Electrical and Computer Engineering Research Seminar

Machine-learning-aided Image-guided Surgery

When
10:30 am Friday, September 29, 2023

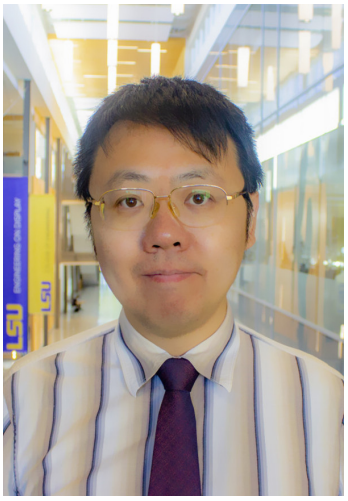
Where
Room 1256 Patrick F. Taylor Hall

ABSTRACT

Surgical resection is still the major treatment for solid tumors. The complete surgical resection of the cancer tissues in the surgery is essential to the prognosis of cancer patients. However, 40% of the US patients have the local recurrence in 5 years from the initial surgery, due to the failure to detect all the cancer tissues intraoperatively. To address this issue, we developed a spectroscopic device and machine-learning algorithms for rapid intraoperative tissue identification; we also designed a portable visible/near-infrared (VIS/NIR) camera system to directly visualize the tissue fluorescence. Human clinical studies were conducted with various cancers, including pancreatic and breast cancers, in several major hospitals in Louisiana. In the surgeries, our method may help to identify the cancer, the normal tissue, and the positive and the negative margins, within seconds.

Similar approaches, i.e., machine-learning-aided biomedical imaging, also helps to develop novel dental imaging scheme to overcome the significant challenge of current dental X-ray/CT. More than 2/3 of the US population has to receive dental imaging routinely. Current dental diagnosis largely relies on dental X-ray/CT, with several major drawbacks, such as failure to detect some critical dental diseases (e.g., early stage cracks and caries), ionizing radiation risks, and the necessity of holding immobile bulky imaging sensors during imaging. The objective of this project is to address these drawbacks by developing a novel dental imaging scheme with a lab-designed sensitive NIR fluorescence photonic imaging system, consisting of a high-resolution camera and a spectroscopic device, together with nanofluorophore, for real-time imaging of critical dental structures and diseases, including the diseases that are undetectable by the dental X-ray/CT.

Dr. Jian Xu



Dr. Jian Xu earned his M.S., M. Phil, and Ph.D. degrees in Electrical Engineering from Yale University. He is an Associate Professor in the LSU Division of Electrical and Computer Engineering. Dr. Xu primarily focuses on medical instrumentation tailored for image-guided cancer surgery, as well as the design of biomimetic and environmentally sustainable energy transducers, featuring natural nanoconductors. Dr. Xu was honored with the prestigious NSF CAREER Award in 2021. His research has garnered substantial attention, with his work being featured in an OUTLOOK report titled "Optics shine a light on dental imaging" published in Nature. Dr. Xu's medical devices have been employed in three clinical studies across several hospitals in the U.S. These studies encompassed patient applications spanning pancreatic cancer, laryngeal cancer, oral cancer, and dental diseases.