

# **SPIE Photonics West BiOS: High-Speed Biomedical Imaging and Spectroscopy: Toward Big Data Instrumentation and Management**

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Real-time capture and analysis of fast, non-repetitive, dynamical events has long been a challenging problem in the field of instrumentation for biomedical applications ranging from cancer detection to drug discovery. Notable examples include momentous efforts on establishing high-speed optical spectroscopy with high spectral resolution and wide spectral range (e.g., Raman spectroscopy, Fourier-transform infrared spectroscopy, THz spectroscopy, and fluorescence detection) and optical microscopy with high spatial and temporal resolution (e.g., light-sheet microscopy, ultrafast imaging, photoacoustic microscopy, super-resolution fluorescence microscopy, and image cytometry).

What makes it even more challenging is that these real-time and/or high-throughput instruments are required to have a quantitative high-content measurement capability. Notwithstanding the sensitivity and speed limitations of single-shot real-time continuous measurements, such instruments lead to the so-called “big data” problem – aligning with the pressing need for progressively larger biomedical datasets for efficient and accurate data analysis to make better decisions in life science research and clinical diagnosis. Owing to their high throughput in optical measurements, they produce a tremendous amount of data that overwhelms even the most advanced computers. This necessitates innovations in data acquisition, data management, and signal processing techniques.

The aim of this Conference is to bring researchers specialized in real-time optical bioinstrumentation, big data management, and high-speed signal processing together in a single multidisciplinary forum. With the presentations of the latest developments, this Conference is intended to serve as an arena to promote idea exchanges, interdisciplinary collaborations, and technological advancements in this new and exciting field of real-time optical bioinstrumentation with focuses on its future trend and development.

This conference intends to cover, but not limited to, the following topics:

- **Methods for high-speed optical spectroscopy and imaging**
  - High-speed spectroscopy and fluorescence detection
  - High-throughput and high-content live cell imaging/microscopy
  - Microscopy techniques with high spatial and/or temporal resolution
  - Real-time 3D imaging of cells, tissues, and whole-organisms
  - Ultrafast imaging techniques
  
- **Biomedical applications of high-speed optical spectroscopy and imaging**
  - Flow cytometry
  - Image cytometry
  - High-throughput and high-content screening
  - High-throughput histopathology (e.g. whole-slide imaging and tissue microarray)
  - Real-time functional *in vivo* imaging
  
- **Computational methods for big data management**
  - Instrumentation for real-time computational imaging/spectroscopy
  - Computationally efficient algorithms
  - Data compression and compressive sensing
  - Real-time signal processing
  - High-speed digital image/signal processing
  
- **Big data visualization and analytics**
  - Real-time biomedical image and spectral data processing systems
  - High-throughput image/spectral data processing algorithms
  - Automated data analysis for large-scale phenotyping
  - Accelerated image and pattern recognition

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- Keisuke Goda (University of Tokyo, Japan)

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**Best Paper Awards**

We are pleased to announce that Hamamatsu and PiPhotonics will sponsor three Best Paper Awards for this Conference, with a total cash prize of \$2000: one champion (\$1000), and two runner-ups (\$500 each). Participants must be both the primary author and presenter of an accepted abstract to be eligible. Qualifying papers and presentations will be evaluated by the awards committee and the winners will be notified at the end of, or after, the meeting.

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