URSI-RCRS 2024, ARIES/GEHU, Bhimtal, India, 22 - 25 October, 2024

AI Based Methods to Study the Effect of EMF Radiation for BioMedical Data Analysis

Mahua Bhattacharya
Center for Biomedical Research
ABV Indian Institute of Information Technology & Management
Gwalior 474015, Madhya Pradesh, India

Extended Abstract

Artificial Intelligence based techniques have revolutionized the diagnostic procedure and automated decision making system for therapeutic planning using medical data in macro, micro and molecular levels. The acquisition system of medical data in any form which captures the information of biological tissue (hard tissue, soft tissue and semi -soft tissue) depicts the prognosis of diseases and the pattern of abnormality for clinical investigation. For more precision and accuracy for diagnosis of diseases, computer based decision support techniques are being developed using advanced image processing, computer vision, machine learning and AI. Apart from the diseases, human and animal health suffer from various environmental effect which are recent research topics for observation and investigation . The aim of present research is to study the effect of Electromagnetic Radiations (EMF) [1],[2] on biological cell / tissues using non-invasive imaging techniques due to mobile phone radiation which uses the electromagnetic radiation in microwave range. Research indicates that EMFs having a wide spectrum of disturbance affect physiological, cellular, and molecular levels of the human and animal body [3]. This may also be further cause of cancer prone diseases with symptoms at cellular and molecular levels. Computer vision and Machine Learning based techniques for automated cell segmentation can assist the physicians to analyze the cellular level anomalies to determine the early diagnostic and treatment procedures. Non-Linear Segmentation NSM model has been suggested [4], [5] to extract the foreground region of rat brain cell images based on difference of squared saturation and brightness components and diffraction phenomena. The NSM model is efficient enough to segment the foreground region from the background using HSV Color Model (Hue, Saturation and Value) for finding any abnormality in cellular level. The research [6] is further extended to molecular level to detect the connection between tissue specific tumor samples and genes as genetic marker by developing the heterogeneous network based on Graph neural networks (GNNs). The proposed model uses network based on tumor sample-gene relation data and gene-gene interaction data and successfully predicts the tumor gene association through incorporating tissue-specific gene expression and primary site-based gene counts as features. Thus we may propose that such predictive model based on domain specific computational approaches may open a new horizon for modern day therapy planning and drug delivery.

References

1. Highland GJ (2000) Physics and biology of mobile telephony. Lancet 356:1833–1836
2. Lin JC (2004) Studies on microwaves in medicine and biology: from snails to humans. Bioelectromagnetics 25(3):146–159
3 Hardell L, Sage C (2008) Biological effects from electromagnetic field exposure and public exposure standards. Biomed Pharma- cother 62(2):104–109
4. Zhi X, Jiang S, Zhang W, Wang D, Li Y (2017) Image degradation characteristics and restoration based on regularization for diffractive imaging. Infra-red Phys Technol 86:226–238
5. Mukta Sharma and Mahua Bhattacharya (2020) Discrimination and Quantification of Live/Dead Rat Brain Cells using Non-Linear Segmentation Model, Medical & Biological Engineering & Computing , Springer -Verlag , pp: 1-20.
6. Surabhi Mishra, Gurjot Singh, Mahua Bhattacharya (2024) Tissue specific tumor-gene link prediction through sampling based GNN using a heterogeneous network, Medical & Biological Engineering & Computin (Springer Nature) Pages 1-12, Publisher Springer Berlin Heidelberg.