# DEEP LEARNING FOR CELL SEGMENTATION OF LARGE MULTI-CHANNELS TIME-SERIES DATA IN AMIRA SOFTWARE

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Quantitative live cell imaging has been widely used to study various dynamical processes in cell biology. Fluorescence microscopy, a popular imaging modality for live cell imaging, has been used to monitor the dynamics of specific molecules in live cells. However, the fluorescence live cell images are highly prone to noise, low contrast, and uneven illumination. These often lead to erroneous cell segmentation, hindering quantitative analyses of dynamical cellular processes.

Deep learning has been successfully applied in image segmentation by automatically learning hierarchical features directly from raw images data. Amira software offers an integrated Deep Learning environment providing an opportunity to automatically segment and extract cellular features from high-throughput microscopy images. Advances in deep learning have positioned neural networks as a powerful alternative to traditional approaches such as manual and algorithmic-based segmentation. In particular, the development of the U-Net architecture provided a significant boost to segmentation performance and has now become the template for many modern segmentation models.

It typically requires large datasets and high computational cost to train deep neural networks. These make it challenging to apply deep learning in routine laboratory settings. Thanks to the new Smart Multi-channels time-Series system in Amira, the visualization of very large multi-channel time series data sets is now possible.

We evaluate a deep learning-based segmentation workflow for time-series label free live cell images, using pre-trained neural networks on a small ROI of images in the time-series to predict features of the imaged cells for the entire dataset.

We demonstrated the deep learning segmentation module in Amira software well facilitates quantitative analyses of challenging high-resolution data time-series.