Research Week 2023

Machine learning tools for image analysis at the USR advanced light microscopy core

Hannah S. Bronstein

Keywords

Workflow, Colorimetry, Machine Learning, Magnetic Resonance Imaging, Software, Staining and Labeling

Abstract

Recent analysis advances include user-friendly AI that can simplify or automate many previously manual image analysis tasks. Here we will discuss new tools for 2D and 3D data analysis in the ALMC and demonstrate how they make image analysis more accurate and efficient for OHSU researchers.

Intellesis machine learning performs challenging 2D segmentation of fluorescence and brightfield data. This segmentation forms the foundation of many downstream analyses, such as counting objects or assessing fluorescence intensity within specific structures. Intensity-based segmentation struggles with images that have high background or high signal variability. Intellesis machine learning can be trained to identify objects by iterative user-guided pixel painting on a few images. This supervised learning trains the neural net to discriminate between background and object based on a large set of parameters, not just local pixel intensity. We will present examples of machine learning segmentation on fluorescence images, colorimetric staining, and transmitted light images from users at the ALMC.

For complex 3D data, machine learning segmentation of fluorescence and transmitted light data is now integrated with the 3D image analysis software Imaris. It can perform difficult segmentation jobs not previously possible with traditional threshold-based segmentation, such as 3D segmentation of transmitted light and MRI data, and boundary definition around areas of low/no signal. Once segmented, objects can be further classified into phenotypes using machine learning classification. 3D relevant data can be measured such