



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> <b>Benjamin Y. Chen</b>	<b>Project Number</b> <b>J1402</b>
<b>Project Title</b> <b>A Study on Alternative Methods of Cell Counting</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of this project was to determine if there existed a superior algorithm for counting cells using image processing. With image processing, images of cells that usually would have taken many minutes to count now take fractions of seconds. My hypothesis was that using edge detection instead of a threshold in a cell counting program, greater accuracy and precision would be achieved.</p> <p><b>Methods/Materials</b> Using a threshold is the most commonly used algorithm in a cell counting program, but I believed using edge detection could yield better results. Two similar programs in MATLAB were prepared, each using one of the two algorithms and variables idealized for the algorithm. Two sets of cell images, one low contrast blood cells and the other high contrast colon cancer cells, from the BBBC (Broad Bioimage Benchmark Collection) were used to test the accuracy and precision of each algorithm.</p> <p><b>Results</b> In the high contrast image set, edge detection came in with an average accuracy of 93% and a standard deviation of 4.8%, while thresholding performed perfectly with an average accuracy of 99% and a standard deviation of 0.4%. But in the low contrast image set, edge detection again performed well with an average accuracy of 94% and a standard deviation of 4.4% , while thresholding did rather poorly with an average accuracy of 68% and a standard deviation of 20.3%.</p> <p><b>Conclusions/Discussion</b> The data showed that edge detection outperformed thresholding significantly in the low contrast image set, suggesting that it would be much more suitable for images with low contrast, while thresholding would be more optimal with high contrast images. Thresholding was used as it was the best algorithm at separating background and foreground, while edge detection outlines objects in the foreground, making it more ideal when the contrast between background and foreground is too low to use a threshold. Therefore, the hypothesis was partly true.</p>	
<b>Summary Statement</b> The purpose of this project was to determine if there existed a superior algorithm for counting cells using image processing.	
<b>Help Received</b> Parents helped construct display board	