NIGERIAN ASSOCIATION OF MEDICAL PHYSICISTS (NAMP)

in collaboration with

NIGERIAN NUCLEAR REGULATORY AUTHORITY (NNRA) & NIGERIA ATOMIC ENERGY COMMISSION (NAEC)

13th Medical Physics Annual Scientific Conference & Workshop Abuja 2024

Theme:

MEDICAL PHYSICS:
Improving Medicine, Shaping the Future of Healthcare

Mon 4th to Fri. 8th Nov. 2024

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ABOUT

NIGERIAN ASSOCIATION OF MEDICAL PHYSICISTS

i. To promote and develop to the highest standards, the application of the methods and concepts of physics in medicine, biology and related sciences through clinical services,education and research

ii. To encourage professional interest in training and safety in the application of Physics in medicine.

iii. To prepare and disseminate technical information, scholarships, scientific resources related to Medical Physics and related fields to members.

iv. To promote cooperation in scientific research, development and education within the field of medical physics.

v. To promote scientific exchanges on medical physics and related fields of science.

vi. To recommend standards for education, training and accreditation programmes within the field of medical physics.

vii. To initiate and/or support in approved centres and institutions, research and educational programs in medical physics.

viii. To promote certification of medical physicists.

ix. To develop the field of medicine and healthcare in the country through the application of concepts of physics.

x. To be the voice of Nigerian medical physicists in the international community.

His Excellency,
ASIWAJU BOLA AHMED TINUBU
President, Federal Republic of Nigeria

MUHAMMAD ALI PATE
Coordinating Minister of Health and Social Welfare
Federal Republic of Nigeria

NYESOM WIKE
Minister of the Federal Capital Territory
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Keynote Speaker

Prof. Wil Ngwa
Professor of Global Health,

Wilfred Ngwa is a global oncology researcher and medical physics expert who is developing technologies that integrate with radiation therapy to reduce cancer treatment times and costs. He is a professor of global health at Rutgers Global Health Institute and a professor in the Department of Radiation Oncology at Rutgers Cancer Institute of New Jersey and Robert Wood Johnson Medical School. He also is a Rutgers Presidential Faculty Scholar.

The broad aim of Ngwa's research and global collaboration is to increase access to cancer treatment and reduce health disparities, particularly in low- and middle-income countries.

He leads a research group that is developing low-cost approaches and technologies that can substantially reduce treatment times and costs and that can be implemented in resource-poor settings. One such technology incorporates artificial intelligence and smart radiotherapy biomaterials, such as nanoparticle drones that can be injected intravenously and will emit missile-like electrons when activated by photon beams during radiation therapy. This process is designed to increase damage to cancerous tumors while minimizing toxic effects on body tissues. This technology also can be programmed to sustainably deliver cancer-fighting immunotherapy drugs in resource-effective and measurable ways. This research is supported by the National Institutes of Health and industry partners and is in clinical translation.

Ngwa's overall research program is designed to address many types of cancer, and he is leading studies related to treating prostate, breast, and cervical cancers in Nigeria, South Africa, Tanzania, and the United States. Since 2019, he has been the chair of The Lancet Oncology commission on cancer in sub-Saharan Africa. He also is an external adviser to the U.S. presidential administration's Cancer Cabinet, convened by President Joe Biden to help establish and make progress on the administration's reignited Cancer Moonshot initiative, and he is a co-chair of the U.S. Cancer Moonshot 2.0 Lancet Oncology commission. He is editor of IOP Publishing's scientific series in global health and radiation oncology and an editorial board member for Journal of Global Oncology, Frontiers in Oncology, and ecancermedicalscience.

He is the founding director of the Global Health Catalyst Summit, designed to catalyze high-impact international collaborations and initiatives to eliminate health-related disparities in the U.S. and globally.

Ngwa is originally from Cameroon, where he studied physics and computer science at the University of Buea, receiving a bachelor of science degree. He earned his master's and doctoral degrees from University of Leipzig in Germany then completed postdoctoral education and training in radiation oncology at MD Anderson Cancer Center at the University of Texas and at Brigham and Women's Hospital, Dana-Farber Cancer Institute, and Harvard Medical School.

Prof. Wil Ngwa is the Keynote Speaker at the 2024 Medical Physics Conference, Nigeria

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Machine Learning-Based Classification of Brain Tumors Using Perceptron Model and Nuclear Magnetic Relaxometry Data

Yusuf A. Abdulmajid, Udeme I. Nicholas, Dada O. Michael, Awojoyogbe O. Bamidele
Department of Physics, Federal University of Technology, PMB 65, Minna, Niger State, Nigeria.
Corresponding Email: majidyusuf34@gmail.com

Abstract

A brain tumor is an abnormal growth of cell that develops in the brain; this can be malignant or noncancerous. The classifications of these tumors are glioblastomas, low grade gilomas and metastases. The region of interest are contralateral white matter CW, peritumoral white matter PW, and solid tumor ST. Conventional magnetic resonance imaging (MRI) scanners are one of the image modalities used for brain tumor diagnoses. However, conventional MRI scans are not automated thereby making diagnosis difficult and provides inaccurate result, time-consuming and expensive. The literature has not yet determined how relaxometry investigations with machine learning models and computational techniques can distinguish between intra-axial brain tumors. The perceptron neural networks (PNN) provides a powerful tool to help doctors analyze, model and make sense of complex clinical data with quantitative parameters such as longitudinal and transverse relaxation times (T1 and T2) respectively. The study provides and creates machine learning models in relaxometry studies in which diagnosis can be done without undergoing full MRI scans and these processes are based on short time acquisition. The study also helps to check patient's treatment performance especially those who are not allergic to MRI contrast agent and help in follow-up studies. The Bloch equation was used to simulate the acquisition parameters (T1 and T2) in R programming language. A code in R-studio was used to extract the mean ± standard deviation (SD) data from 31 patients with untreated intra-axial brain tumors in another study, which were randomly generated from 31 to 900 hypothetical patients in, excel to have large dataset as sample for training models. In machine learning classification, negative binomial (nb) had the best performance model for CW with the accuracy of 79 % and 68 % for kappa, while support vector machine (SVM) model had the best model for PW with accuracy of 70 % and 55 % for kappa and glmnet model had the best performance model for ST with accuracy of 72 % and kappa is 58 %. These models with higher accuracy and kappa were used for deployment in machine implementation on CW, PW and ST. With these quantitative magnetic resonance imaging (MRF) method, with relaxometers, software, and models that allow for the analysis of results in less than five minutes, this study looks into the issue of time-consuming and sufficiently reduced MRI scan costs as well as automation for accurate diagnosis, making it faster, less expensive, and more efficient.

Keywords: Brain tumor, abnormal growth of cell, malignant or noncancerous, glioblastomas, low grade gilomas and metastases.

Artificial Intelligence-Based Classification of Brain Tumors Using Garson Model and Magnetic Resonance Fingerprinting

Yusuf A. Abdulmajid, Udeme I. Nicholas, Dada O. Michael, Awojoyogbe O. Bamidele
Department of Physics, Federal University of Technology, PMB 65, Minna, Niger State, Nigeria.
Corresponding Email: majidyusuf34@gmail.com

Abstract

Conventional magnetic resonance imaging (MRI) scans are not automated thereby making diagnosis difficult, time-consuming and expensive. In low- and middle-income countries (LMICs), these scanners are inadequate and the few available ones are not regularly maintained due to poor funding. Consequently, patients with intra-axial brain tumors are mostly not diagnosed early enough for treatment. Furthermore, enough scanners are not available for follow up assessment after treatment and worse still; most patients avoid follow up assessment due to the cost of having an MRI scan. To address this challenge, this study assessed the utility of magnetic resonance fingerprinting (MRF) and machine learning (ML) for differentiating common types of adult intra-axial brain tumors (gliomablastomas, low grade gliomas and metastases). In this study, emphasis was placed on the use of two parameters measured with MRF, T1 and T2 relaxations times. T1 and T2 values for these brain tumors were obtained from literature for 31 patients with untreated intra-axial brain tumors and scanned using magnetic field strength (B0) of 1.5T. The three classes of tumors were considered in three regions of interests (ROI); that is, contralateral white matter (CW), peritumoral white matter (PW) and solid tumor (ST). A code in R-studio was used to extract the mean ± standard deviation (SD) of T1, T2 data from 31 patients with untreated intra-axial brain tumors in another study, since the data from 31 patients is quite small to train ML models, a larger data was simulated with a computer program written in R in which 300 patients were assumed to be scanned. In all, 900 dataset (representing each patient) were simulated such that each tumor class had 300 data points each. The time-independent Bloch nuclear magnetic resonance (NMR) flow equation was then solved analytical for transverse magnetisation (M_y). Using the simulated data points, the relaxation rate (T0) and M_y were then calculated for each tumor class. The calculations were then pre-processed into a dataset for training ML models. An artificial neural network such as Garson Algorithm was implemented for the dataset. The results showed the model was able to identify complexities in the inputs such that T0 was found to be the most important feature determining MR signal for CW and PW while T1 is most important feature determining the signal. 80% of this dataset was used as training set while the remaining 20% was used as testing dataset for implementation of supervised ML models. nb had the best classi fication