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Perspective

New Deep Tissue Imaging Techniques

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Abstract

New deep tissue imaging techniques are discussed for the study of the abnormalities of the biological tissues. Examples of prominent problems like cancer, brain tumour, etc are given.

Keywords: *Imaging Sensors; Deep Tissue Structure; Artificial Intelligence; Cloud System; Healthcare*

Introduction

The tissue imaging is taken as the images from different layers of the tissue structure, mainly in multi-layer complex systems.

The pathology is used for the analysis of images obtained from cells and tissues by using microscopy. Small tissue samples are taken from patients and then after staining of the samples and by visualizing them with visible or fluorescent light, processing/analysis is made.

Photoacoustic imaging is also used which is a novel hybrid imaging technique that combines both optical and ultrasound.

A high resolution non optical imaging technique is more useful.

Cancer research

Recent advances in tissue imaging for cancer research are given for early and reliable diagnosis of the cancer abnormalities.

Image analysis in clinical research has advanced very significantly. Different techniques are useful from immunohistochemistry to advanced techniques like multiplex imaging, digital pathology, flow cytometry and intravital microscopy. Tissue imaging *ex vivo* is used very easily. Various protocols and applications of digital analysis can provide basic and clinical data for tissue images, to analyse tissue images, mainly in *invitro* form as *in vivo* imaging is not easily accessible for research. This is very useful for cancer research.

Figure 1

Brain study

Brain tissue imaging is shown in the following figures as examples of deep tissue imaging.

The diagnosis of brain damage requires the highest resolution with say, a noninvasive imaging technique. Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET) and X-Ray Computed Tomography (CT) techniques are, generally, used for brain imaging.

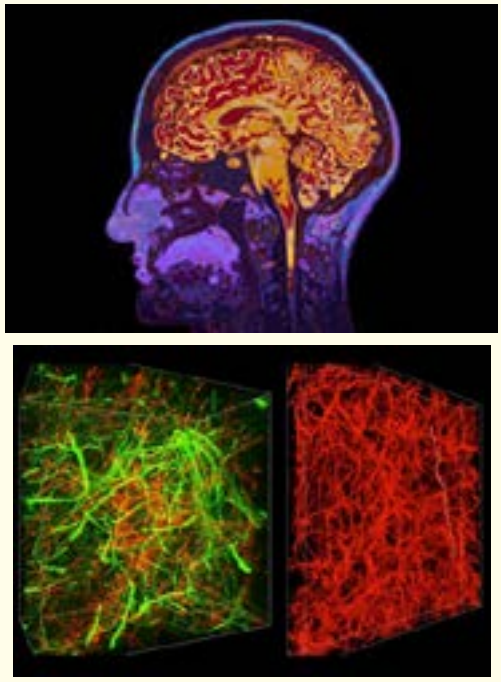

Figure 2

Ultrasound imaging technique, with pulsed laser source is used to illuminate the tissue to generate sound waves, photoacoustic waves, which are used as sound waves to get high-contrast, high-resolution, deep-tissue imaging of physiological parameters. Photoacoustic imaging, like ultrasound imaging, is a multiscale and multi depth imaging.

Features of PAS

Main features are low-cost, high-speed, compact pulsed laser diode-based photoacoustic tomography (PLD-PAT) imaging system for small animal brain imaging and tumor imaging. The clinical use of Translating photoacoustic imaging into clinical use is a challenge. Imaging system is based on clinical ultrasound platforms for noninvasive sentinel lymph node imaging and bladder imaging in small animals. Apart from photoacoustic tomography, it is a high-resolution photoacoustic microscopy systems for angiogenesis imaging and machine learning for enhancement. Molecular imaging is an advanced system for tissue imaging. capabilities.

Deep tissue imaging is used in biological imaging, to get more clear and detailed images deep within the tissue. Deep tissue imaging techniques are improved now.

Fluorescence imaging is one of the most commonly used imaging tools in research and clinical settings, applied to either fixed and live specimens (Zhao., *et al*. 2018). The advantages of fluorescence include its highest sensitivity, specificity, and spatial resolution that can reach subcellular levels on the advanced applications of deep issue imaging that have emerged in recent years.

Noninvasive imaging techniques

The non-invasive techniques are available now in echocardiography, nuclear imaging (positron emission tomography, PET; or single-photon emission tomography, SPECT), magnetic resonance imaging (MRI) and computerized tomography (CT) scan.

Imaging techniques

Five common modalities for imaging tests are: X-ray, CT, MRI, ultrasound and PET.

Medical imaging techniques

- Ultrasound Imaging.
- MRI (Magnetic Resonance Imaging).
- Pediatric X-ray Imaging.
- Medical X-ray Imaging.

Medical imaging techniques combining light and ultrasound

The combination of light and ultrasound gives a new medical imaging technique and if combined with the spectroscopic capability of light, this gives the spatial resolution of ultrasound. Spectroscopy is used to measure blood volume and blood oxygen, but in some biological tissues, these are highly scattering at optical wavelengths, but spatial resolution is poor. Ultrasound provides excellent resolution, but not good soft-tissue contrast. There are many techniques for combining light and ultrasound, for medical applications. In optoacoustic imaging, an acoustic pulse is generated by a pulse of laser light and is detected to produce an image. In acousto-photonic imaging, ultrasound modulates laser light is used for diffusive optical tomography. These are used in new medical applications.

Conclusion

New technological advances in deep tissue imaging techniques are discussed, in brief, with examples of cancer research and brain study.

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