Washington University in St. Louis
Office of Technology Management

TUMOR DETECTION USING DIGITALLY ENHANCED AND STIMULATED THERMAL IMAGING

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Background

Temperature differences between tumor and healthy tissue due to increased blood flow and metabolic activity are exploited for thermal imaging (TI) as an adjunct imaging modality for cancer diagnosis. Despite many technological advances and recent improvements, TI has a limited tumor depth detection and necessitates inconvenient procedures (applying freezing temperatures to the skin) that are challenging to standardize. To address these drawbacks, scientists from Washington University developed Laser-Stimulated Thermal Imaging (LSTI), enabling faster, accurate, and real-time tumor detection.

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Technology Summary

The LSTI technology developed by Dr. Samuel Achilefu and his team uses a low-powered laser to deliver a point source of heat into tissue. In conjunction with digital image enhancement, this provides a unique thermal diffusion profile with a high spatial resolution (down to a 10µm) that distinguishes cancerous- from healthy tissue (see Figure). In contrast to existing approaches, this technology enables detection of both superficial and deep tumors by varying the laser wavelength (multispectral excitation), duration, and power. Equally important, the stimulation is completed within seconds rather than several minutes. Besides tumor detection, applications include tissue physiology and pathophysiology studies, navigating surgical procedures, monitoring of disease treatment response, vein mapping, identification of thromboses/hemorrhages, monitoring of cardiovascular functions.

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Figure: LSTI image of a mouse tumor. Locally detected temperature differences (cool = blue, warm = red), visualize the tumor area, tumor boundary, and tissue inhomogeneities within the tumor site.

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Key Advantages

- Accurate, objective, and non-invasive, tumor detection
- Portability and real time tumor detection enable Point-of-Care applications
- Faster analysis and less inconvenient compared to existing approaches
- Animal data
- Numerous other applications

Patents

- US 20190328238

Additional Inventors

- Clyde Bethea
- Cheryl Bethea