CDP
Cellular Density Project

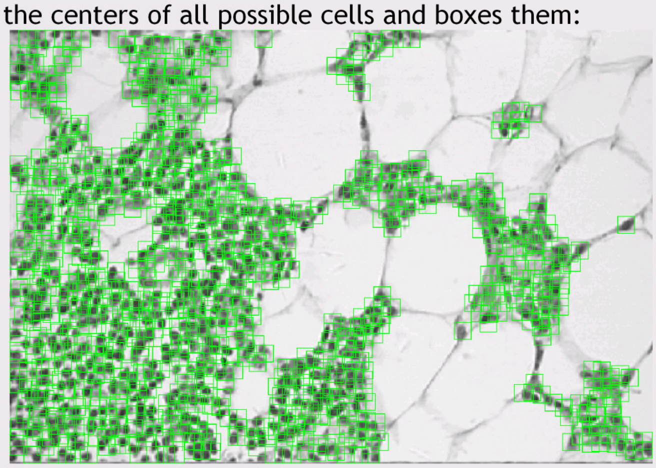
Christopher Mitchell

Introduction

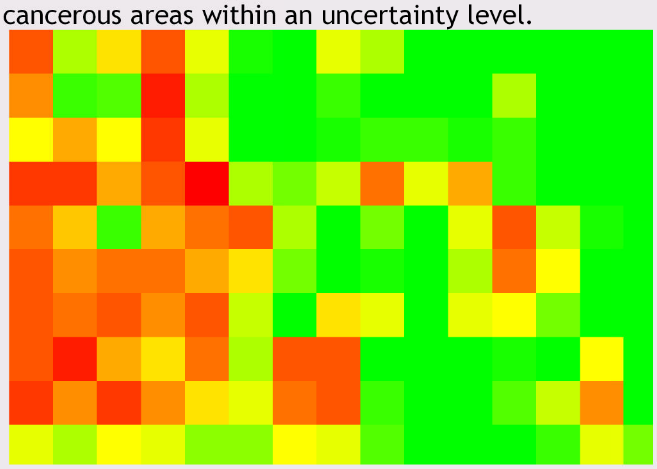
The Cellular Density Project is an attempt to apply computer-based image processing to the detection of cancer in photomicroscopy. One of the primary signs of cancer is unchecked cell growth, leading to abnormally high cellular density within a well-defined area. The CDP uses a Matlab-based program to find each of the cells in a microscope image, then determine density across the image and utilize statistical analysis methods to determine whether or not the image contains possibly cancerous areas.

Methodology

The CDP uses the same method as popular image recognition algorithms, namely eigenobjects, to detect cell nuclei in a microscope image. Because the nuclei show up as circles on a contrasting background, a training set of eigencells can be constructed and used to identify new objects as nuclei or non-nuclei. Within a threshold set by the user, the program finds the centers of all possible cells and boxes them:

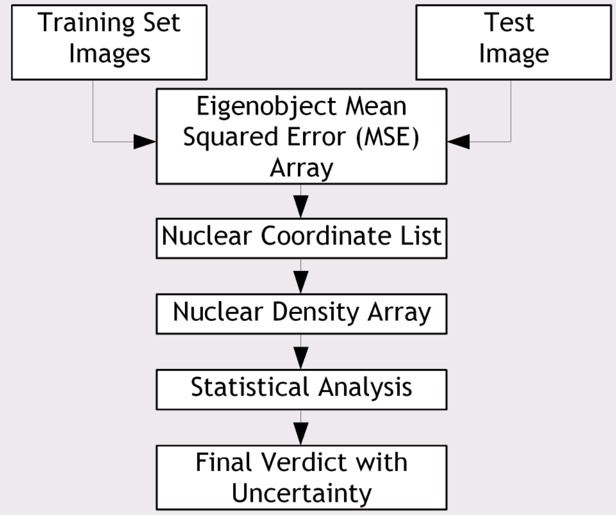


Next, the program determines the density of cells in each area of the image, produces a heatmap, and identifies the image as containing or lacking possible cancerous areas within an uncertainty level.



```
*Based on deviation:* This image contains cancerous
region(s) at uncertainty of 8.518519e+001%.
*Based on mean:* This image contains cancerous region(s)
at uncertainty of 7.2e+001%.
```

Functionality



Conclusions

This project has shown that it is feasible to score the probability a photomicroscopic image contains cancerous regions using image processing techniques. At present it takes five to ten minutes to process each image due to the amount of data that must be processed. In the future, the eigenobject detection routines could be optimized to scan the image in several passes, beginning with a rough scan and getting gradually more precise in areas showing higher probabilities of containing nuclei. In addition, it could be made faster by porting it from Matlab to C or C++. The final program from the CDP of Summer 2007 produces two scores for the probability an image contains cancer based on two statistical aspects; it could be made more precise if additional analysis aspects were found.

Contacts

Research Team: Christopher Mitchell (Cooper Union, EE 2009) – mitche2@cooper.edu
Advisor: Professor Yu-Dong Yao, Stevens Institute of Technology – yyao@stevens.edu

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