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Mini Review

Bio imaging: Development, Importance, and Deficiency

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Abstract

A relatively recent development in medicine is bio imaging, which is based on digital technology. Real-time biological process visualisation is included. This cutting-edge imaging method provides information on anatomical structure by fusing it with functional data such as electric and magnetic fields, mechanical motion, and metabolism. With greater depth and complexity shown as you move along, it is a non-invasive method that provides you with a bird's-eye view of the human body. Therefore, bio imaging is a powerful tool for observing the internal structure and illnesses of the organism. Examples of bio imaging in the medical field include X-ray, ultrasound, and MRI images as well as 3D and 4D body scans using computed tomography (CT) scans and DEXA scans, which are useful for determining bone density in osteoporosis (Banjo AD et al., 2010). Some recent developments in biological imaging include fluorescence redistribution after photo bleaching, fluorescence resonance energy transfer, and maximum-resolution, two-positive charge fluorescent excitation microscopy. It gives us a way to take pictures of the complete body, anatomical sites, organs, tissues, and biological markers at the cellular level. It can be used to identify, characterise, and manage issues in clinical settings as well as to help with sickness management and therapy.

Keywords: Anatomical structure, Bio imaging, Electric and magnetic fields, Mechanical motion, Metabolism

INTRODUCTION

A branch of computational biology and bioinformatics is called bioimage informatics. It focuses on the use of computational methods to the large-scale and high-throughput analysis of bioimages, particularly cellular and molecular images. The objective is to extract relevant information from complex and heterogeneous images and associated metadata (Yusuf SR et al., 2017).

Automated microscopes can gather several images with little manual input. Data has exploded as a result, necessitating automatic processing. Surprisingly, there is evidence that automated systems can execute some of these activities better than people. Automated systems are additionally objective, in contrast to human-based analysis, whose assessment may (even subconsciously) be influenced by the desired outcome (Ajiboso SO et al., 2012).

Imaging is one of the main sources of data in biology, a field that heavily relies on data. This can involve various optical and electronic microscopy techniques, magnetic resonance imaging, and other image acquisition techniques. Images are typically processed to produce data after acquisition. Finding a relevant image that demonstrates an interesting property is sometimes all that is required, but other times this processing may involve a complicated pipeline made with the purpose of extracting quantitative data. It's critical that we comprehend the strategies and instruments at our disposal as well as some of the potential dangers (Edem VF et al., 2012). Multi-photon imaging, image-guided interventions, surgical planning, oncology treatment planning, endoscopic and laparoscopic operations, and virtual telemedicine are some of the contemporary uses of bioimaging. Bioimaging includes image processing and analysis, which enables measurement and quantification of anatomical, physiological, and/or clinically significant parameters. Because it provides essential supporting data, this track of the bioengineering programme is closely related to the other tracks. For instance, gene-array imaging and analysis as part of bioimaging give data for mining with bioinformatics approaches (Idowu ET et al., 2016).

For complicated bioimaging applications (such from molecular to cellular to organ), multi-scale and multi-modal imaging are usually required. An example of this is combined ultrasound and light imaging. Understanding complex structures and dynamically interacting processes deep inside the body is made feasible by imaging. The complete energy spectrum is utilised by many imaging techniques. Ultrasound, optical coherence tomography (OCT), MRI, and CT employing X-rays are a few examples of clinical modalities. Among the research techniques are electron microscopy, imaging from mass spectrometry, fluorescence tomography, biochemical luminescence, different kinds of OCT, and optoacoustic imaging. Confocal, multi-photon, total internal reflection and super-resolution fluorescence microscopy are examples of light microscopy techniques (Ozer J et al., 2008).

DISCUSSION

In the last thirty years, the applied sciences have undergone a conceptual and practical revolution, and this revolution is biomedical imaging. Such a breakthrough was made possible by two key factors: the technological advancement of hardware that allows for the gradual collection of increasingly minimal amounts of information about the organ under study, as well as the creation and use of sophisticated mathematical tools for signal processing within a truly interdisciplinary methodological framework. In a normal acquisition process for biomedical imaging, the biological tissue must be probed using some form of emitted, reflected, or transmitted radiation. The creation of a mathematical model that describes the process of creating a picture is followed by the formulation of computational techniques for the numerical solution of the model's equations. The rebuilt images are then subjected to techniques based on or influenced by Artificial Intelligence (AI) frameworks, such as machine learning, in order to extract therapeutically useful information (Wahab A et al., 2008). The inherent numerical instability of the reconstruction problem, the convergence characteristics, and the computational complexity of the image processing methods are significant challenges in this research endeavour. The following discussion of these difficulties will make use of many biomedical practise examples of considerable significance (Kingsley CK et al., 2016).

By using equipment that cannot physically enter the body or intrude on the skin, a process known as "bio imaging" enables researchers to see biological processes in real time. The goal of bio imaging is to interfere with living processes as little as possible. Additionally, it is frequently utilised to obtain information on the three-dimensional structure of the object being observed without having physical contact. The term "bio imaging" is used more broadly to describe techniques for visualising biological substances that have been fixed for monitoring. Bio imaging can be used to evaluate common anatomy and physiology and collect data in the basic and medical sciences. Interdisciplinary teams with knowledge in electrical engineering, mechanical engineering, biomedical engineering, and other domains are necessary due to the multidimensional nature of bio imaging research. In order to address biological concerns in the life sciences, bioimaging science develops and applies imaging technology and computational software tools (Brown H et al., 2015). It is a developing area of biomedicine and bioengineering. The development of tools and methodologies for characterising tissue properties and examining its structure and function through in vivo or ex vivo visualisation at multiple resolutions, ranging from molecular and cellular to organ level, is the focus of this discipline, which brings together engineers, computer scientists, physicists, biologists, chemists, and clinicians. The principles of optics, photonics, magnetic resonance, nuclear medicine, radiation, ultrasonics, and spectroscopy are the main foundations of imaging technology (Onyinyechukwu AA et al., 2017).

CONCLUSION

Clinicians now have a powerful tool in bioimaging to monitor patient responses to treatment. It promises non-invasive, secure disease identification throughout therapy. In the modern world, bioimaging is a very significant and novel imaging technology. Accurate imaging is necessary for efficient cancer management, both in vitro and in vivo; therefore creating strategies for imaging inquest are essential. Due to the advancements it has made in the diagnosis of numerous ailments, it is of utmost significance in the medical sciences. It has assisted in reducing the risk of various illnesses and problems. It aids medical professionals in early diagnosis to avoid long-term effects. The development of several bioimaging techniques has been covered in this article. The advantages and disadvantages of bioimaging techniques have also been covered. The development of bioimaging in the field of medical sciences has proven to be beneficial for everyone.

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