Poster Session - Big Data, AI & Laboratory Automation

1P-005 Subcellular mitochondria structure prediction in label-free microscope images using convolutional neural networks

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The advance of microscope techniques allows insight into the world of cells and cellular structure. Fluorescence microscopy enables us to analyze the subcellular structure of the living cell with the advantage of specific labeling, but with it comes the potential problem of phototoxicity. On the other hand, transmitted light (TL) microscopy is low cost and label free, but it lacks the ability to easily distinguish the subcellular targeted objects. Here, we adopt the published label-free method and data by Allen Institute of Cell Science to train and predict 3D fluorescence images from our own TL microscopy images of cardiac myocyte-derived cell line AC16. Convolutional neural networks (CNNs) have shown significant success in the area of image recognition and segmentation compared to other traditional machine learning methods. Based on CNN-like U-Net architecture, the model can effectively predict fluorescence images from new TL input by learning each relationship between 3D TL and fluorescence live cell images for different kinds of subcellular structures. Here, we specifically focus on building corresponding models for subcellular mitochondrial structures using such CNN technology. With the multi-model combined prediction, it is possible to generate integrated images through only TL input, reduce the time for sample preparation, and also increase the time scales we can visualize and measure.