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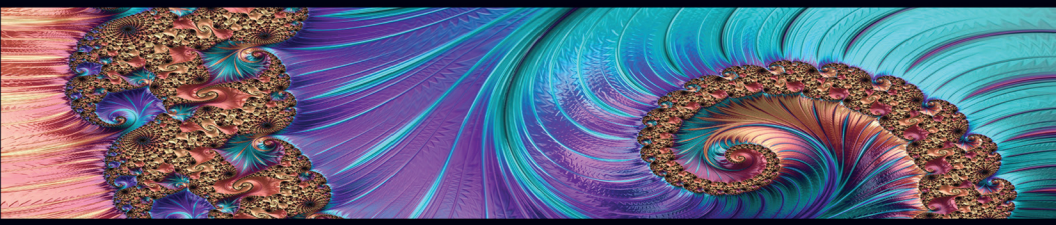

NEAR-INFRARED SPECKLE CONTRAST DIFFUSE CORRELATION TOMOGRAPHY FOR NONCONTACT IMAGING OF TISSUE BLOOD FLOW DISTRIBUTION

Daniel Irwin, Siavash Mazdeyasna, Chong Huang, Mehrana Mohtasebi, Xuhui Lui, Lei Chen, Guoqiang Yu

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Near-infrared Speckle Contrast Diffuse Correlation Tomography for Noncontact Imaging of Tissue Blood Flow Distribution

Imaging of tissue blood flow (BF) distributions provides vital information for the diagnosis and therapeutic monitoring of various vascular diseases. The innovative near-infrared speckle contrast diffuse correlation tomography (scDCT) technique produces full 3D BF distributions. Many advanced features are provided over competing technologies including high sampling density, fast data acquisition, noninvasiveness, noncontact, affordability, portability, and translatability across varied subject sizes. The basic principle, instrumentation, and data analysis algorithms are presented in detail. The extensive applications are summarized such as imaging of cerebral BF (CBF) in mice, rat, and piglet animals with skull penetration into the deep brain. Clinical human testing results are described by recovery of BF distributions on preterm infants (CBF) through incubator walls, and on sensitive burn tissues and mastectomy skin flaps without direct device–tissue interactions. Supporting activities outlined include integrated capability for acquiring surface curvature information, rapid 2D BF mapping, and optimizations via tissue-like phantoms and computer simulations. These applications and activities both highlight and guide the reader as to the expected abilities and limitations of scDCT for adapting into their own preclinical/clinical research, use in constrained environments (i.e., neonatal intensive care unit bedside), and use on vulnerable subjects and measurement sites.

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