



Thursday July 10th, 15-16:00
Biozentrum U1.191

Quantification and Analysis of Biological Spatiotemporal Patterns with Advanced Machine Learning Techniques

Abstract: Advances in biotechnology create major computational challenges to extract and quantify biologically meaningful spatiotemporal patterns embedded within complex and rich data sources, many of which cannot be captured with existing methods. Here, we introduce Activity Quantification and Analysis (AQuA2), a fast, accurate, and versatile data analysis platform built upon advanced machine learning techniques. It decomposes complex live imaging-based datasets into elementary signaling events, allowing accurate and unbiased quantification of molecular activities and identification of consensus functional units. We demonstrate applications across a wide range of biosensors, cell types, organs, animal models, microscopy techniques, and imaging approaches. Additionally, we demonstrate how advanced machine learning techniques can be used to quantify the subcellular objects in Electron Microscopy (EM) imaging data and track accurately millions of cells in embryo development.

Biosketch: Guoqiang Yu is a professor in the Department of Automation at Tsinghua University. He is also a Principal Investigator at IDG/McGovern Institute for Brain Science at Tsinghua University. His research interest is in the intersection between artificial intelligence and biomedicine. He serves on the advisory board for the journal *Neuron* and as an associate editor for *BMC Bioinformatics* and *Bioinformatics Advances*. Before joining Tsinghua, he was a professor in the Department of Electrical and Computer Engineering at Virginia Tech in the United States. He has received the CAREER Award from the National Science Foundation and has won Best Paper Awards from several journals and conferences, including *Neuron* and *BIBM*. He is a core member of the NIH Brain Initiative Alliance and the Data Science Alliance, and has served as the principal investigator for several NIH and NSF-funded research projects in the R01 and U19 series. He has published nearly 100 papers in prestigious journals such as *Cell*, *Science*, *Nature Neuroscience*, *Nature Medicine*, *Neuron*, *IEEE PAMI*, and at top international conferences such as *NeurIPS* and *ICML*.