Motivation and Problem

• Architectural photography style transfer is a challenge due to its special composition of dynamic sky and static foreground.

• Generic neural style transfer and image-to-image translation treat the image as a single entity without knowing the foreground and background, leading to mismatched chrominance and destroyed geometric features of the original architecture.

• Given an architectural photo and style reference, we transfer styles of background and foreground separately keeping foreground geometry intact.

Contributions

1) A new problem setting for style transfer: photorealistic style transfer for architectural photographs of different times of day.

2) A two-branch image-to-image translation neural network with disentanglement representation that separately considers style transfer for image foreground and background respectively, accompanied with simple but effective geometry losses designed for image content preservation.

3) A new dataset of architectural photographs and an extensive benchmark for architectural style transfer.

Methodology

Architectural style transfer framework with three main modules: segmentation, image translation and blending optimization.

High-frequency geometry loss:

• Gradient loss:
  \[ L_{\text{grad}} = E_{x_1, x_2} \mathbb{I}[(V(Y(x_1, -2)) - V(Y(x_1, 1)) foreseeable]

• Spatial luminance KL loss:
  \[ L_{\text{KL}} = E_{x_1, x_2} \mathbb{I}[KL(Y(x_1, -2)) \| Y(x_1, 1)) foreseeable]
  \[ \mathbb{I}(.) \text{ is luminance channel.}

Ablation Study

<table>
<thead>
<tr>
<th>Methodology</th>
<th>w/o ( L_{\text{grad}} ) + ( L_{\text{grad}} )</th>
<th>w/o ( L_{\text{grad}} )</th>
<th>w/o ( L_{\text{grad}} )</th>
<th>( L_{\text{total}} )</th>
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Reference