1. Introduction

- **Neural artistic style transfer** by Gatys et al. (2015) [A]
  - Add a style condition input to ConvDeconv net.
- **Feed-forward fast style transfer** network by Johnson et al. (2016) [B]
  - Timing consuming (1 hr)

Multiple style feed-forward network is desirable!

**Idea 1** Conditional fast style transfer network
- However, only trained styles can be transferred.

Unseen style feed-forward network is better!

**Idea 2** Unseen style transfer network (Extension of a conditional fast style transfer net.)

2. Concurrent Works (mini survey)

(A) Multiple Styles

- V. Dumoulin et al.: A Learned Representation of Artistic Style, ICLR conf. talk, 2017/03
  - (Train style-specific code and shift parameters of all the IN layers)

  - (Train style-specific conv. layers, and switch them.)

(B) Arbitrary Styles


3. Conditional Fast Style Transfer

- **Add a style condition input to ConvDeconv net.**
  - Add a fusion layer and a style input
  - Style input: one-hot conditional vector e.g. style1: [1,0,0,0,...], style2: [0,1,0,0,...], style3: [0,0,1,0,...]
  - Base network: Johnson’s ConvDeconv net [B]
    - Each layer has BN and ReLU except last one.

**Conditional Fast Style Transfer Network**

- **Training**
  - Perceptual loss with VGG16 (the same way as Johnson’s work [B])
    - content: conv3_3
    - style: conv1_2, c2_2, c3_3, c4_3
  - Each mini batch: one content image + all the style images (= multi-style version of Instance Normalization)

**Generating stylized images in three ways**

- Input: content image + style condition image
  - Single style: one-hot vector (1,0,0,0,...), (0,1,0,0,...)
  - Mixed style: multiple-style-weighting
    - Spatial mixed style:
      - [1,1,1,...], [0.2, 0.1, 0.8,...]

**Results of cond. style transfer with trained styles**

4. Unseen Style Transfer

- **Add a style condition network to the conditional FST network.**
  - Confirmed that a real-value cond. is OK.
  - Style condition vector can be generated by a CNN (not by hand)
  - Propose a style condition network which generates a style condition vector from a given style image directly.

**Unseen Style Transfer Network**

- **Training**
  - End-to-end training with perceptual loss
  - Each mini batch: one content image + randomly selected style images from 50,000 style images (WikiArt)

**Generating stylized images in three ways**

- The same way as a Conditional Fast Style Transfer Network

**Results of unseen style transfer with NOT-trained styles**

5. Mobile Implementation

- Shrink the network for mobile devices.
  - Add one down-conv. and one up-conv.
  - Reduce the num of ResBlock from 5 to 3

Online Demo

- Conditional style transfer
- Unseen style transfer

References
