Recent Advances in Non-Invasive Detection Techniques for Abnormalities in Biological Tissues: Early Bone Fracture Detection

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Recent non-invasive detection techniques are discussed for finding the abnormalities in biological systems/tissues. A case study of early bone fracture detection and evaluation is given.

In complex heterogeneous tissue media, it is difficult to diagnose abnormalities or diseases, easily with conventional techniques. Determination of physiological and anatomical conditions non-invasively and nondestructively, is important for getting reliable and authentic data from abnormal points to compare these with the data from normal tissues.

Some of the prominent evaluation systems are as follows.

Without X-ray, the most acceptable simple method is the use of a tuning fork to generate acoustic vibration propagation inside the bone sample and to use, on the other side, a microphone pick-up as an acoustic sensor to get electrical output signals from different locations and plot these signals accordingly. The peaks received would represent the location of abnormality like fracture to know the proper depth and size of the fracture. Such work, reported by us, is well accepted world over, however, an intelligent bone fracture detection system has been developed further for proper fracture detection with the bone fracture image classification, by training a backpropagation neural network on processed images. This is more simpler and quicker method, for early bone fracture detection.

Bone fracture detection is also easily made by using CNN (Computer Neural Network) Algorithm for minor fractures.

For identification of faults through computer-based technique, a highly responsive system is used by taking CNN (computer neural network) Algorithm for getting results in bone fracture, even in noisy environment, by using edge detection techniques for the analysis of minor fracture details, as an efficient analysis.

A new technique using machine learning and digital geometry is also used these days to detect bone fractures by bone contours.

Generally, electromagnetic radiation, computed tomography, magnetic resonance imaging (MRI), ultrasound, are commonly used as imaging techniques to detect fractures to accurately pinpoint the location of the fracture, with images edge detection using CNN algorithm.

MATLAB makes it easy to process it further to convert to black and white for proper fracture analysis and classification by machine learning.

Deep Learning Approach is used these days for bone fracture detection and of fracture size and depth. This is also a new approach.

AI (Artificial Intelligence) is used to study further the effects of environmental conditions on biological tissues in normal or abnormal conditions, for better day to day life.

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This research contribution will give enhancement to the research in the field and to maintain better health.

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