Deep Feature Interpolation for Image Content Change

Steven Lang, Manfred Faldum

February 6, 2017

Motivation

Basic Idea

Motivation

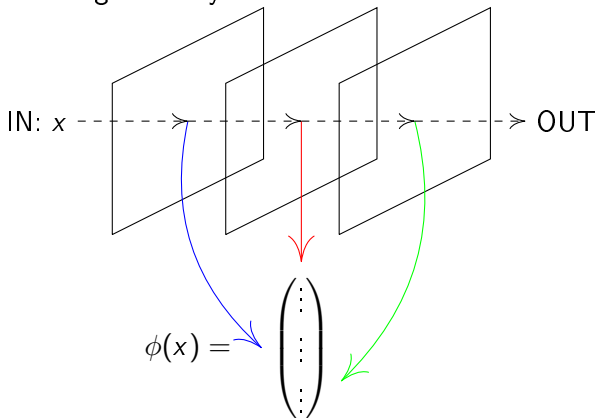- ▶ Right picture: add attribute in pixel-space

Motivation

- ▶ Right picture: add attribute in pixel-space
- ▶ New idea: add attribute in deep-feature-space

Basic Idea

How to get the attribute in deep-feature-space?

▶ Let $\phi(x)$ be the mapping from pixel-space into deep-feature-space by concatenating some layers

Basic Idea

- Take k nearest neighbor images with existing attribute: S^+
- Take k nearest neighbor images with missing attribute: S^-
- $\phi^+ = \phi(S^+)$ and $\phi^- = \phi(S^-)$
- Build the mean $\overline{\phi^+}$ and $\overline{\phi^-}$
- Representation of attribute $w = \overline{\phi^+} - \overline{\phi^-}$

Basic Idea

How to get the output picture?

- $\phi(z) = \phi(x) + \alpha w$
- Reverse mapping of $\phi(z)$ into pixel space
- $\tilde{z} = \underset{\tilde{z}}{\operatorname{argmin}} \frac{1}{2}||\phi(z) - \phi(\tilde{z})||_2^2 + \lambda R_\beta(\tilde{z})$
- with $R_\beta(\tilde{z}) = \sum_{i,j}((\tilde{z}_{i,j+1} - \tilde{z}_{i,j})^2 + (\tilde{z}_{i+1,j} - \tilde{z}_{i,j})^2)^{\frac{\beta}{2}}$

Practical

- ▶ Model VGG 19 trained on LFW dataset
- ▶ Used for $\phi(x)$ the third, fourth and fifth Relu Layer
- ▶ For regularization used $\beta = 2$ and $\lambda = 0.001$