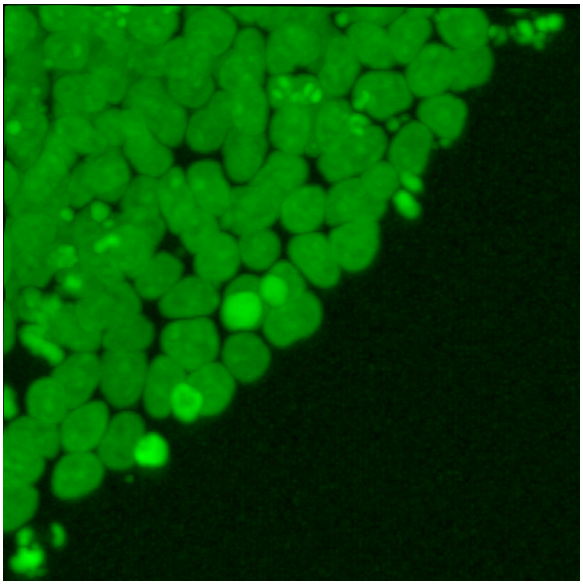
THE UNIVERSITY OF CHICAGO
DATA SCIENCE INSTITUTE

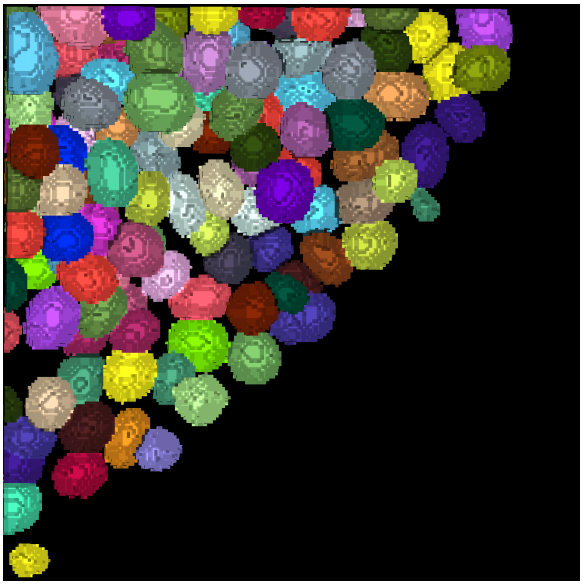
Cell segmentation is the process of distinguishing cells in microscopy images to analyze cellular features and dynamics. Since cell segmentation is time-consuming (especially in 3D), the Center for Living Systems (CLS) utilizes deep learning to automate this process. Existing pre-trained models have limited ability to segment cells of varying sizes, requiring significant data preprocessing effort from the CLS. Therefore, this team worked with the CLS to train and evaluate a flexible 3D cell segmentation model for easy uptake and segmentation of new image data.

The team tackled this using two automated cell segmentation models: Stardist and Cellpose. Training these models is a supervised learning task, however the ground truths ("correct answers") needed for this are not available and are time-intensive to create. Therefore, using a combination of pseudo-ground truths and a hand-labeled sample of 100 cells, the team trained a robust 3D cell segmentation model, visualized below. This model outperformed its existing pre-trained equivalent across two key evaluation metrics: precision and recall.

Therefore, the team trained a model that better replicates manual cell segmentation than the existing pre-trained ones, in part due to its increased ability to handle varying cell sizes, saving the CLS time in manual-labeling and data preprocessing.



Original Cell Image



Predicted Cell Segmentation