Deep Spectral Methods: A Surprisingly Strong Baseline for Unsupervised Segmentation and Localization

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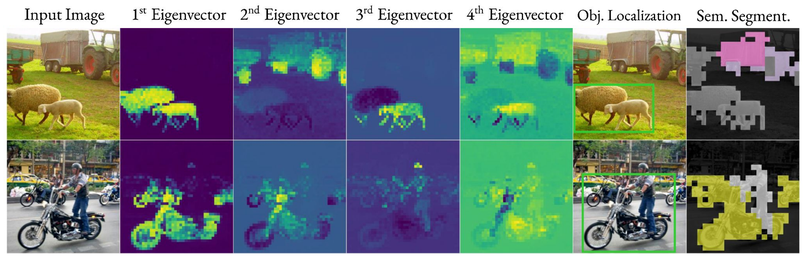
Introduction

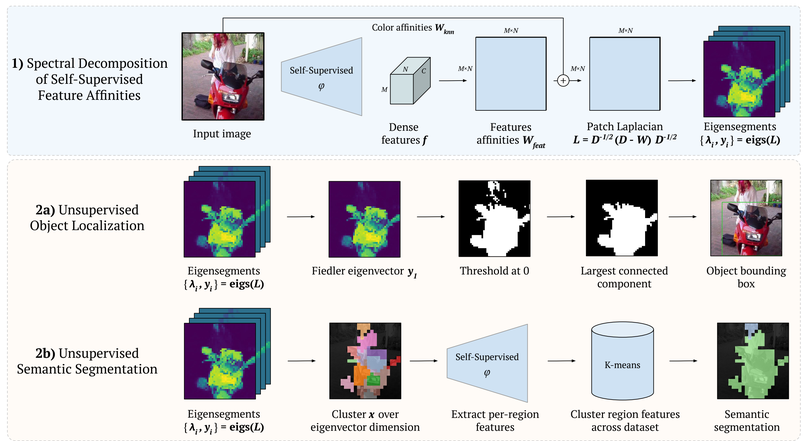
We propose a method for **unsupervised localization, segmentation and matting** of images in the wild by combining **deep self-supervised networks** with classical ideas from **spectral graph theory**.



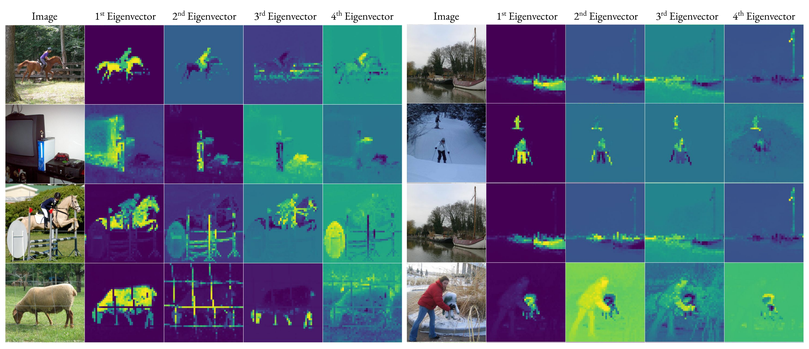
Overview

- We take inspiration from pre-deep learning image segmentation methods, which framed segmentation as a graph partitioning problem.
- Our method first utilizes a self-supervised network to extract dense image features.
- We then construct a weighted graph over patches, where edge weights give the semantic affinity of pairs of patches, and we consider the eigendecomposition of this graph's Laplacian.
- We find that without imposing any additional structure, the eigenvectors directly correspond to semantically meaningful regions, and can be used for a wide range of downstream tasks (e.g., localization, segmentation, and matting).
- Broadly, our work demonstrates the potential benefits of combining deep learning with traditional graph-theoretic methods.

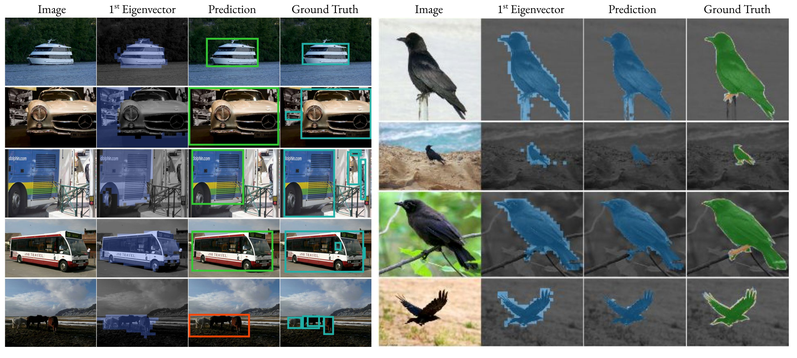
Methods



Spectral Decomposition



Object Localization & Segmentation



Semantic Segmentation

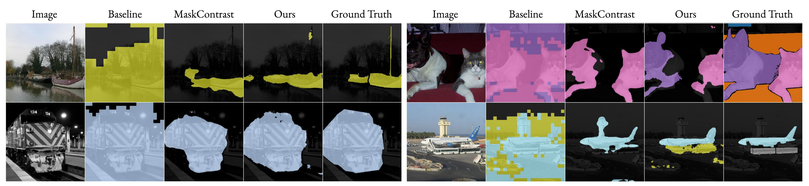
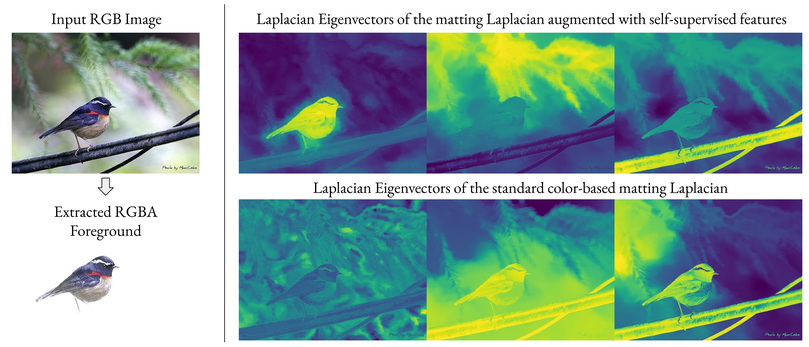
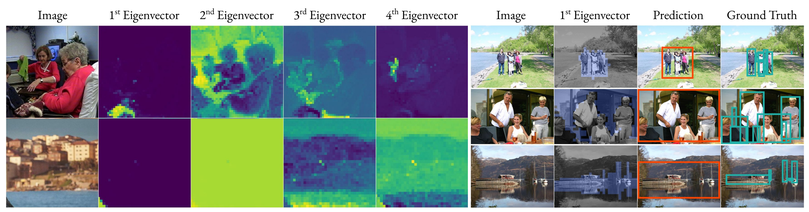


Image Matting



Failure Cases



Project Page: https://bit.ly/spectral-seg