

# Segmentation of Large Numbers of 3D Cells on Different Scaffolds

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*Abstract*— Our objectives are to automate segmentation of large data sets of three-dimensional (3D) cell images on different scaffolds and to estimate the segmentation accuracy from projected ground truth, statistical samples and visual inspection inputs. Human bone marrow stromal cells were cultured on 10 different scaffolds and imaged in 3D using confocal laser scanning microscopy. Approximately 110 cells were imaged per scaffold yielding 1100 Z-stacks, 122,949 images and 122 GB of data. Six segmentation processes were designed and the most accurate method was selected upon imaging and geometrical assumptions. Selection was driven by minimization of human labor needed to provide ground truth while maximizing statistical confidence in the segmentation accuracy. Segmentation accuracy was determined against manually segmented z-stacks. The two most accurate segmentation methods were applied to all z-stacks and visually inspected in a 2D tiled view and interactive 3D view in a web browser. The results of visual inspections were incorporated into the analyses to increase the confidence in segmentation accuracy estimates. The results demonstrate a path toward studying cell-scaffold interactions at high statistical confidence. The significance of our work is in constructing segmentation candidates, providing tools for sampling and visual inspection, selecting the most accurate method, and delivering accurate segmentation accuracy with limited manual input.

*Index Terms*— segmentation