RIGOR: Reusing Inference in Graph Cuts for generating Object Regions

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Goal: Generate unsupervised multiple figure-ground segmentations, in an order of magnitude faster than the state-of-art, without loss of accuracy.

Method Overview: Our algorithm has the following stages:

1. Inputs:
   - Seeds: S
   - Superpixels:
   - Parameters: λ

2. Precomputation Graph:
   - Combines all seeds into one
   - Computes: Unary potentials V(x)
   - Computes: Separations E(S, S′)

3. Max-flow:
   - Reparameterizes and cuts by Max-flow

4. Repeat Step 3

Fact 1: More seed locations gives higher recall

Fact 2: Obtaining more segments from more seed locations is slow

Question: What information can be shared when minimizing N energy functions for parametric min-cut, if pairwise costs, V(ux, uy) remain same across the functions?

Seed:

- Dsj(xj) = ∞ if xj ∈ Si and xj = 0

Condition:

- Sj ∩ Sj = ∅, for all i, j

Step 1: Combine all seeds into one Precomputation Graph

Step 2: at end of Precomputation stage

Step 3: Reparameterize and cut by Max-flow (this retains the optimal solution)

Key Insight: Most of the edgelets between superpixels never get used in any parametric min-cut for any seed (about 43% edgelets).

Novelty: Use a set of Boykov Kolmogorov [2] trees (one for each seed) to precompute information useful for all parametric min-cuts, in the case where pairwise costs do not change.

Step 1: Combine all seeds into one Precomputation Graph

Seed S1 graph

Seed S2 graph

Graph for creating Precomputation graph (S1 ∩ S2)

U

Run B.K. for growing trees

Share information transformed by reparameterization

Recompute Max-flow for seed max-flow for seed

Objective: Our algorithm performs

Performance:

- Our algorithm performs slightly better and is an order of magnitude faster than CPMC [1].
- 25x times faster than Object Proposals [6] and ~100x faster than Shape Sharing [7].

References: