Light Science & Applications

Computational augmentation of optical coherence tomography contrast

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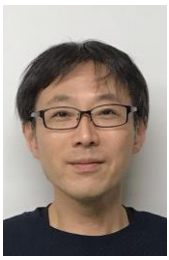
We introduce a series of contrast extensions for optical coherence tomography (OCT) and OCT microscopy (OCM), collectively referred to as "computationally augmented OCT/OCM." This approach combines OCT/OCM with extensive signal processing to enhance contrast. One notable extension is dynamic OCT, which involves repetitive OCT frame acquisition (typically a few tens of frames) followed by sequential statistical signal processing. This technique enables the generation of new image contrast based on cellular metabolism.

Additionally, we present a deep-learning-based extension of dynamic OCT, utilizing only four frames per sample location. This advancement facilitates rapid volumetric dynamic OCT imaging. Another deep-learning-based method introduces a novel OCT contrast: scatterer density imaging. Since scatterer density correlates with tissue density, this imaging modality is sensitive to tissue alterations.

We elucidate the principles of these OCT extensions and demonstrate their applications *in vitro*, including tumor spheroids and organoids, as well as *in vivo* imaging of the human eye.



Short Bio:

Yoshiaki Yasuno earned his PhD degree in spatio-temporal optical computing, which later became the foundation of Fourier domain optical coherence tomography. He currently leads the Computational Optics Group at the University of Tsukuba, Japan, focusing on coherence domain biomedical imaging.