Artistic Style Transfer

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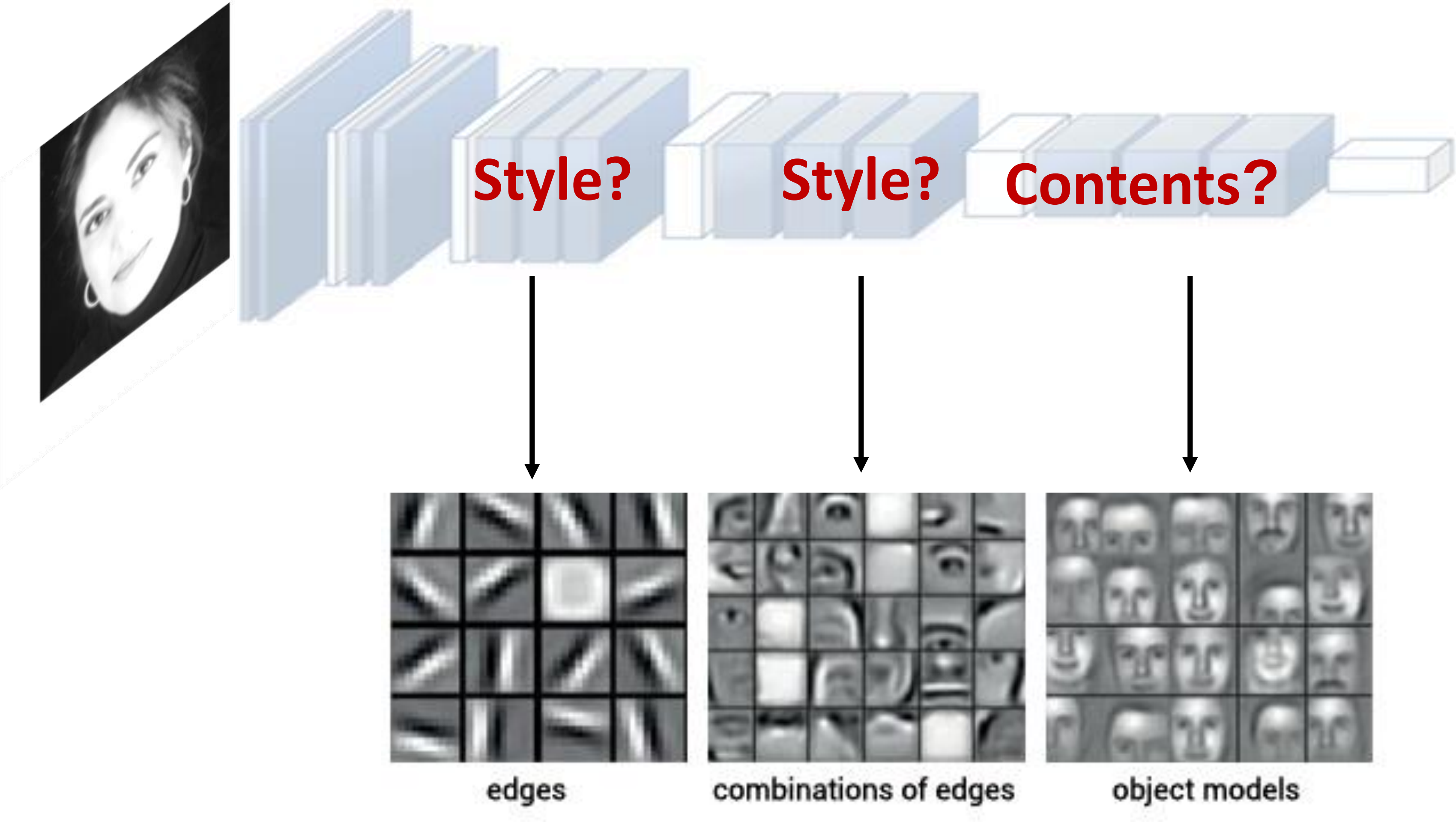
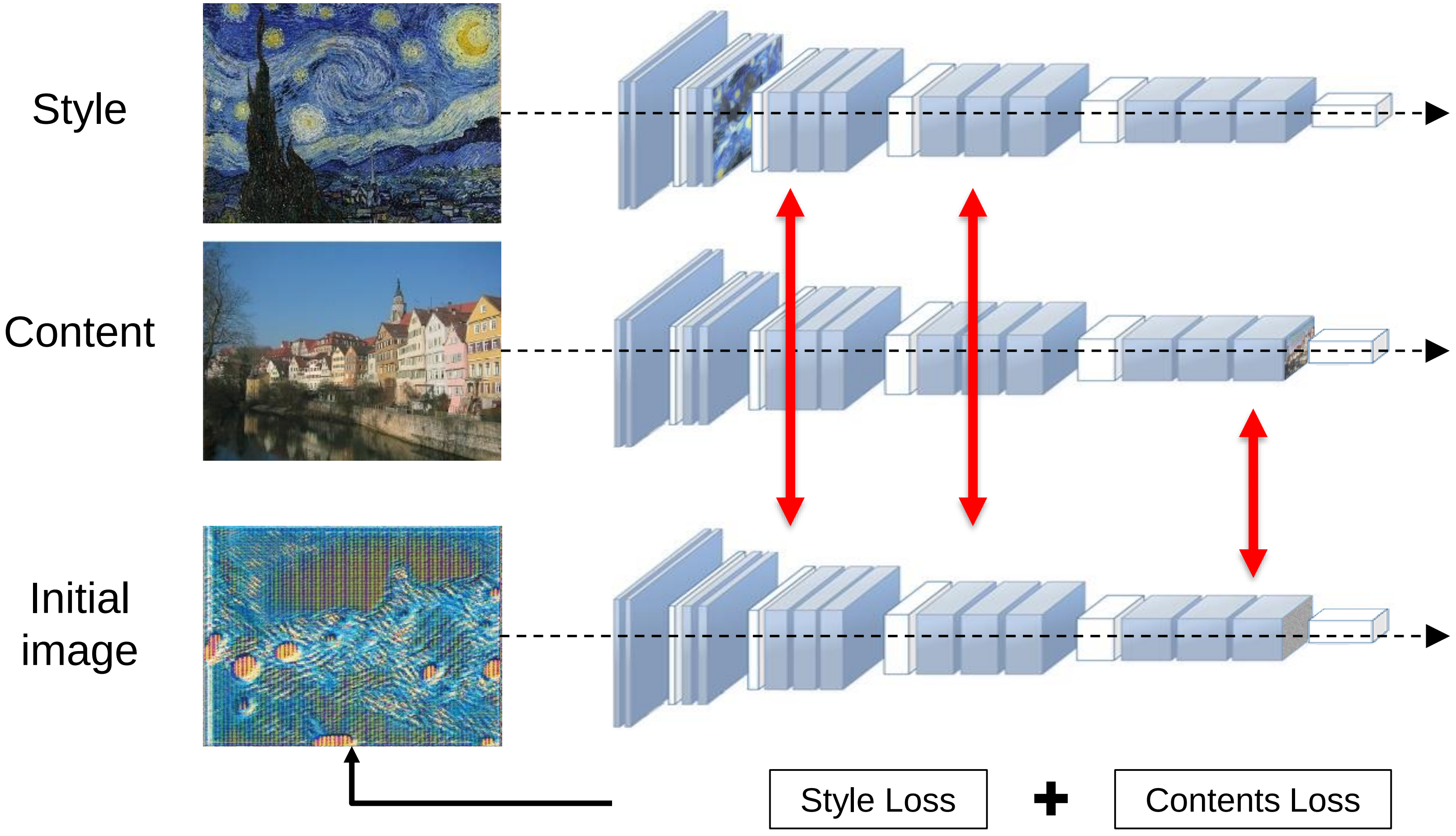
Artistic Style Transfer

Convolutional NN

- Hierarchical feature representation

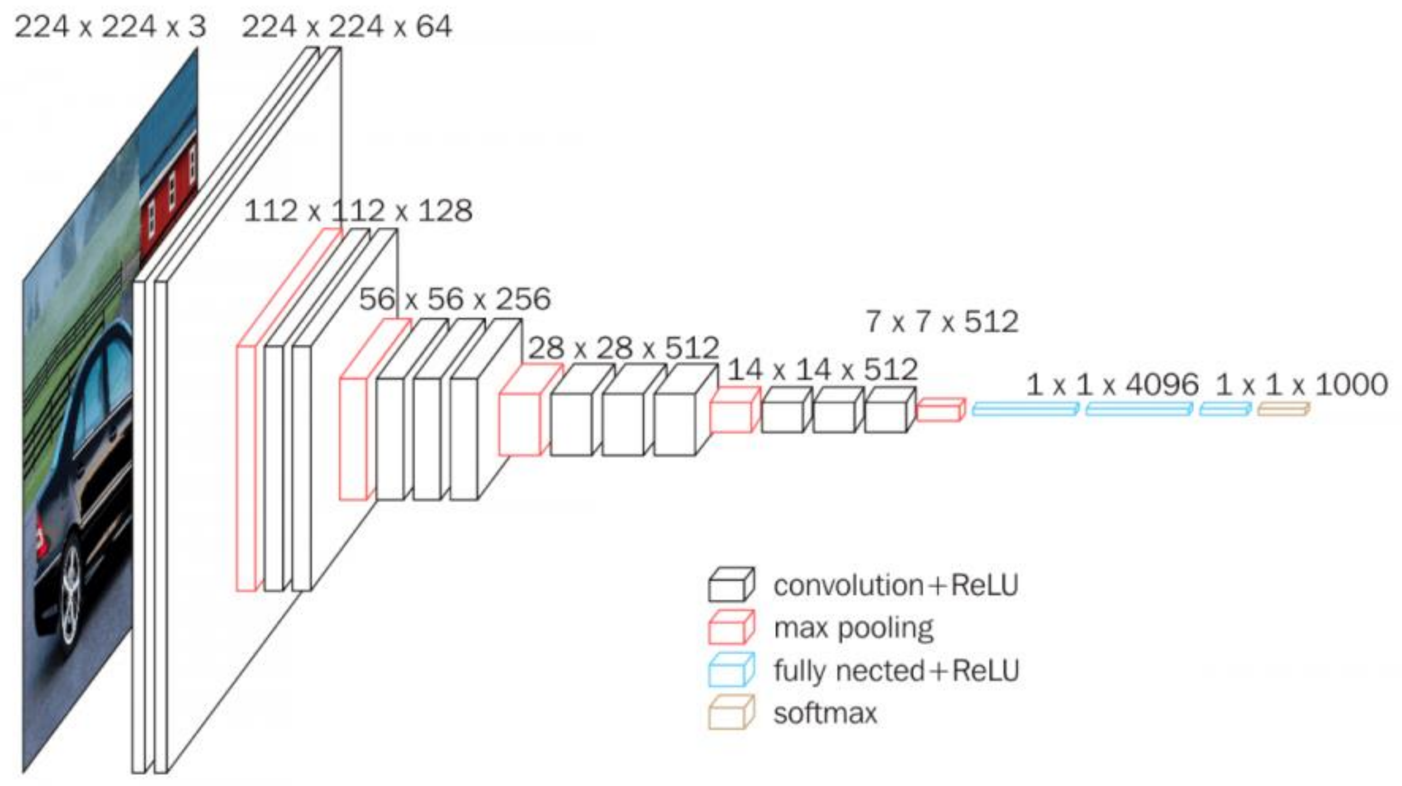


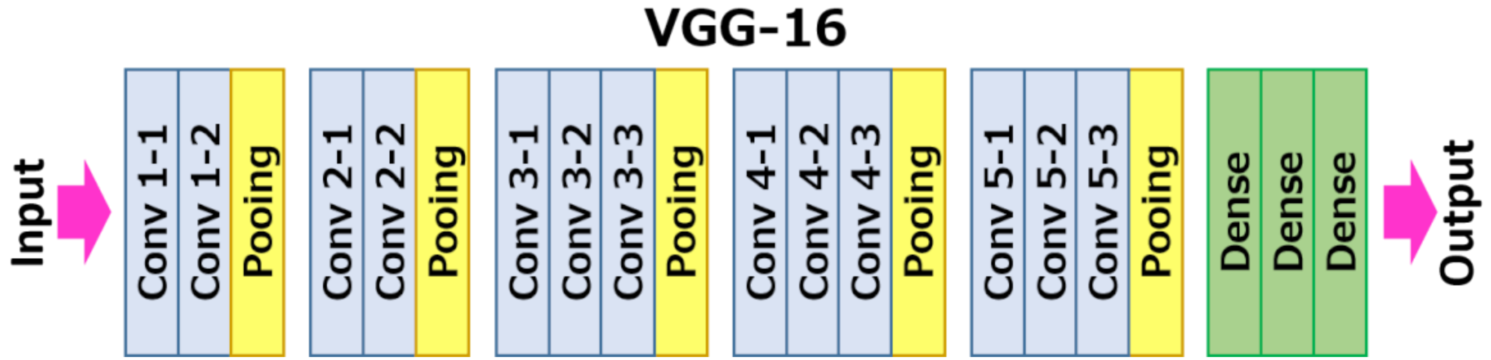
Artistic Style Transfer



Implementation

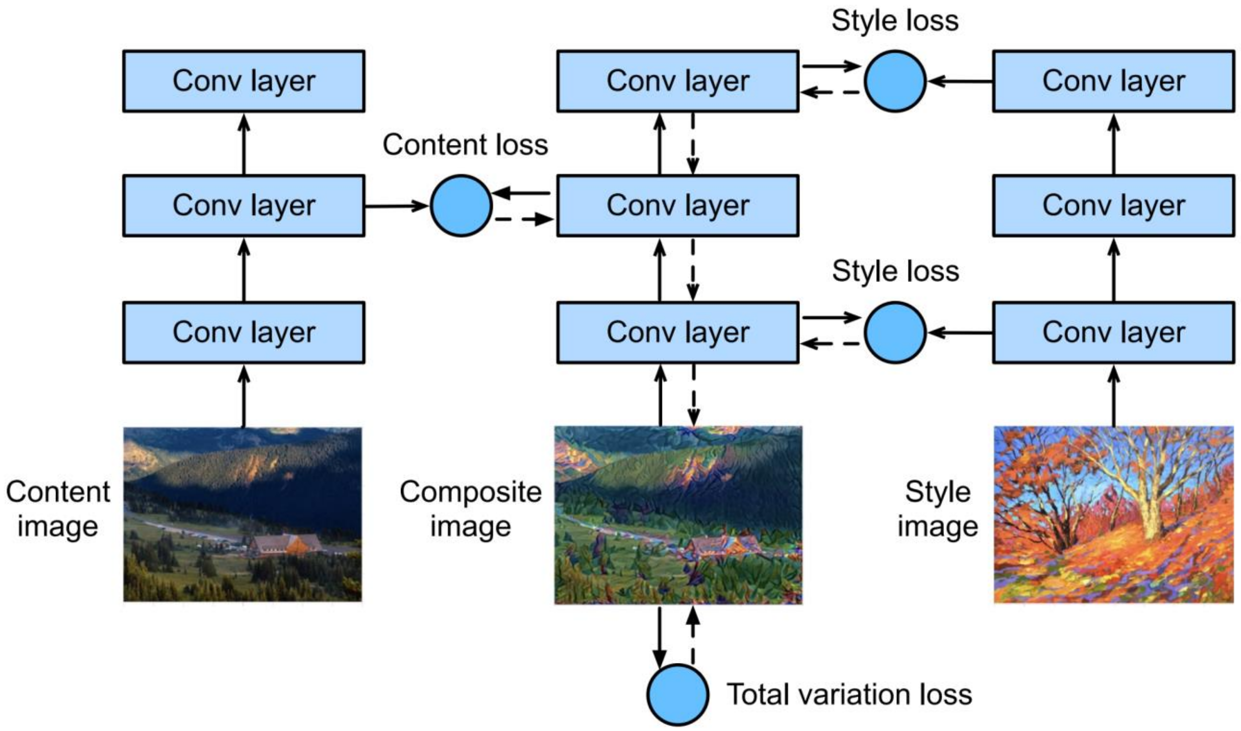
- VGG16





Implementation

- Composite image is the only variable that needs to be updated
- We select a pre-trained CNN to extract image features
- The output of certain layers to use as content features or style features



Implementation

- Content loss is used to make the composite image approximate the content image as regards content features

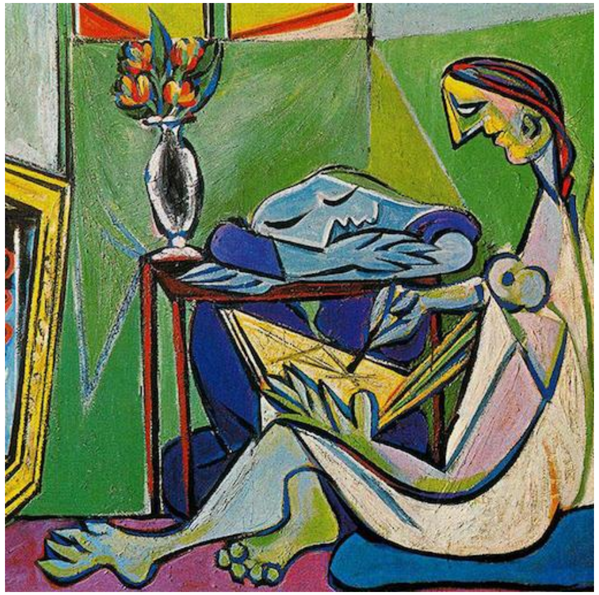
```
def get_loss_content(gen_layer, ref_layer):
    loss = tf.reduce_mean(tf.square(gen_layer - ref_layer))
    return loss
```

- Style loss is used to make the composite image approximate the style image in terms of style features
  - Gram matrix

```
def get_gram_matrix(conv_layer):
    channels = conv_layer.get_shape().as_list()[3]
    conv_layer = tf.reshape(conv_layer, (-1, channels))
    gram_matrix = tf.matmul(tf.transpose(conv_layer), conv_layer)
    return gram_matrix/((conv_layer.get_shape().as_list()[0])*channels)

def get_loss_style(gram_matrix_gen, gram_matrix_ref):
    loss = tf.reduce_mean(tf.square(gram_matrix_gen - gram_matrix_ref))
    return loss
```

Results



Total Variance Loss

- Sometimes, the composite images we learn have a lot of high-frequency noise, particularly bright or dark pixels.
- One common noise reduction method is total variation denoising.

$$\sum_{i,j} |x_{i,j} - x_{i+1,j}| + |x_{i,j} - x_{i,j+1}|$$

```
def get_loss_TV(conv_layer):
    loss = tf.reduce_mean(tf.abs(conv_layer[:,:,1:,:] - conv_layer[:,:,:-1,:])) ...
          + tf.reduce_mean(tf.abs(conv_layer[:,1:,:,:] - conv_layer[:,:-1,:,:]))
    return loss
```

Results