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BIOMATH

Department of Biomathematics Seminar Series:
Frontiers in Systems and Integrative Biology

Automated measurements from images and video to enable better modeling: Vascular geometry, consumer-resource interactions, and bacterial colony sizes

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ABSTRACT

The promise of using video and images to collect biological data has been a major research focus for decades. Enough tools and algorithms now exist that it is possible for researchers to straightforwardly extract data from images and video for physiological and ecological systems. These approaches enable high-throughput methods that often yield higher-quality data and substantially more data than previous efforts. Moreover, these approaches can also enable the collection of new types of data. We will briefly discuss three examples of systems from which we have gathered new data using these methods. First, we will describe new software for automatically measuring vessel dimensions and geometry from three-dimensional angiographic (e.g., CT and MRI) images. This software leads to much faster collection of larger amounts of data. Because these angiographic images are non-invasive, they do not distort or destroy the vasculature and thus lead to more exact measurements. Second, we show how video-tracking software can be used to track wingless fruit flies that are being hunted by wolf spiders. This software leads to measurements of components of consumer-resource interactions that have rarely or never been measured before and with much higher resolution. Finally, and as our primary focus for this talk, we discuss new software to identify individual bacterial colonies grown in agar plates, measure their sizes, and construct size distributions. With these more accurate and larger volumes of data, we can analyze how the phenotype of colony size responds to a range of concentrations of antibiotics. Rather than just focusing on the mean, we now have sufficient data to investigate the variance, coefficient of variation, and other measures of the distribution, in the hopes of revealing new insights about bacterial diversity and the evolution of resistance.

Host: Tom Chou, Ph.D.

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