Cell segmentation is the process of distinguishing cells in microscopy images to analyze cellular features and dynamics. Since cell segmentation is time-consuming, the Center for Living Systems (CLS) utilizes deep learning to analyze large datasets efficiently. This team worked with the CLS to employ two AI models, Cellpose and StarDist, to evaluate cell segmentation performance on two public datasets: LIVECell and TissueNet. First, the team utilized pre-trained models to obtain prediction masks. Then, the prediction accuracy was evaluated with three metrics (intersection over union, precision, and recall) by comparing the predictions to publicly-available ground truth labels. The team found that Cellpose models outperform StarDist for all datasets and cell types, particularly on LIVECell data. While StarDist's versatile model outperformed its 2D model, there was no significant performance difference between Cellpose models (Figure 1).

For their secondary goal, the team trained a custom 3D cell segmentation model using a dataset of eight microscopy images from the Gardel Lab and compared its performance with StarDist's pre-trained 3D model. Although the team's analysis indicated that their custom model outperformed the pre-trained model, these results require cautious interpretation since the custom model was trained on (and evaluated against) potentially inaccurate ground truth data.

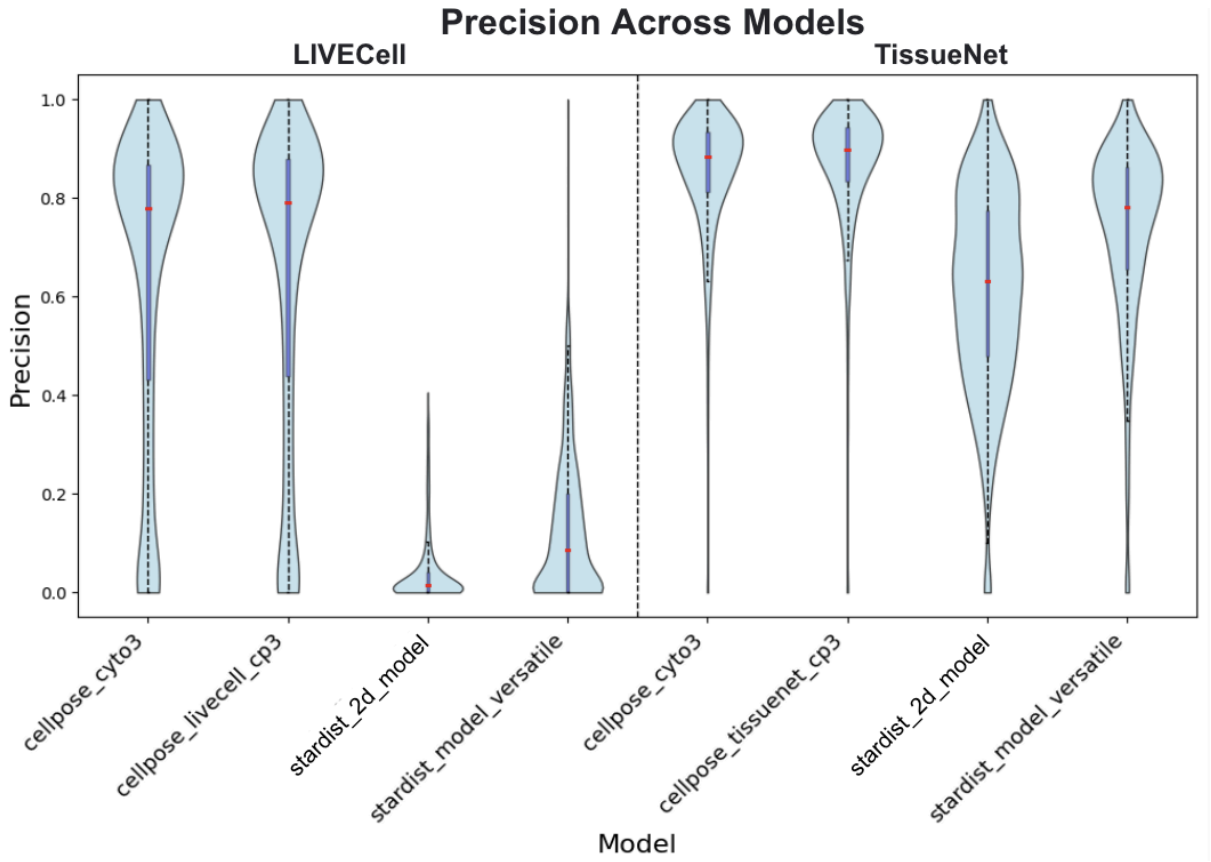

Figure 1: Precision Violin Plot across Models and Datasets Evaluated