Image & Texture Manipulation using Texture Attributes

CS676: Texture Synthesis Project—Proposal

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Problem Statement

Synthesizing new textures using combinations of existing textures and images

Texture Manipulation Example:

Image Manipulation Example:

Methodology

Make a joint loss function

$$\min_{\mathbf{x}} \beta \sum_{i=1}^{m} L_2\left(C_{l_i}(\mathbf{x}), \hat{C}\right) + \gamma\Gamma(\mathbf{x}) + \lambda L_1\left(F_s(\mathbf{x}), \hat{F}_s\right)$$

Details of the loss function

Similarity from the input image

$F_s(\mathbf{x})$ are the features taken from a layer of the CNN with generated image $\mathbf{x}$.

$\hat{F}_s$ is the activation for the initial input image.

L_1 is the square loss.

Details of the loss function

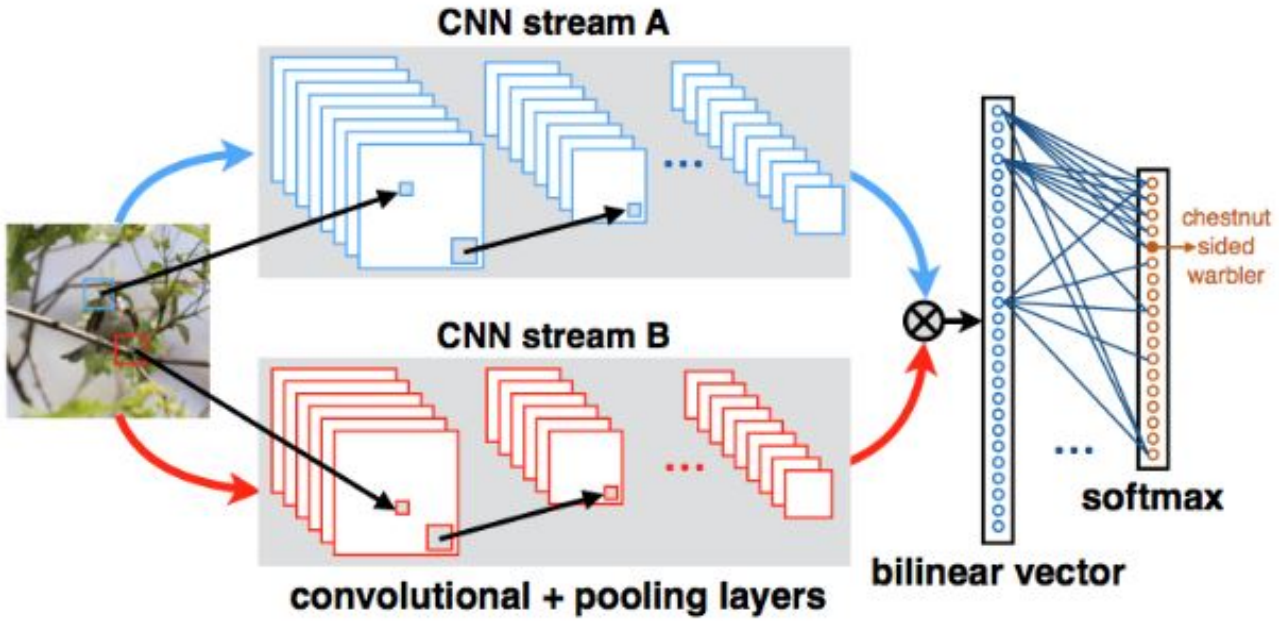
Similarity from the specified texture

$L_2(C_{l_i}(\mathbf{x}), \hat{C})$ is the negative log-likelihood of the activation of the texture class $\hat{C}$.

To get it, we train an SVM texture classifier using the output of a specific layer of the VGG-16 network as the input feature.

Bilinear CNN features

Bilinear CNN Models for Fine-grained Visual Recognition



$$B_{r_i}(I) = \frac{1}{N} \sum_{j=1}^{N} f_j f_j^T$$

Making images smooth

TV regularization

$$\Gamma(x) = X_{i,j}(x_{i,j+1} - x_{i,j})^2 + (x_{i+1,j} - x_{i,j})^2$$

Optimization

Used L-BFGS with gradients computed through backpropagation.

Dataset

Describable Textures Dataset (DTD)
5640 images, categorized into 47 categories.
Sample categories:

- meshed
- knitted
- striped
- ..

Lin, T. & Maji, S. (2015). Visualizing and understanding deep texture representations. *CoRR, abs/1511.05197*. Retrieved from http://arxiv.org/abs/1511.05197