

Accurate Banded Graph Cut Segmentation of Thin Structures Using Laplacian Pyramids

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1) Problem

Time and memory efficient interactive image segmentation.

Graph Cut Segmentation

- Requires too much memory
- Slow

Banded Graph Cut

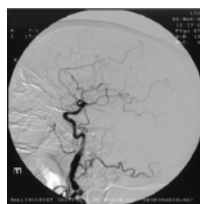
- Misses thin structures

Proposed Solution:

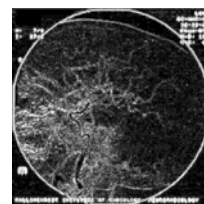
Laplacian Augmented Banded Graph Cut

- Fast
- Memory efficient
- Preserves thin structures

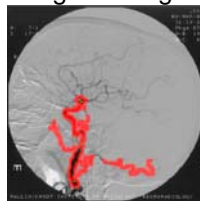
4) Band Construction and Propagation



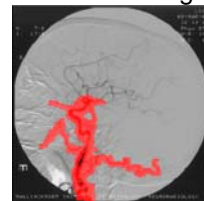
Original image



Difference image



Segmentation projected from previous level



Augmented with difference image

2) Laplacian Pyramid

Low Frequency Components

- Big scale features



High Frequency Components

- Small scale features (ignored by Banded Graph Cut)
- Should be taken into account.

5) Results

Full GC



10s/300Mb

Banded GC (2 Levels)

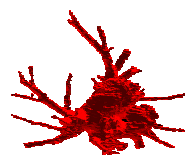


3s/36Mb

Laplacian GC (3 Levels)



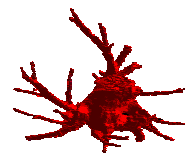
3s/33Mb



40s/700Mb

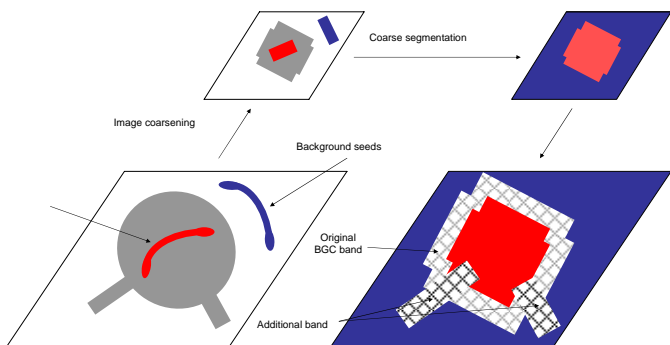


8s/86Mb



15s/216Mb

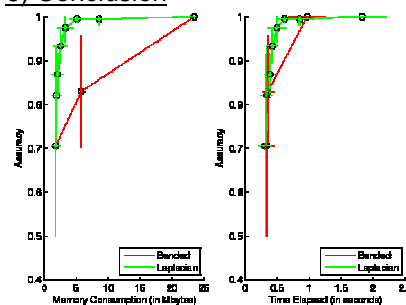
3) Band Construction and Propagation



- Project previous segmentation boundary onto current level
- Augment this band using high frequency features
- Compute graph cut on this band

6) Conclusion

- Reduces time and space complexity of graph cut considerably
- Retains thin structures and small details in the segmentation



Time/space and accuracy tradeoff plot for angiography images.

- Provides a smooth transition between time/memory complexity and segmentation accuracy
- Combining with active graph cuts (Juan, Boykov, CVPR'06) or dynamic graph cuts (Kohli, Torr, ICCV'05) might yield improved performance