# Style transfer

# Style transfer



- Content of source

- Style of target

- How do we measure style and content?

Image generative by https://github.com/pytorch/examples/tree/master/fast_neural_style

# Content

- High level activations of a CNN

  - e.g. VGG
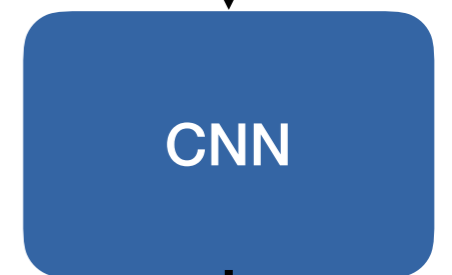
# Style

- Low level activations?

  - Contain both style and content
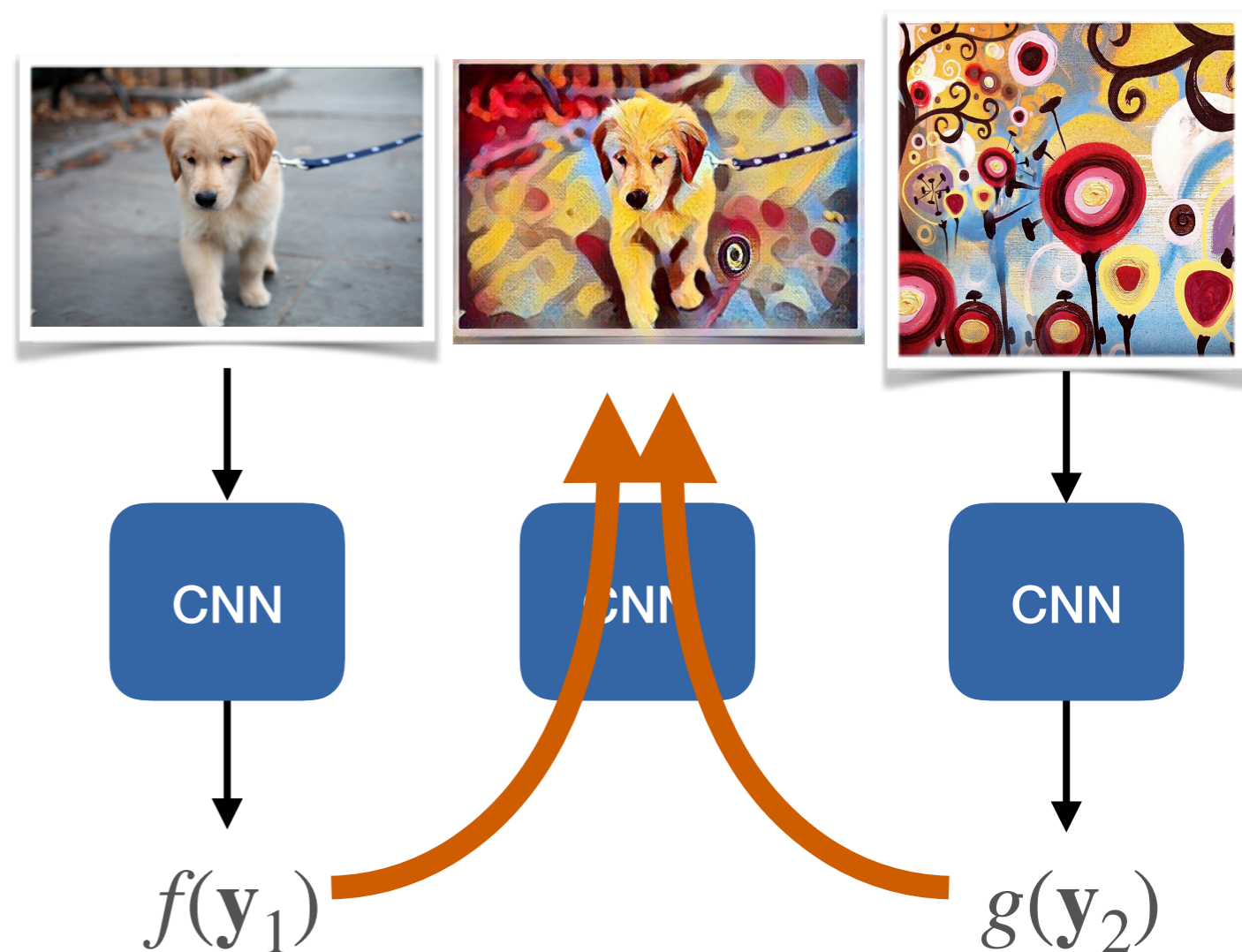
    - Spatial arrangement

# Style

- Solution: Statistics of low level activations

  - No (global) spatial information
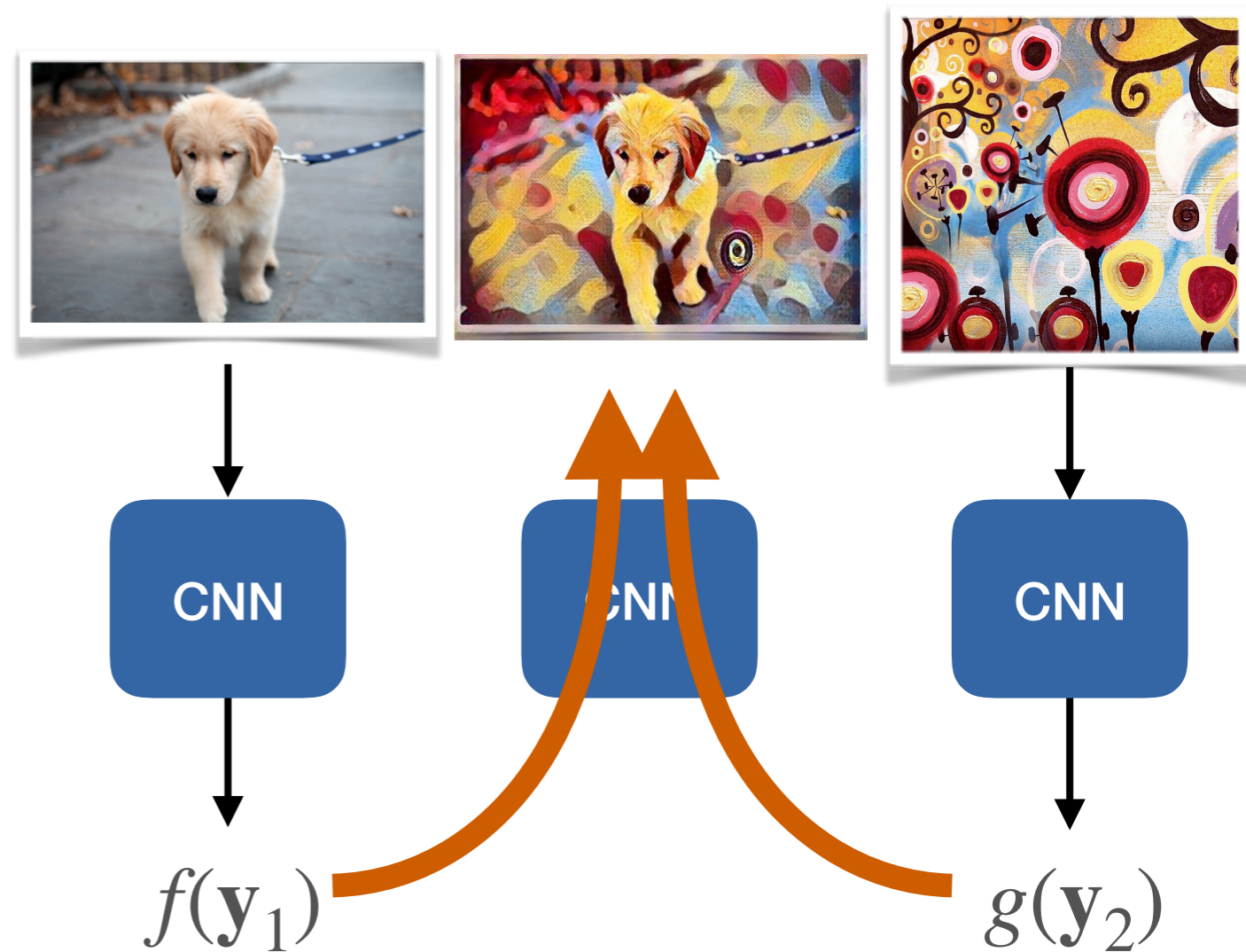
  - Local patterns only

# Neural style transfer

- Optimize for image $\mathbf{x}$

  - With high level activations $f(\mathbf{y}_1)$

  - and Gram statistic of low level activation $g(\mathbf{y}_2)$



$f(\mathbf{y}_1)$

$g(\mathbf{y}_2)$

Image Style Transfer Using Convolutional Neural Networks, Gatys et al., CVPR 2016

# Neural style transfer - Issues

- Optimization is slow

  - 100-1000 backpropagation steps per image



CNN   CNN   CNN

$f(\mathbf{y}_1)$   $g(\mathbf{y}_2)$

# Fast neural style transfer



- Train a network to do style transfer

  - Objective

    - Match activations

    - Match Gram statistics

- Fast inference

- Slower training

Perceptual Losses for Real-Time Style Transfer and Super-Resolution, Johnson et al., ECCV 2016