Object Co-skeletonization with Co-segmentation

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Introduction

Goal: To exploit joint processing to extract objects’ skeletons in images of the same category, which is also known as object co-skeletonization.

Challenges:
- Sensitive to Unsmooth Segmentations
- Placed on Homogeneous Regions

This Paper: Leveraging existing co-segmentation idea to help perform co-skeletonization such that both the tasks help each other synergistically. Segmentation provides the required shape information for skeletonization, and skeletonization provides the required scribble information for segmentation.

Formulation

For Co-skeletonization
\[
\min \lambda \psi_{pr}(K_i, O_i | N_i) + \psi_{sm}(K_i, O_i | I_i) + \psi_{sm}(K_i, O_i | I_i)
\]
\[
s.t. \ K_i \subseteq O_i
\]
(1)

For Co-segmentation
\[
\min \lambda \psi_{pr}(K_i, O_i | N_i) + \psi_{sm}(O_i | I_i) + \psi_{sm}(O_i | I_i)
\]
\[
s.t. \ K_i \subseteq O_i
\]
(2)

Algorithm 1: Our approach for solving (1)
- Data: An image set \( I \) containing images of the same category
- Result: Sets \( \mathcal{O} \) and \( \mathcal{K} \) containing segmentations and skeletons of images in \( I \)

Experimental Results

Comparison of various methods with our modified co-segmentation approach on different datasets.

References:
[2] Skeleton pruning as trade-off between skeleton simplicity and reconstructive error, DIP15.

我们的新数据集：CO-SKEL

Smoothness: Typical spatial neighborhood smoothness and simplicity in segmentation and skeletonization, respectively.

Our New Dataset: CO-SKEL

Traditional ML
Placed on Homogeneous Regions

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(1)

For Co-segmentation
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