Joint Event

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Suppression of scattering effects for macroscopic imaging of physiological functions in animal bodies

Abstract:

The absorption of near-infrared light in animal tissues is relatively lower than at other wavelengths, allowing deeper penetration and enabling real-time transillumination imaging. Additionally, by leveraging the spectral characteristics of biological components such as hemoglobin, functional imaging of physiological information within the body becomes feasible. However, near-infrared light undergoes strong scattering in tissues, leading to significantly blurred trans-body images. To address this issue, we have developed several scattering suppression techniques. For instance, the near-axis scattered light component can be extracted from the diffused light transmitted through tissues, deconvolution using the point spread function for scattering, and image restoration with deep learning. We validated the efficacy of these methods in various experiments, including: trans-body imaging of mouse digestive organs following a normal diet, visualization of blood flow changes in mouse kidneys, visualization of activated areas in the rat cerebrum following somatosensory stimulation, visualization of veins in human hands and feet, artery-vein differentiation in trans-body images of the human forearm, and imaging of blood flow changes in human hands in response to mental stimuli. These results demonstrate that applying scattering suppression techniques to near-infrared trans-body imaging enables safe, non-invasive, and functional imaging through animal bodies.

Biography

Koichi Shimizu received M.S. (1976) and Ph.D. (1979) degrees, from University of Washington, Seattle, USA. He was Research Associate in University of Washington 1974-79. He was an Assistant-, an Associate- Professors, and a Professor in Hokkaido University, Sapporo, Japan in 1979-2016. He is currently a Professor Emeritus of Hokkaido University, Japan, an Invited Research Professor of Waseda University, Japan and a Professor of Xidian University, Xi'an, China. He has been engaged in the studies of biomedical engineering. He served as associate editors of IEEE Trans. ITB in 1999–2007 and Advanced Imaging from 2023. He has been a Fellow of the Electromagnetics Academy, and an editorial board member of Scientific Reports, Nature.