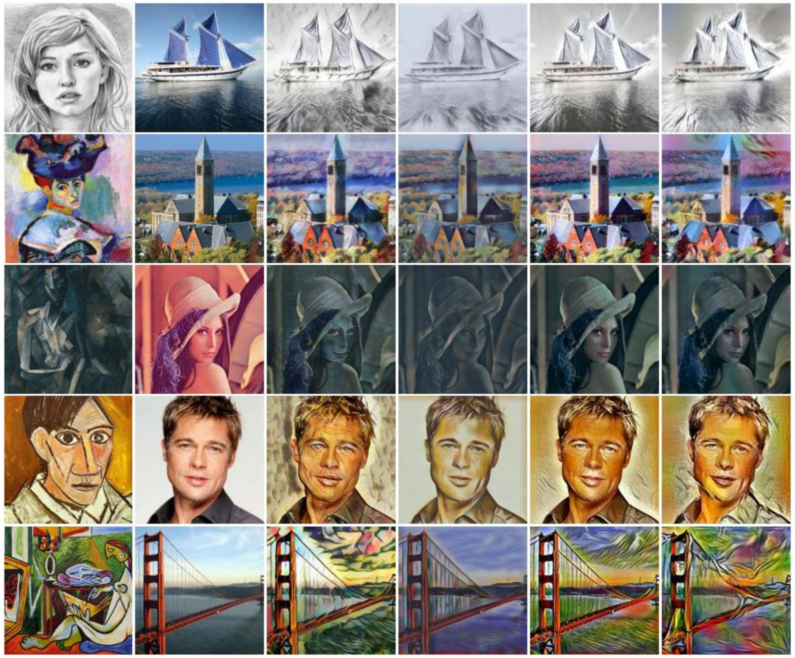
# Introduction

- We propose a multiple style transformation network, which can generate multiple styles of text images in a single model and control the style of texts in a simple way.



# Related work
# *1. Style Transfer*

- The existing researches (Neural image style transfer,AdaIN) related to style transformation of images have made very significant progress.

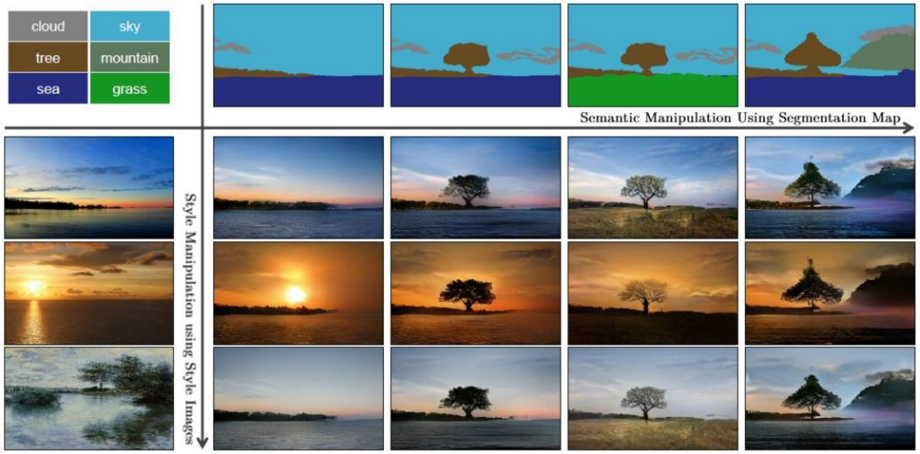


cited from adain[CVPR,2017]

# Related work

## *2.Image-to-image translation*

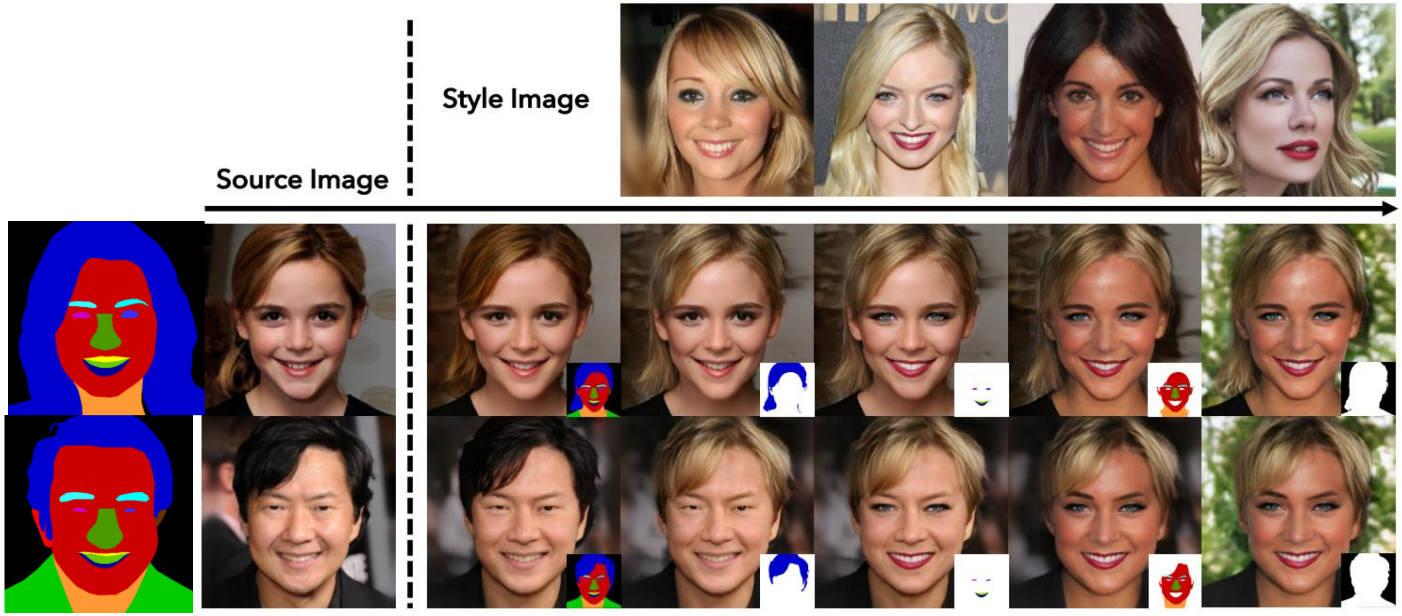
- SPADE [7] allows users to create an actual composite image from a simple image drawn by the user.
- Proposes a new normalization layer Spatially-Adaptive Normalization.




cited from SPADE[Park et al.,CVPR2019]

# Related work

- SEAN [18] made improvements for SPADE [7]. Individual control of each region of a semantic segmentation image was achieved.

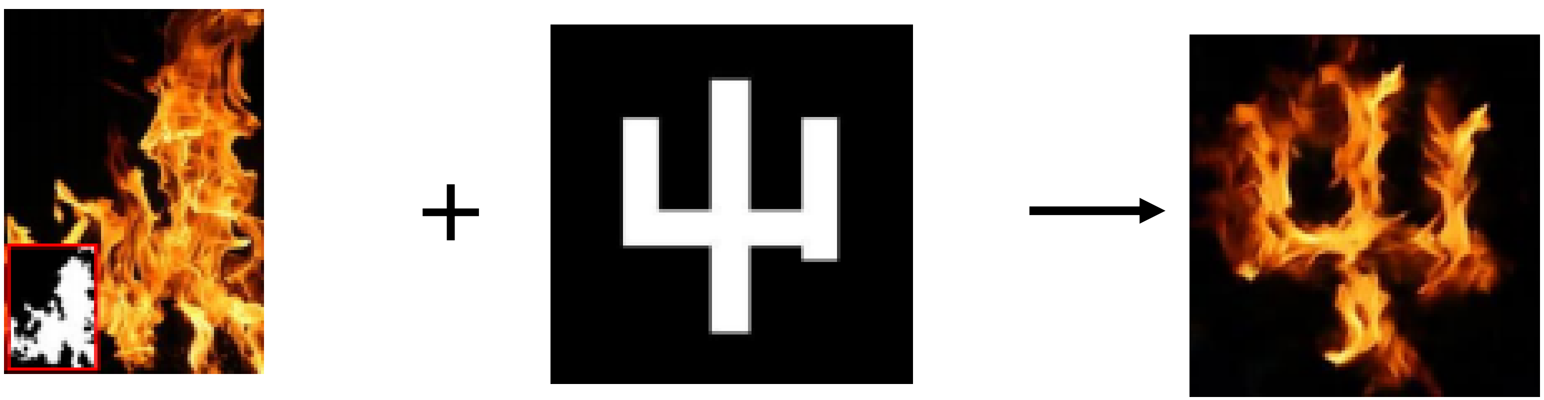



cited from SEAN[Zhu, CVPR 2020]

# Related work

## *3. Text font style transfer*

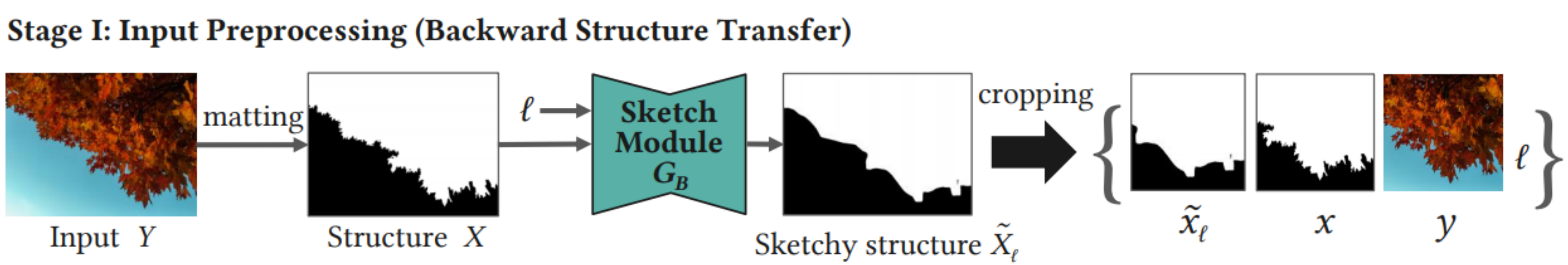
- Can transform text styles by learning one style image and can control different degrees of style.



cited from Shape-Matching GAN [Yang, CVPR2019]

# Shape-Matching GAN

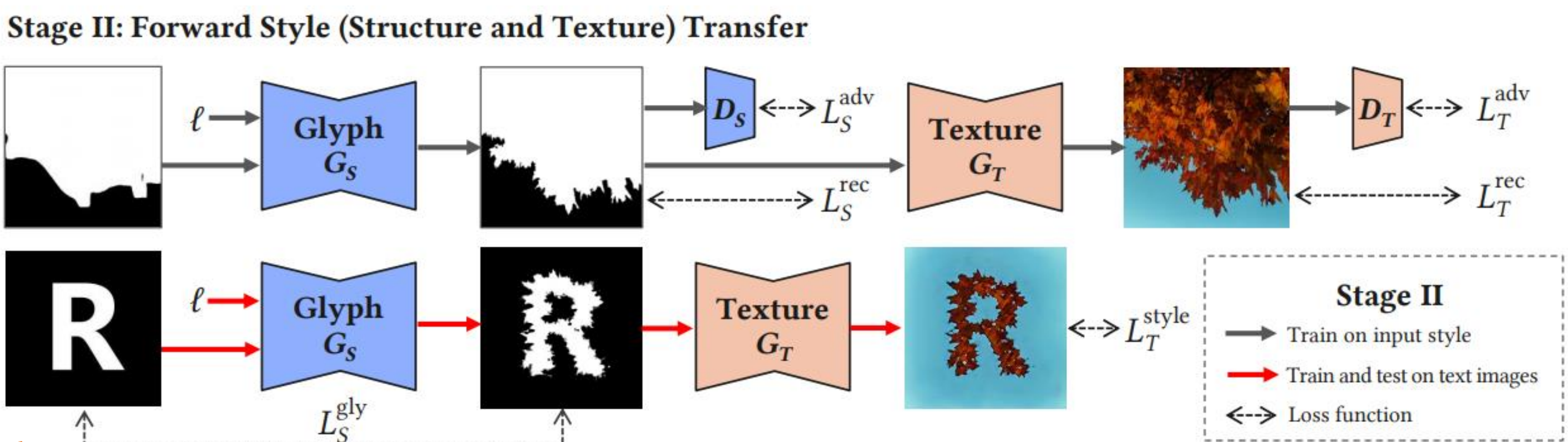
- Base method Shape-Matching GAN.
- Stage 1:sketch module is used to change the style images into different degrees of deformation through the parameter l.




from Controllable Artistic Text Style Transfer via Shape-Matching GAN [Yang, CVPR2019]

# Shape-Matching GAN

- Base method Shape-Matching GAN.
- Stage 2: there are two main parts,structure module (GS,DS) and texture module (GT,DT).




cited from Controllable Artistic Text Style Transfer via Shape-Matching GAN [Yang, CVPR2019]

# Shape-Matching GAN

- Network requires only one style image for text style transformation.

- Shape-Matching GAN works well when learning just one style, but it does not work when learning multiple styles.

- multiple styles of text can not be generated with only one model.

# Proposed method

- we propose a multiple style transformation network for text style transfer based on Shape matchingGAN.

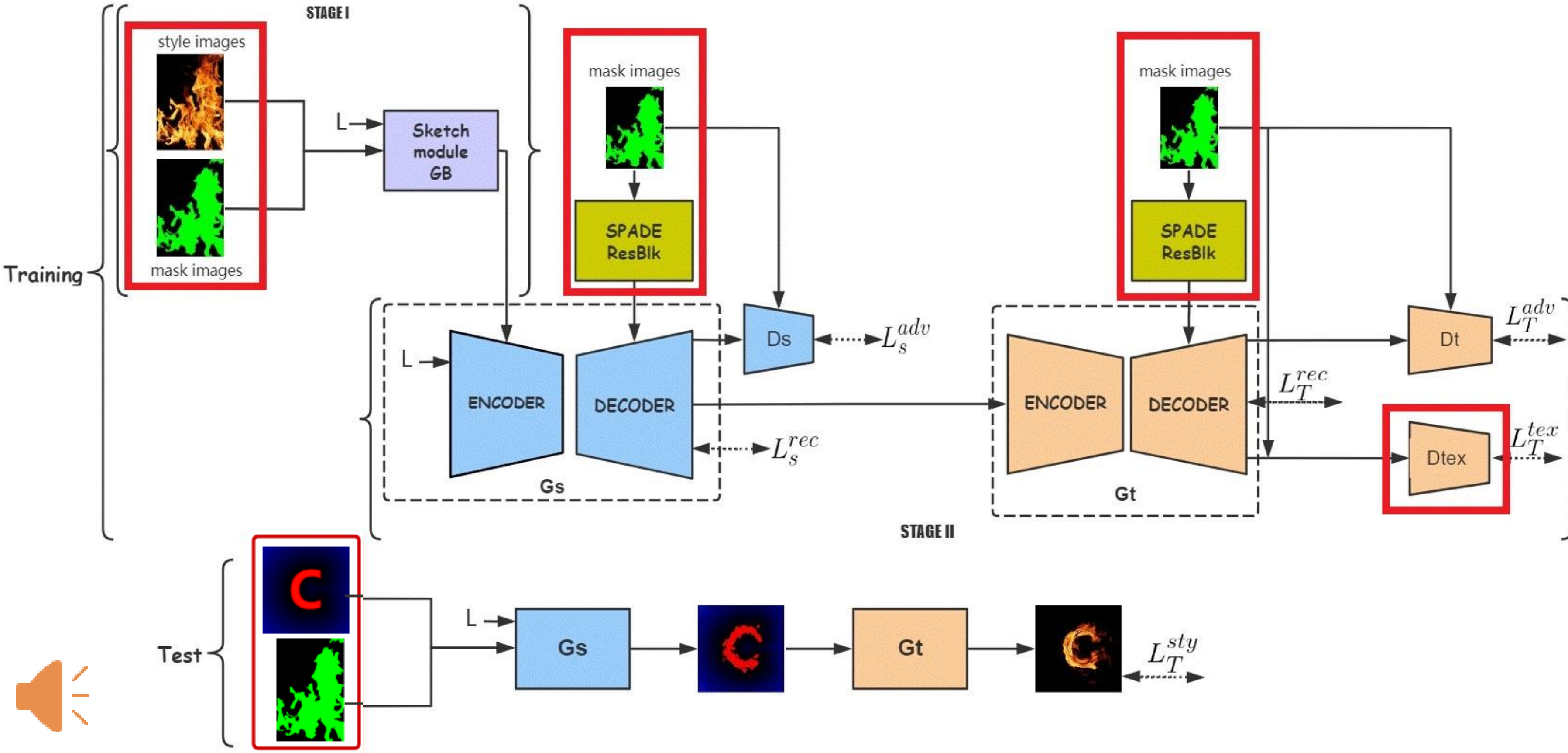
- our main idea:

1.add conditions.

2.optimize the network.

# Proposed method

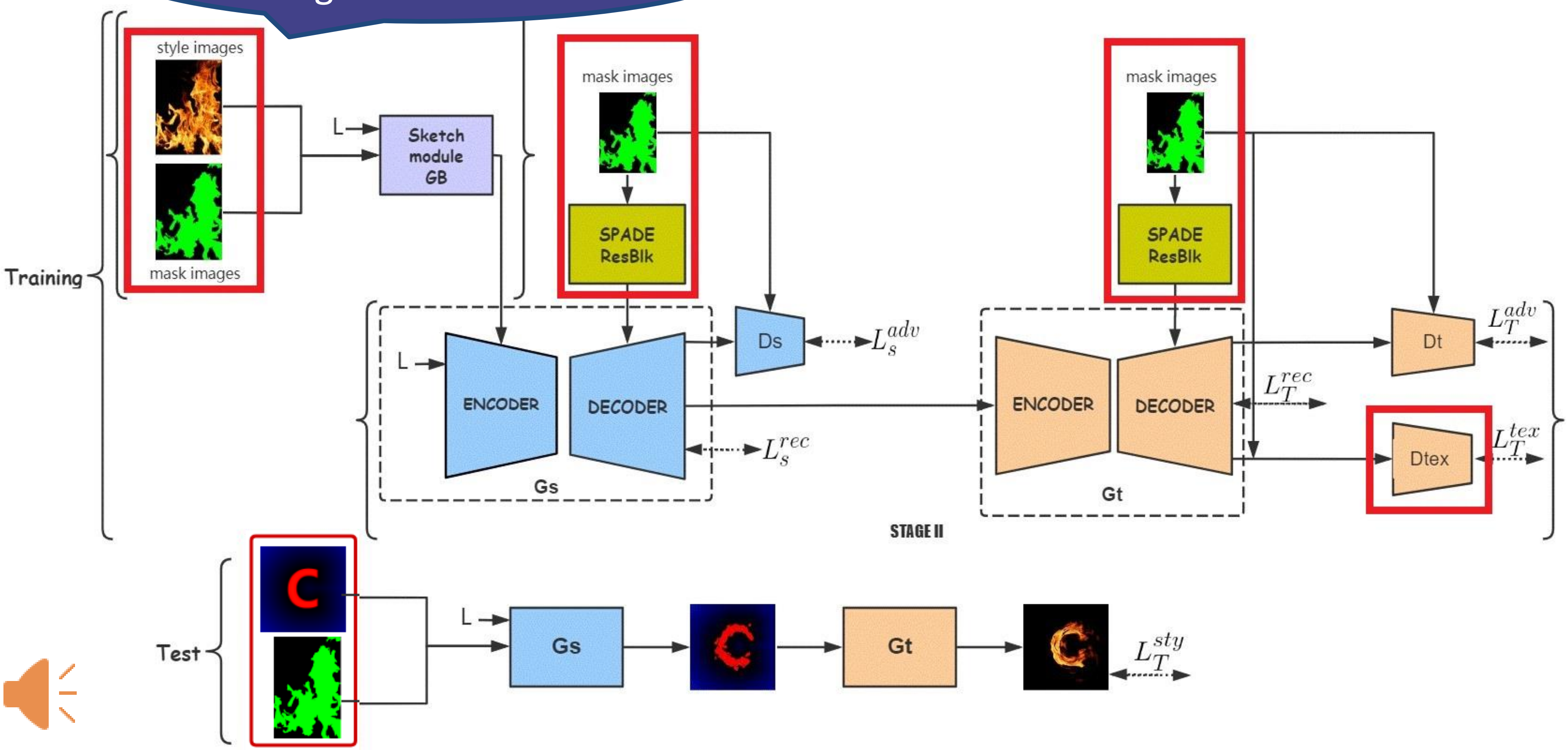
- The red line shows the network structure that we have changed for Shape-MatchingGAN.



# Conditional input

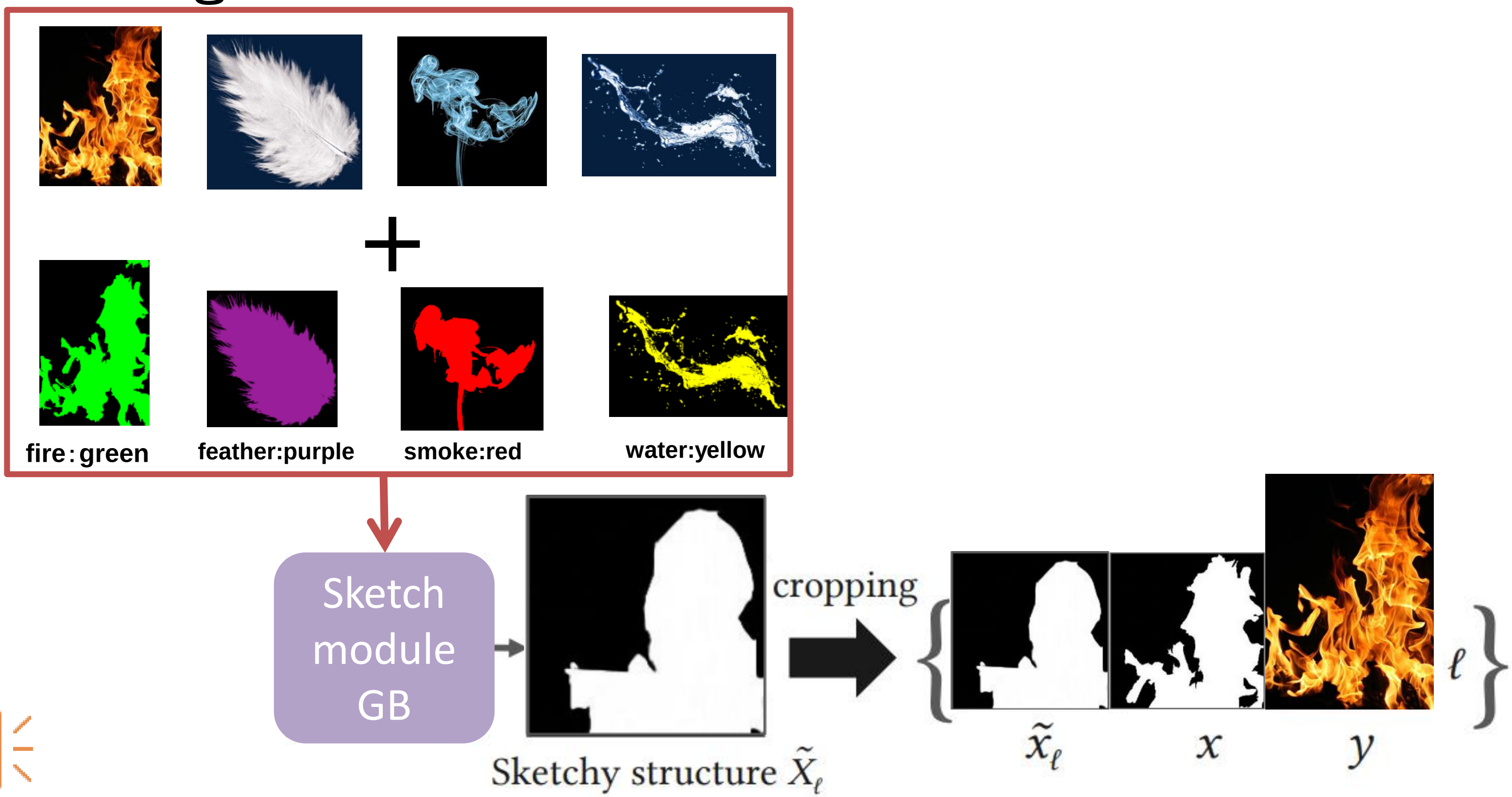
- Conditi

1.put the mask images as conditions



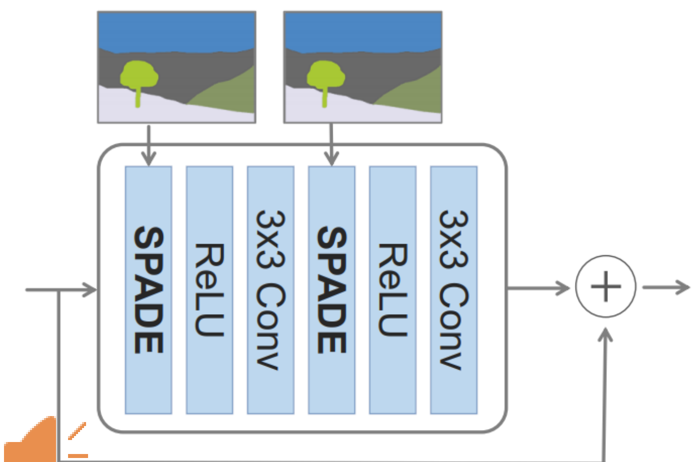
# Conditional input

- Input into the network in pairs with the style images.

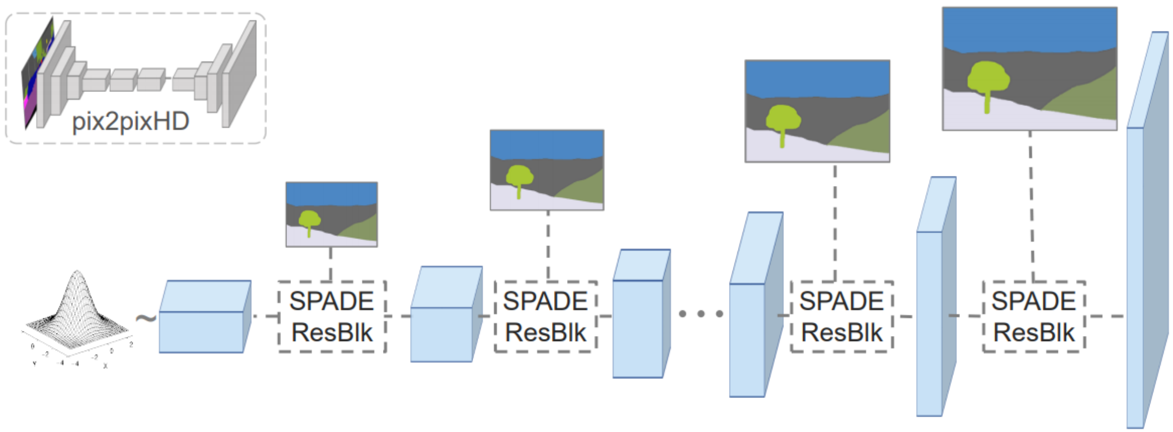


# Multi-style training

- SPADE layer can effectively prevent the information about mask images from being washed out in the network.




SPADE ResBlk

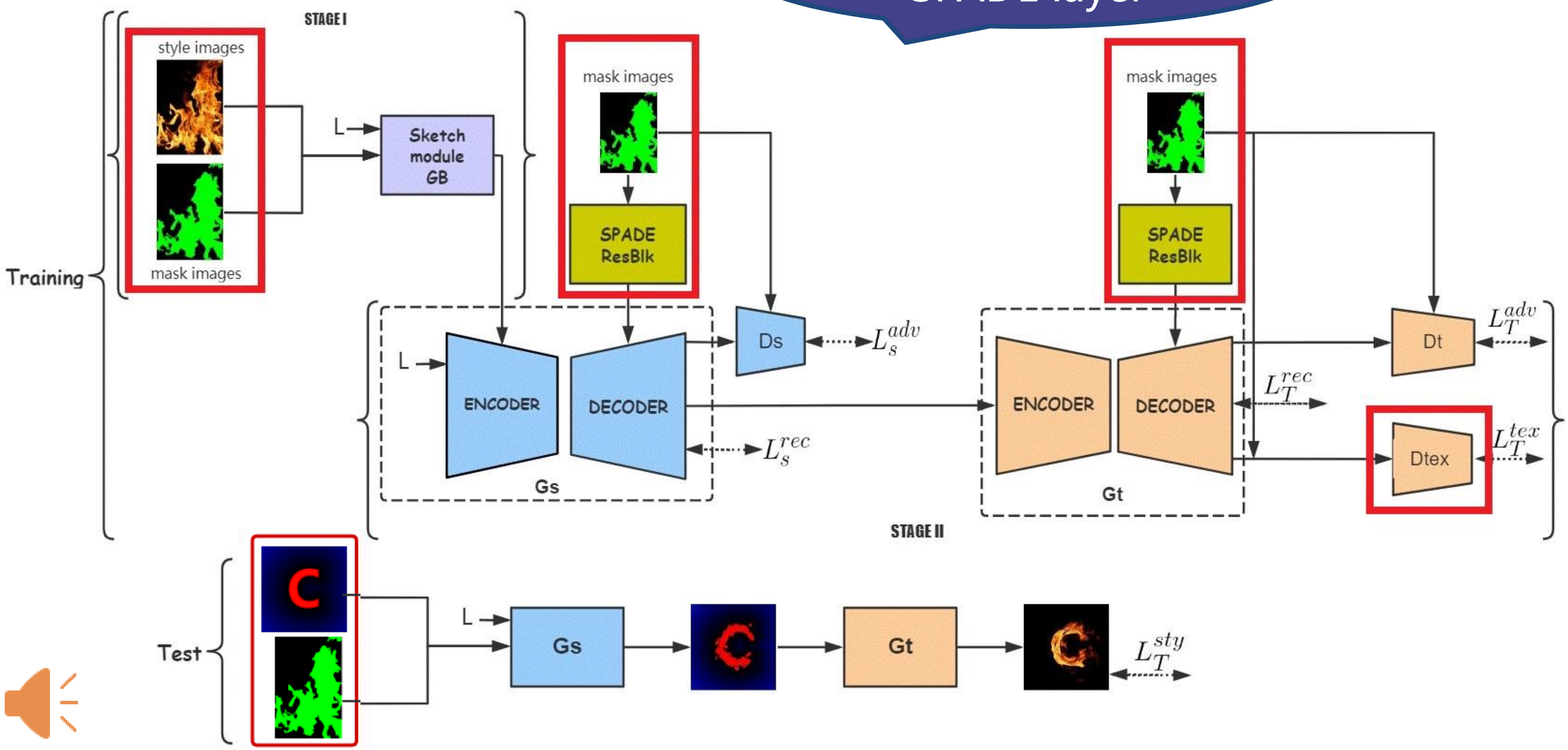



SPADE[Park et al.,CVPR2019]

# Multi-style training

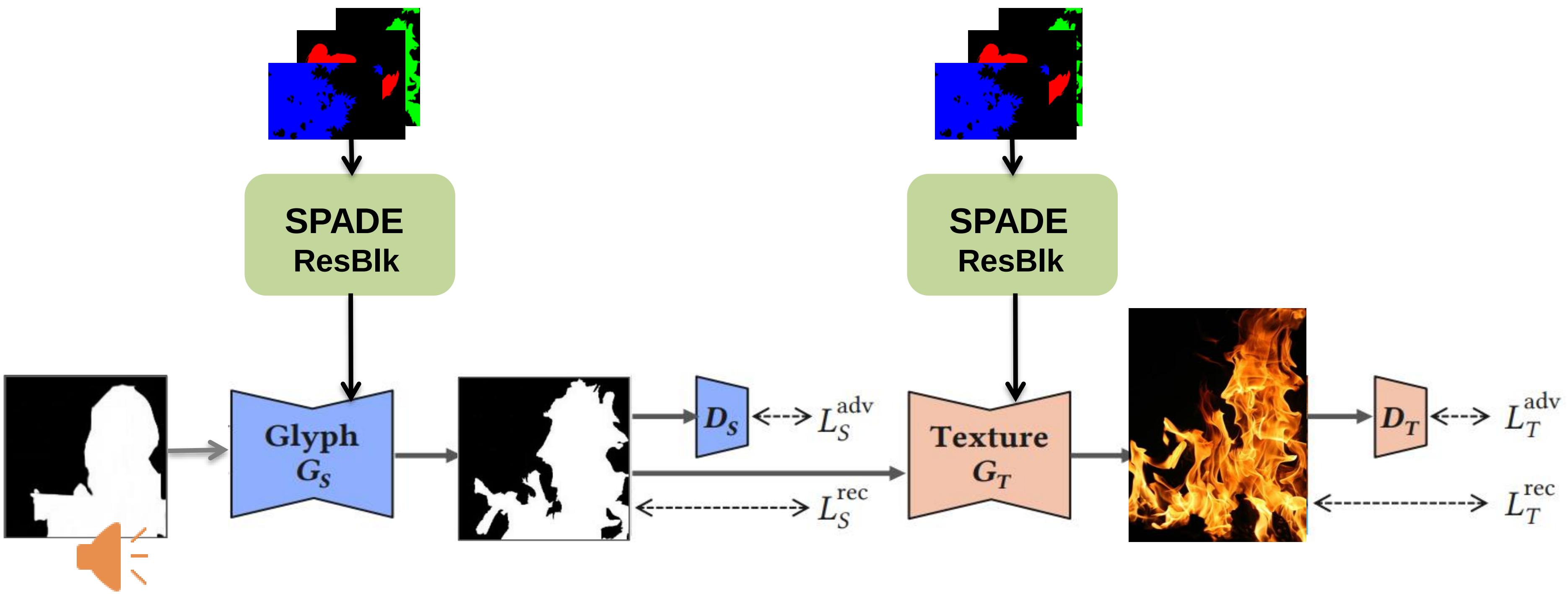
- Implemented the SPADE layer in Shape-Matching GAN.

2.implemented the SPADE layer



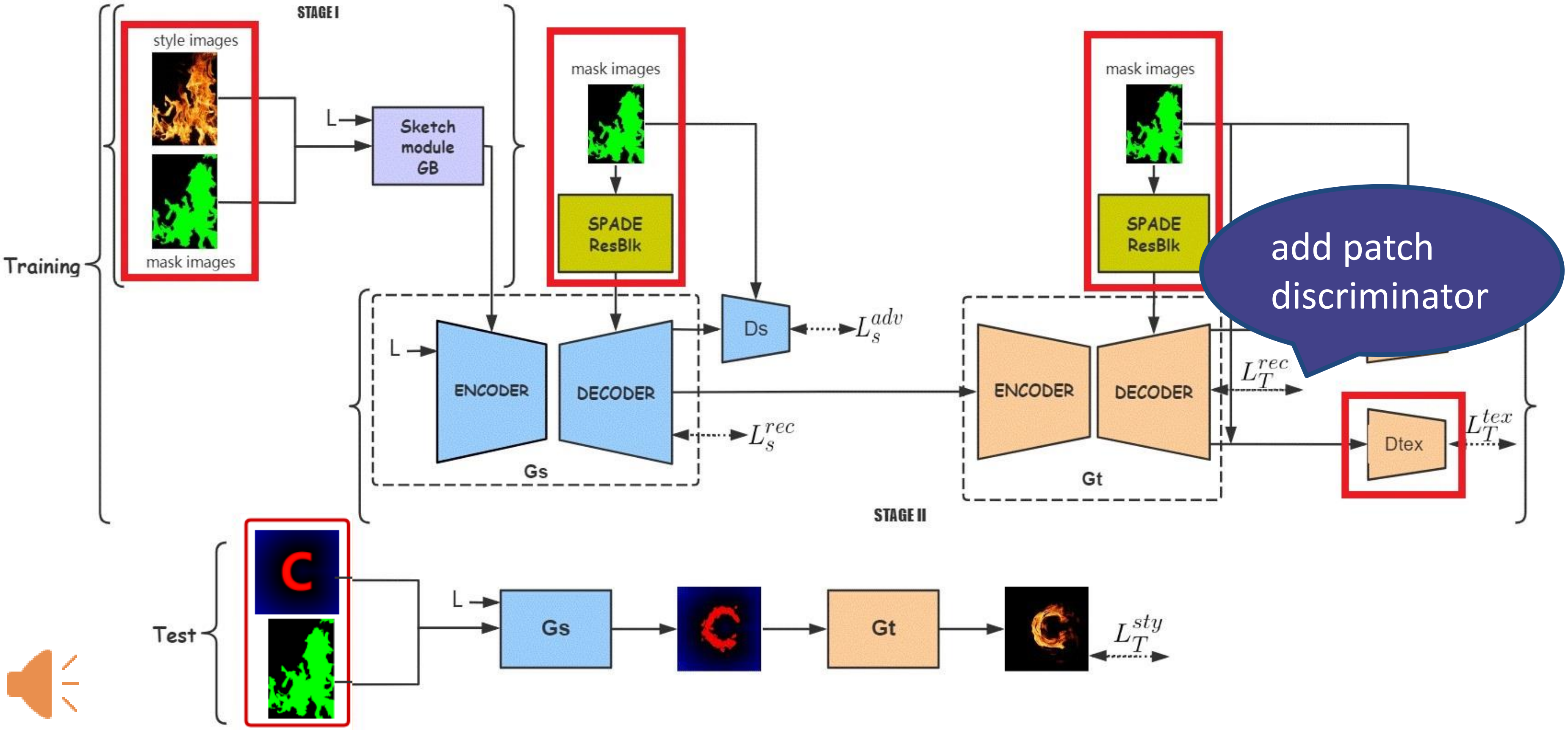
# Multi-style training

- The mask of the four kinds of the style images is used as input for SPADE ResBlk.



# Improving the quality of the generated images

- Add a discriminator to make the quality of the generated images better.



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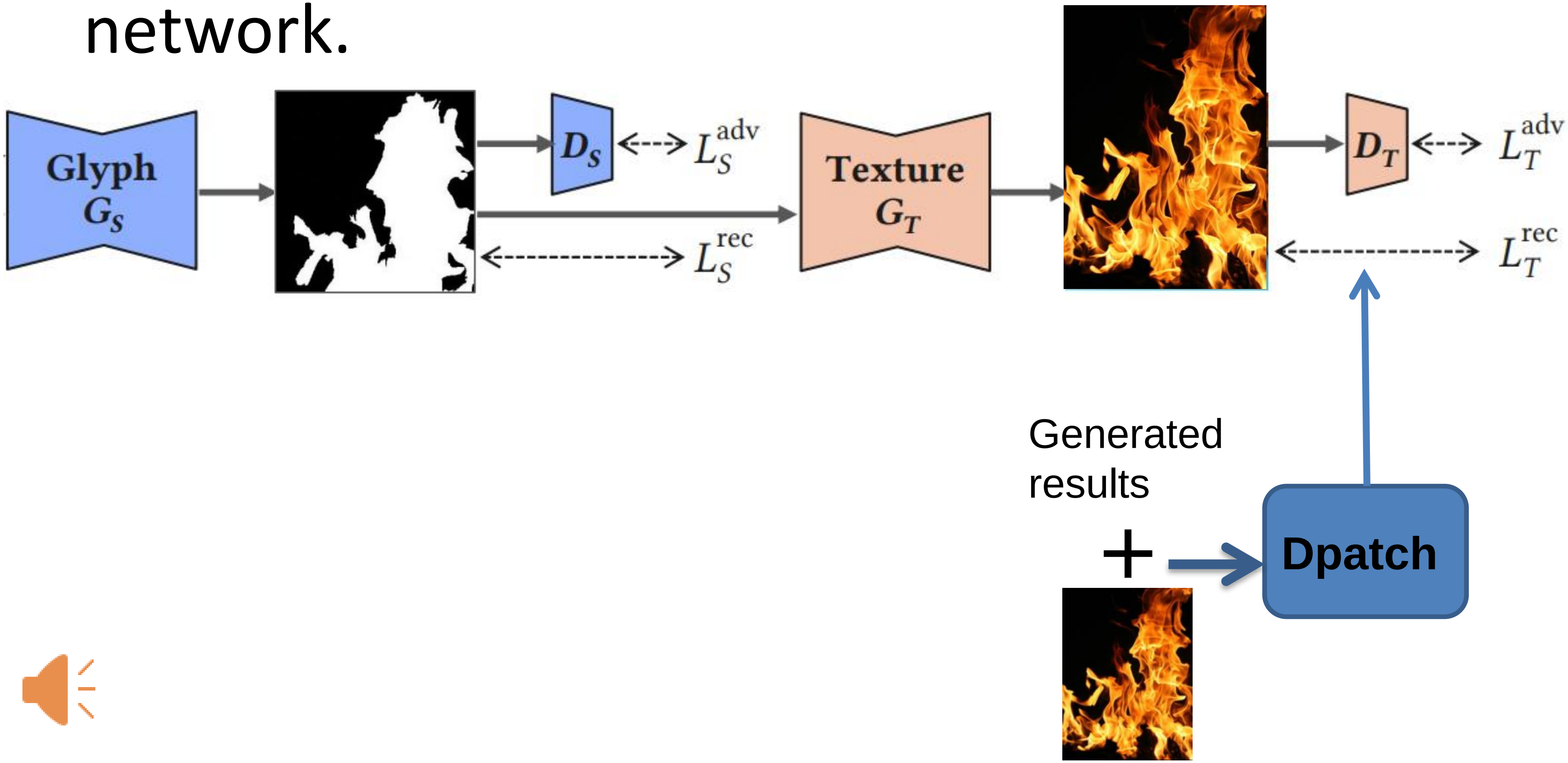
# Improving the quality of the generated images

- Add a PatchGAN discriminator to our texture network.

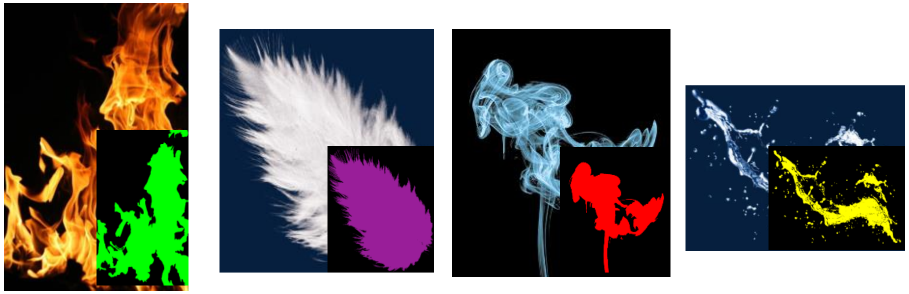


# Dataset

- Dataset: 129 text images, 4 style images and corresponding mask images.

Example of text image

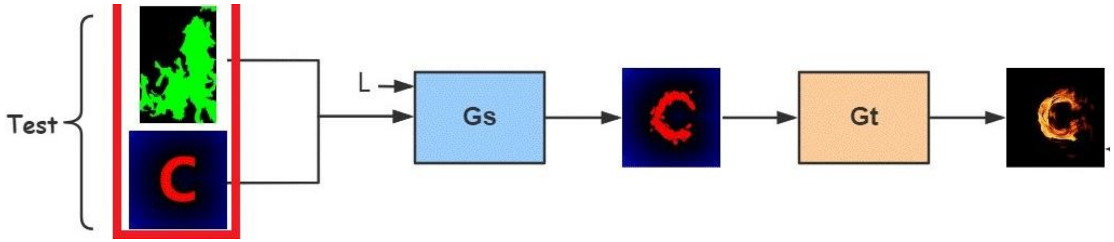

Style image and mask image



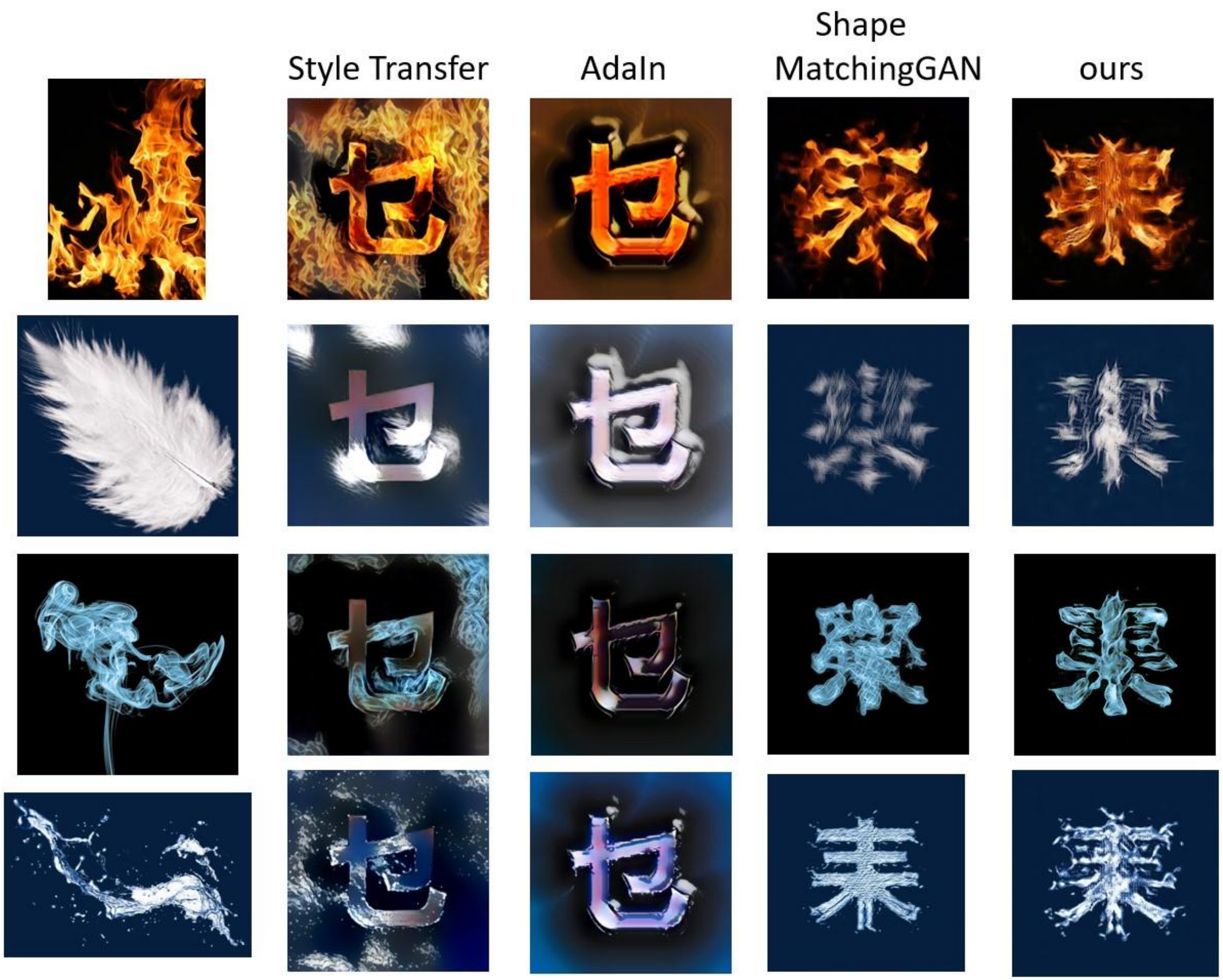
# Network training

- Training process: input the style images and the corresponding mask images into the network in pairs.

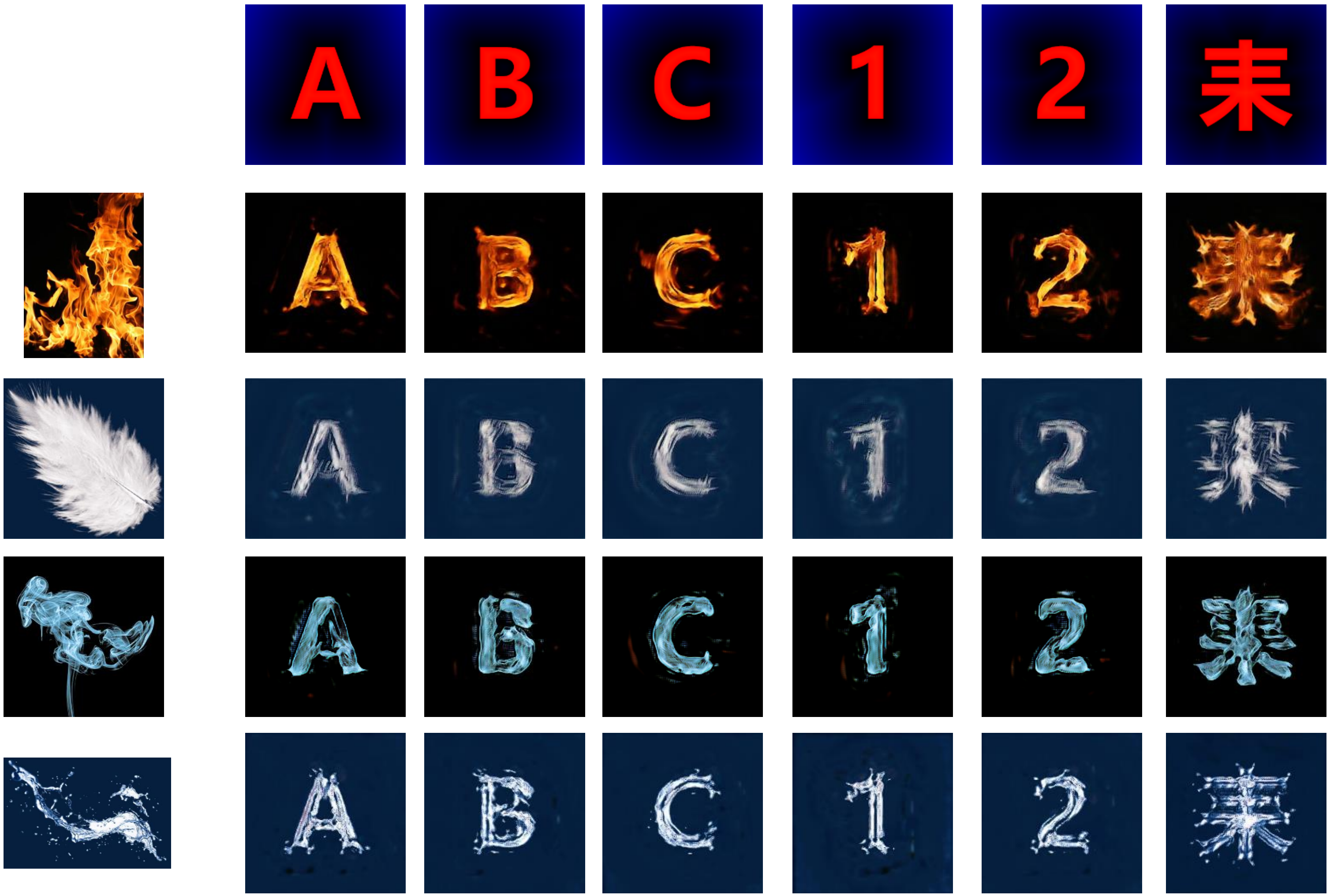
- Testing stage: input the selected text image and style mask image to generate the corresponding style text image.



# Results of the experiments



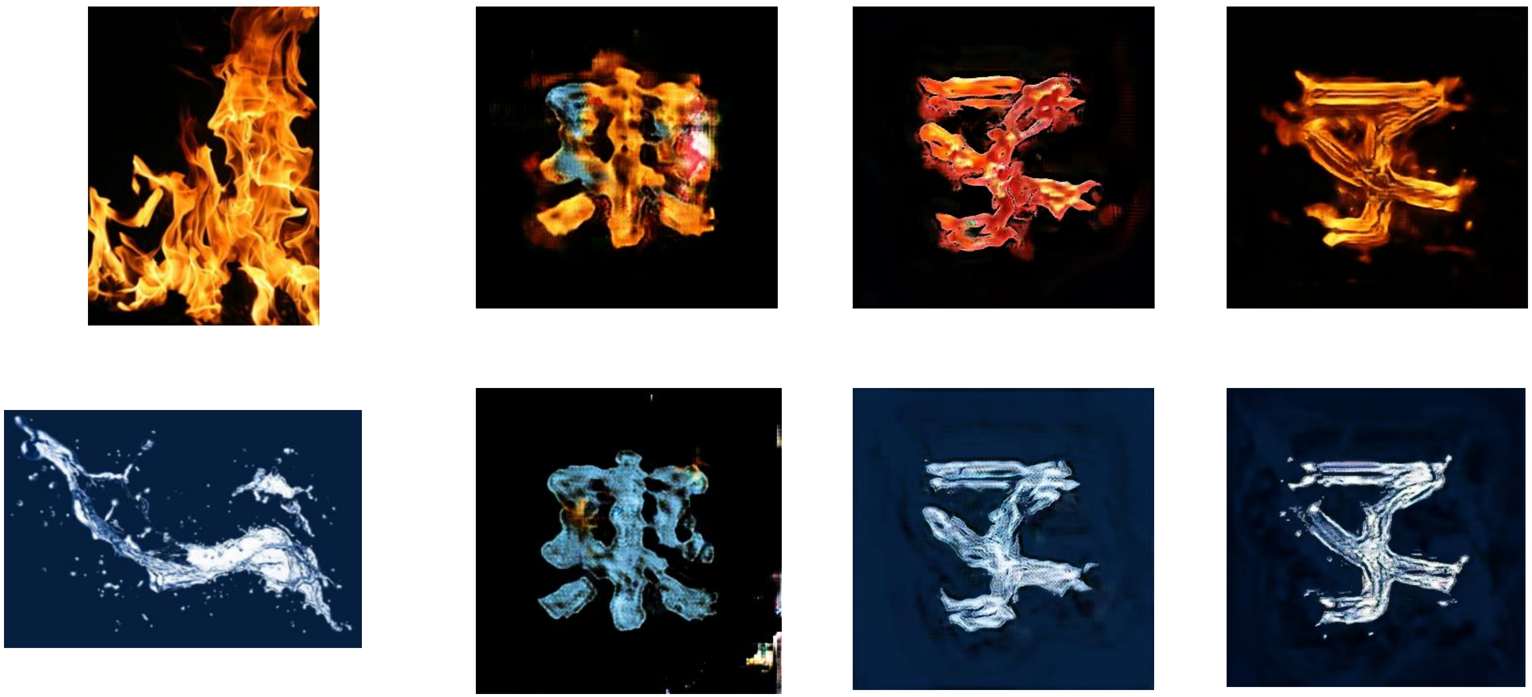
# Results of the experiments



# Results of the ablation study

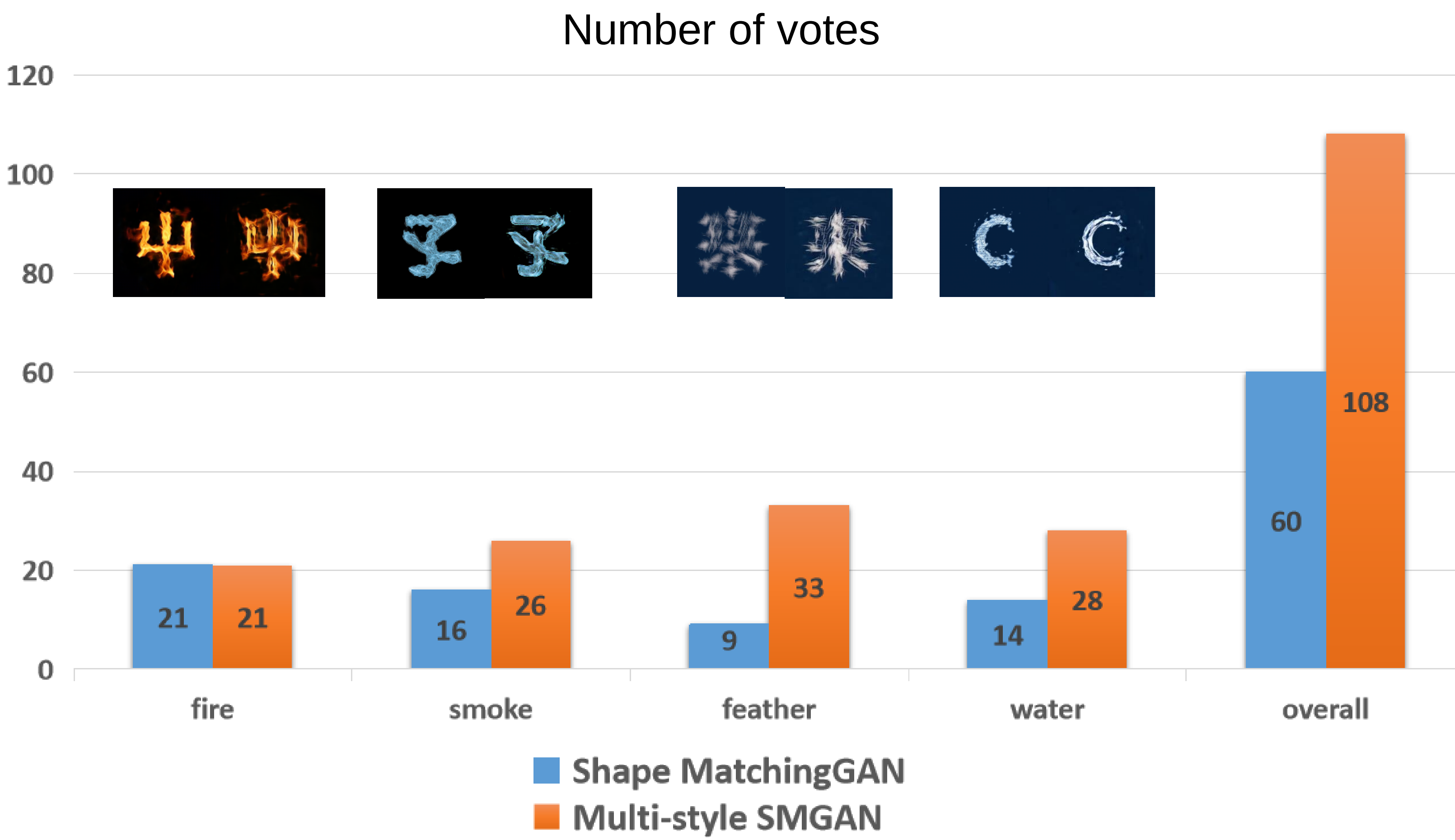
Remove a part of the proposed method.

input style | w/o SPADE | w/o Dpatch | full model



# User study

## **Baseline** vs **Multi-style SMGAN**



# Conclusions

- In this study, we proposed a multi-style transfer network for text.
- We can also control the generation of various styles of text images in the generation stage.
- The results show that we have achieved a good effect on the generated style images based on the effective transformation of multiple text styles.