

**Abstract:**

Recent years have seen a revolution in computer vision which has come from embracing data as a primary source of information in solving complex inference problems. The spatiotemporal structure of a class of images, such as microscopy images of live cells in a Petri dish, can be implicitly constrained and defined by a well-chosen annotated dataset. This paradigm has led to impressive gains in a number of key areas, due in part to the power of modern machine learning methods when applied to big data. In this talk I will discuss my work on model-based inference and data-driven learning for cell mitosis event detection. In particular, I will present the rationale behind our design of data descriptors and classifiers and attempt at a principled thought process. A consistent thread in my work is the incorporation of key insights from the problem domain which constrain and bias the learning problem, and lead to effective performance.