Multi-faceted Software-Based Measurements from Large Microscopy Images

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LECTURE ABSTRACT

With the biological cells changing states over time and being several orders of magnitude smaller than cell products, modern microscopes have become critical measurement tools of cell health. Microscopes are capable of imaging large spatial areas, repeating image acquisition over time, and sensing over several spectra. However, characterizing stem cell products from such large image collections is challenging because of data size, required time-critical computations and their traceability, and the lack of interactive quantitative measurements needed to configure automated measurements, and ultimately to determine release criteria.

This presentation will overview the major challenges in evaluating biological cell products, illustrate the current variability of microscopy image-based measurements and their impact on scientific reproducibility, and introduce a measurement system called web image processing pipeline (WIPP) to address some of the challenges. WIPP is a client-server framework using Deep Zoom for viewing very large images. It consists of algorithms to extract object measurements from 2D microscopy images needed for inspecting the quality of cell products. In addition to WIPP software, several experimental cell and other image sets are accessible from http://isg.nist.gov/deepzoomweb to encourage the reuse of acquired data and a new development of algorithms applicable to big scientific data. The presentation will also include mechanisms for collaborating with NIST and engaging with the larger microscopy community.

SPEAKER BIOSKETCH

Peter Bajcsy received his Ph.D. in Electrical and Computer Engineering in 1997 from the University of Illinois at Urbana-Champaign (UIUC) and a M.S. in Electrical and Computer Engineering in 1994 from the University of Pennsylvania (UPENN). He worked for machine vision, government contracting, and research and educational institutions before joining the National Institute of Standards and Technology (NIST) in 2011. At NIST, he has been leading a project focusing on the application of computational science in biological metrology, and specifically stem cell characterization at very large scales. Peter's area of research is large-scale image-based analyses and syntheses using mathematical, statistical and computational models while leveraging computer science foundations for image processing, machine learning, computer vision, and pattern recognition. He has co-authored more than more than 38 journal papers and 11 books or book chapters, and close to 100 conference papers.