Deep Cytometry and Other Applications of Time Stretch Instruments

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Abstract:

Deep learning has achieved spectacular performance in image and speech recognition and synthesis. It is naturally suited for applications where large amounts of data are available. Pioneered and advanced in the last 20 years, high throughput instruments based on the Photonic Time Stretch have established record realtime measurement speed in spectroscopy, interferometry, OCT, and imaging flow cytometry. Time stretch instruments have led to the discovery of new scientific phenomena in nonlinear dynamics and to qualitatively different instrumentation modalities. They generate approximately 1 Tbit/s of measurement data and are ideal for use with deep learning. In our laboratory, we have shown that high-throughput label-free cell classification with high accuracy can be achieved through a combination of time stretch with microfluidics for finding cancer cells in the blood. Such a technology holds promise for early detection of primary cancer or metastasis. In this talk, I will provide an overview of the technology and describe a new implementation of deep learning in the context of time stretch flow cytometry which avoids data pre-processing. The new network directly identifies the cells from the raw 1D time stretch waveforms hence obviates the computationally costly process of image formation and feature extraction. The improvement in computational efficiency makes it ideal for cell sorting via deep learning.

BIOGRAPHY: Professor Bahram Jalali

Bahram Jalali is the Director of the Photonics Laboratory, the Northrop-Grumman Endowed Chair and Professor of Electrical and Computer Engineering at UCLA with joint appointments in Biomedical Engineering, California NanoSystems Institute (CNSI) and Department of Surgery at the UCLA School of Medicine. He received his Ph.D. in Applied Physics from Columbia University in 1989 and was with the Physics Research Division of Bell Laboratories in Murray Hill, New Jersey until 1992 before joining UCLA. He is a Fellow of IEEE, OSA, APS, AIMBE, and SPIE. He is the recipient of the R.W. Wood Prize from OSA, Aaron Kressel Award from IEEE, and IET Achievement Medal, and the Pioneer in Technology Award from SBMT. He was the Founder and CEO of Cognet Microsystems, a company acquired by Intel in 2001. He was elected into the Scientific American Top 50 and MIT Technology Review Magazine Top 10 in 2005.