Mapping the Brain: An Introduction to Connectomics
An Analysis of the Performance of Vesicle Detection Systems

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1 Introduction

Increases in processing power as well as the development of high speed electron microscopy have led to the acquisition of multiple terabytes of high resolution three dimensional photography of whole brains. There already exists MATLAB code to identify vesicles within the neural EM data to some degree of accuracy. We will begin our study by assessing the accuracy of the already existing vesicle detection software. Afterwards we hope to improve upon this via fundamental changes in the MATLAB algorithm and we will then use our developed performance analysis system to compare the new algorithm to the original. Our hope is that we can develop a more reliable method of identifying vesicles, and that this will in turn lead to better identification of synapses.

2 Project Outline

- Major Items
    1. Establish existing MATLAB library codebase (1/8/16) - Greg
    2. Analyze accuracy and recall of already existing code (1/15/16) - Matt, Alex
    3. Improve upon MATLAB via fundamental method changes (1/18/16) - Alex, Greg, Matt
    4. Analyze the accuracy of our modifications (1/20/16) - Matt, Alex
    5. Compare the performance of our modified detection system to the previous solution - Matt, Alex
- Minor Items
    1. Writing our initial project proposal
    2. Collating our results
    3. Making a one-page summary of our results
    4. Making SOCARF poster presenting findings

3 References

- William Gray Roncal, Michael Pekala, Verena Kaynig-Fittkau, Dean M Kleissas, Joshua T Vogelstein, Hanspeter Pfister, Randal Burns, R Jacob Vogelstein, Mark A Chevillet and Gregory D Hager. VESICLE: Volumetric Evaluation of Synaptic Interfaces using Computer Vision at Large Scale. In Xianghua Xie, Mark W. Jones, and Gary K. L. Tam, editors, Proceedings of the British Machine Vision Conference (BMVC), pages 81.1-81.13. BMVA Press, September 2015.