

Data Science in Cell Imaging

Department of Software and Information System Engineering, BGU

Course # 37225331

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Spring 2020, Wednesdays 17-20

The recent explosion in high-content, dynamic and multidimensional imaging data is transforming cell imaging into a “Data Science” field. This course will review the state-of-the-art in visualizing, processing, integrating and mining massive cell image data sets, deciphering complex patterns and turning them into new biological insight. It will include a mix of approaches in machine learning and computer vision (e.g., deep learning) applied to bio-imaging data.

The course is open for all ISE and adjacent departments (e.g., CS, EE) graduate and undergraduate students in their 3rd or 4th year. Interested students from other departments should contact Assaf (assafzar@gmail.com).

The lectures will be held in English.

Background in mathematics and programming is required. No prior biological knowledge is required; all background will be covered in the lectures. Prior knowledge in machine learning and/or computer vision is highly recommended, but not necessary.

Grade will be determined by single student presentation of an academic paper (20%) and a 1-2 students semester-long project (80%).

Main topics covered in the course:

- Bioimage informatics
- High content single cell phenotypic profiling
- Quantifying cell motility: from the intracellular to the multicellular scales
- Classifying cell state with deep learning
- Generative models for cell structure with deep learning
- Enhancing cell image quality with deep learning
- Quantifying causality with fluctuations analysis (without perturbations)
- Molecular and cellular heterogeneity
- Public data repositories, data harmonization, integration and fusion
- Importing ideas from systems biology