

Image Segmentation Using Graph Cuts



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Background

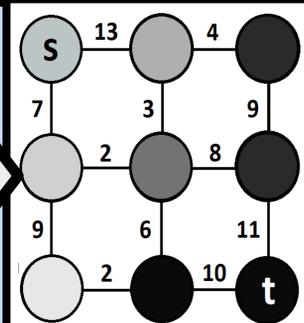
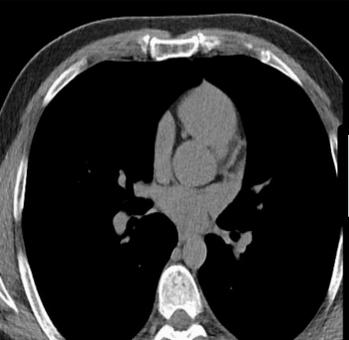
When it comes to X-Ray imagery, medical professionals can sometimes spend hours interpreting the images, thereby delaying the diagnosis and treatment of the patients.

Objective

Our goal is to automate the interpretation of CT scans by using graph theory alongside image segmentation technology.

Graph Theoretic Approach

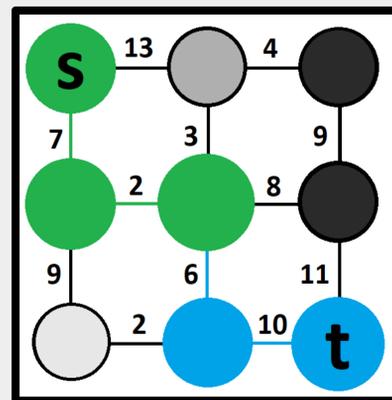
- Represent each image as a weighted graph
 - Every pixel is a node
 - Source pixel and sink pixel
 - Nodes are connected by edges if they represent neighboring pixels
 - Edges are cheap if the pixels they connect have high contrast, costly if low contrast
 - Find minimum cut



GraphCut Algorithm

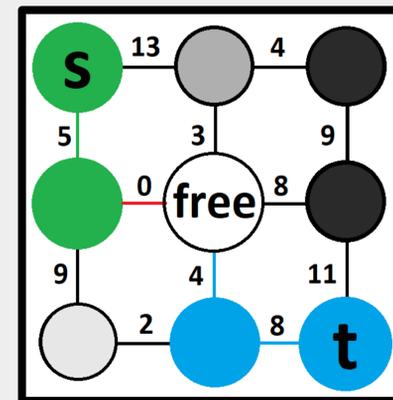
1) Growth

- Two search trees: background and foreground
- Search trees grow until they touch
- Thus, we form a path between foreground and background



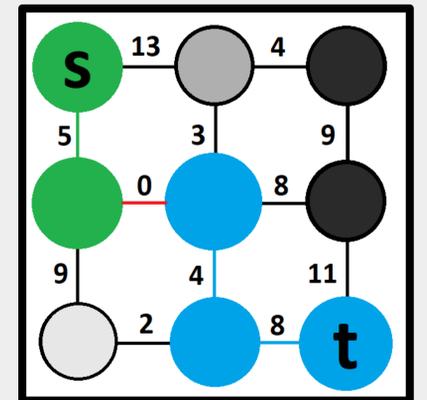
2) Augmentation

- Push maximum flow through newfound path
- As a result, at least one edge will become saturated, and all of its children become free
 - This saturated edge belongs to the minimum cut, becomes part of the border we seek



3) Adoption

- Find a valid parent for each free node, if one exists
- The result is a border segmenting foreground from background



References

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- Boykov, Y. Y., & Kolmogorov, V. (2004). An experimental comparison of min-Cut/Max-flow algorithms for energy minimization in vision. Transactions on Pattern Analysis and Machine Intelligence, 26(9), 1124.
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