Disentangle, Assemble, and Synthesize: Unsupervised Learning to Disentangle Appearance and Location

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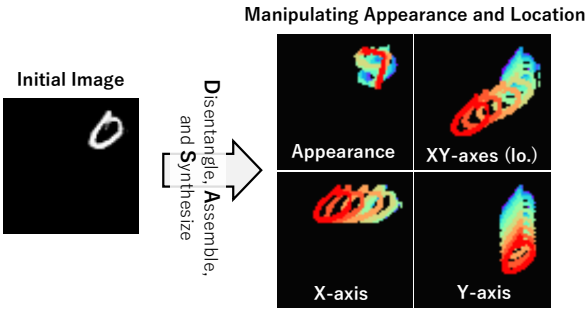
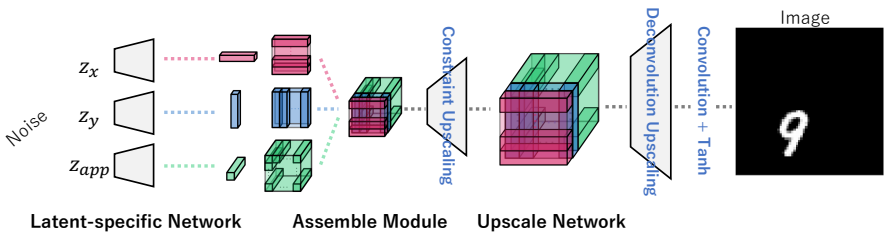
Overview

Goal:
Learning disentangled representations that allow us to control only a specific factor in the image for unsupervised image manipulation

Proposal:
We propose a novel generative model that learns to disentangle the appearance, the x-axis, the y-axis factors, assemble the factors, and then synthesize images.

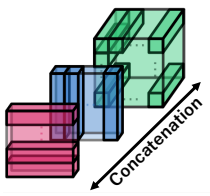


Method: Disentangle-Assemble-Synthesize



Our DAS Generator

Latent-specific Network: Given the appearance, the x-axis, and the y-axis noises, each network outputs a vector of the corresponding factor.
Assemble module: The module assembles these vectors into a structurally constrained map by tiling and concatenating operations.
Upscale network: It performs two-stage upscaling until the output size.
In the first step, it upscales the feature map while maintaining the structural property. Then, it upscales by a vanilla deconvolution that ignores the property.



Key idea: Structural Constraint

Packing the appearance and location in each position of the feature map

→ Since these vectors have the same values for each axis, the generator must assign the corresponding properties to these vectors and assemble them.

Visual Results on Translated MNIST