Receive image of a transparent vessel containing some material and the boundary of the vessel in the image and return the boundary of the material in the vessel.

This code uses the graph-cut min-cut max flow algorithm to trace boundary of materials in transparent vessel. Based on the paper: *Tracing liquid level and material boundaries in transparent vessels using the graph cut computer vision approach.*

The function ***Find_Phase_Boundary_By_Graph_Cut*** in the ***main.cpp*** file receives an image of the transparent vessel containing some material and binary edge image that contain the boundary of the transparent vessel in the first image, it returns the image with the boundary of the material inside the vessel marked red.

This code uses the implementation of the Boykov-Kolmogorov algorithm supplied in: http://vision.csd.uwo.ca/code/ And discussed in the paper: Boykov, Yuri, and Vladimir Kolmogorov. "An experimental comparison of min-cut/max-flow algorithms for energy minimization in vision." *Pattern Analysis and Machine Intelligence, IEEE Transactions on* 26.9 (2004): 1124-1137.

In addition the code demands some version of OPENCV: http://opencv.org/

The program demands the dirent.h file which can downloaded:

http://softagalleria.net/dirent.php

http://users.cis.fiu.edu/~weiss/cop4338_sum09/dirent.h

Test images are available in the code directory (in github).

Larger image sets available at:

https://goo.gl/photos/JzNJHejDJXh4bPub8

https://goo.gl/photos/V1nMfiox2L5GuJY36

https://flic.kr/s/aHsktsKrfs

https://flic.kr/s/aHsksFjwjn

The method demand as input image of the vessel as well as the the boundary of the vessel in the image as a binary edge file with the vessel boundaries marked as 1. Source code (Matlab) for automatic tracing the vessel boundary in the image using segmentation from background or template available at:

1) www.mathworks.com/matlabcentral/fileexchange/46887-find-boundary-of-symmetricobject-in-image

2) www.mathworks.com/matlabcentral/fileexchange/46907-find-object-in-image-usingtemplate--variable-image-to-template-size-ratio-