Palak Keni :- 2016140026
Prajakta Kini :- 2016140027
Anushree Kulai :- 2016140029

FUNDAMENTALS OF COMPUTATIONAL INTELLIGENCE PROJECT REPORT

Problem statement :-

The goal is to automatically detect the appearance of Cystoid Macular Edema (CME) in Optical Coherence Tomography (OCT) images. The deep learning technique used, Convolutional Neural Networks, takes as an input patches of pixels from within the retina. These patches were generated from previous segmentation of retinal images. A further segmentation of the retina is performed using 4 an image processing algorithm called SLIC. Every super pixel thus generated, after being labeled as in the OCT scan, is fed into the neural network to detect the cyst.

Theory :-

We can rephrase our goal of detecting the cysts as finding a closed line that separates the cysts' pixels in the image from the rest of the image. If we define the scan image as a graph where every pixel is represented as a node that is connected by an edge to its neighboring pixels we could use the well-known graph-cut method, whose aim is to find on a graph where an image can be segmented into two groups – the cyst(s) and everything else. The graph-cut method evaluates each edge in the graph based on its score and chooses the edges that allow the segmentation with the lowest score possible.

Neural networks are a machine learning concept that aims to recreate the same learning and recognition processes as in the human brain. Convolutional neural networks are an expansion of this concept that has had great success in recent years, especially in tasks related to computer vision. Convolutional neural networks add an increased focus on locational and relational information in the images.

The network itself is composed of layers of mathematical operations that learn increasingly complex concepts from the images in an effort to learn to categorize them.

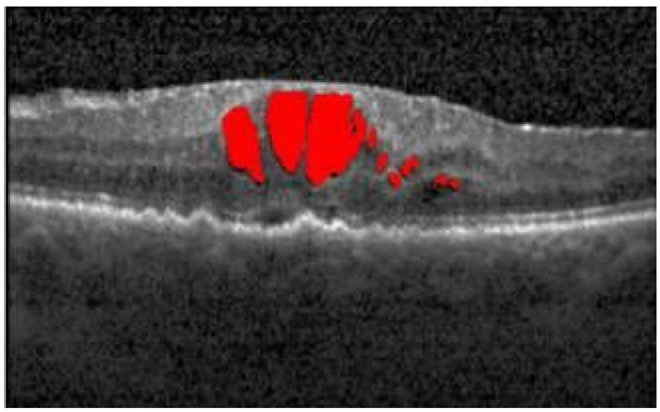
Implementation Details :-

As we said, we define each pixel as a node in the graph, add a source node that is connected to every cyst point and a sink node that is connected to the outlier points.

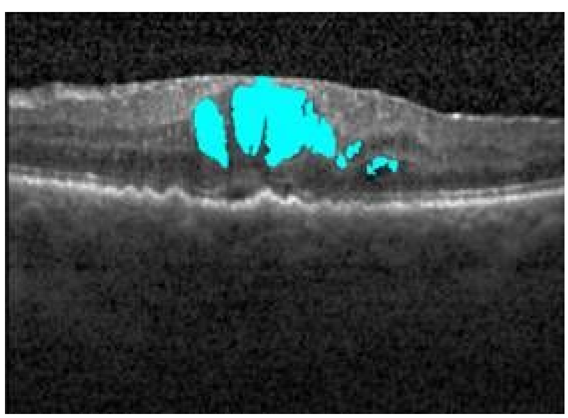
Every node is connected to its Manhattan neighbors (4-neighborhoods) and the edges are given a score that is inverse to their intensity difference – i.e.the more similar the nodes, the higher their edges' score. This ensures that the cut will be between very different pixels (as is the case on the edge that defines the cysts' walls).

The edges that connect the source and the sink receive a score of infinity to ensure that they won't be cut from the graph.

Finally a min-cut algorithm is used to find the actual segmentation.



Manual Annotation



Detected Cysts

Conclusion Generated :-

As we can see in the resulting images above, this deep learning method is very successful at finding the cysts themselves and most of their area. This is a remarkable result considering the dataset that was used in the training process.