

الاية

قال تعالى:

﴿لَقَدْ جَاءَكُمْ رَسُولٌ مِّنْ أَنْفُسِكُمْ عَزِيزٌ عَلَيْهِ مَا عَنِتُّمْ حَرِيصٌ عَلَيْكُمْ
بِالْمُؤْمِنِينَ رَءُوفٌ رَّحِيمٌ﴾.

(سورة التوبة الآية: 128)

Dedication

I dedicate this research to my family ...

...To my grandparents whose spiritual will to pursue intellectual advancement provided me role models and confidence to pursue my own education and intellectual enrichment.

...To my mother whose support an academic and professional achievements served as my inspiration.

...To my father whose support, intellectual curiosity, encouragement, and literary exploits helped guide me through my academic and literary endeavors.

...To my friends, uncles and aunts for unconditional love and support provided me the sustenance I needed to complete this work.

...Finally this research is kindly dedicated to my beloved woman Fatima Osama for her encouragement, loving and housing every hours, also for her family especially our mom Nosiba Jailani who always beside us and encourage and love us lightly, Which jumped us to the ladder of success.

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Abstract

This study aimed to characterize brain glioma in magnetic resonance images using image texture analysis techniques in order to recognize the tumor and surrounding tissues by means of textural features. This an analytical case control study was conducted in radiation oncology department at radiation and isotopes center of Khartoum (RICK), which included 100 patients underwent MRI for brain (50 with brain glioma and the rest with normal MRI (case control) scan), FLAIR, T2, T1, and T1 with contrast sequence was performed then the image extracted as DICOM images and then converted to TIFF format which used as input data for an algorithm generated using IDL (interactive data language) for textural features extraction. Three basic textural features types was used to classify the brain images using five different window sizes (3x3, 5x5, 10x10, 15x15, and 20x20 pixels) which are first order statistics (FOS), second order statistics (SGLD), and diagonal features (dSGLD), to recognizes 4 different classes (brain gray and white matter, tumor, background and CSF); further analysis and image segmentations was performed to remove background from the images for purpose of image enhancement. The extracted feature classified using linear discriminant analysis. The result showed that the classification accuracy, sensitivity and specificity according to window sizes was (99.5%, 98.4% and 100%), (98.5%, 95.7% and 100%), (99.1%, 98.8% and 99.3%), (98.1%, 94.3% and 100%), and (96.1%, 90.0% and 98.8%) respectively for brain glioma. This study implies that 3x3 window gives a higher classification accuracy while the most significant features for classification includes; difference average of SGLD, mean and entropy of FOS.

ملخص الدراسة

هدفت هذه الدراسة الي توصيف الاورام الدبغية الدماغية في صور الرنين المغنطيسي باستخدام تقنية التحليل النسيجي المتقدمة وذلك حتي يتم توصيف الورم والانسجة المجاورة له باستخدام خصائص التحليل النسيجي ومفرداته. هذه الدراسة عبارة عن دراسة تحليلية استخدمت فيها عينات مرجعية للمقارنة اجريت في قسم الاشعة لعلاج الاورام بالمركز القومي للعلاج بالاشعة والطب النووي-الخرطوم, واحتوت علي مائة عينة (مريض) يعانون من الاورام الدبغية غير الاورام النسيجية الاخرى. اجري لهم فحص الرنين المغنطيسي من اجل التشخيص او المتابعة حسب البروتوكول المتفق عليه كما تم استخدام وسيط التباين في صور الرنين من اجل اظهار الورم. استخرجت هذه الصور من اجهزة التشخيص وتم تحويلها الي صيغة (TIFF) وتم ادخالها الي خوارزمية برنامج التحليل النسيجي لحساب التكترس. ثلاث مجموعات من انماط التحليل النسيجي تم استخدامها وهي حسابات الامر الاول والثاني اضافة الي دايقونل الامر الثاني. وتم حسابها في خمسة حقول فتحت لاجل استخراج هذه الانماط لاربعة انواع من الانسجة (المحيط الخارجي للصور, الانسجة البيضاء والداكنة, سائل النخاع الشوكي اضافة الي الورم الدبغي) وهذه الحقول علي التوالي هي (3x3, 5 x 5, 10 x 10, 15 x 15, 20 x 20). تم تحليل البيانات باستخدام برنامج التحليل الاحصائي بطريقة التمييز الخطي وكانت دقة ودرجة حساسية هذه الحقول علي التوالي هي (99.5, 94.3 و 100%), (98.5, 95.7 و 100%), (99.1, 98.8 و 99.3%), (98.1, 94.3 و 100%) و (69.1, 95.5 و 98.8%) وخلصت هذه الدراسة الي ان الحقل (3 x 3) له درجة حساسية عليا علي البقية اضافة الي ان الانماط النسيجية المستخرجة يمكن استخدامها في رسم الحقل الاشعاعي حول الورم بصورة دقيقة.

List of abbreviations

2D-3D	Two-Three Dimensional
3DCRT	Three Dimensional Conformal Radiation Therapy
ALL	Acute Leukocyte Leukemia
BBB	Blood Brain Barriers
CAD	Computer Aided Diagnosis
CBIR	Content-Based Image Retrieval
CBV	Cerebral Blood Volume
CSF	Cerebrospinal Fluid
CTV	Clinical Target Volume
CVA	Cerebrovascular Accident
DICOM	Digital Imaging and Communications in Medicine
EPI	Electronic Portal Imaging Devices
FD	Fractal Dimension
FLAIR	Fluid Attenuation Inversion Recovery
FOS	First Order Statistics
FOV	Field Of View
FSD	Focus Skin Distances
GBM	Glioblastoma Multiform

GE	General Electric
GTV	Growth Target Volume
IBM	International Business Machines Corporations
ICRU	International Commission of Radiation Measurement and Units
IDL	Interactive Data Language
IGRT	Image Guided Radiation Therapy
IMRT	Intensity Modulated Radiation Therapy
IR	Inversion Recovery Time
LGG-HGG	Low-High Grade Glioma
M.E.M	Mohamed Elfadil Mohamed
MDCT	Multidetector Computed Tomography
MLCs	Multileave Collimator
MLE	Maximum Likelihood Estimation
MRI-CT	Magnetic Resonance Imaging-Computed Tomography
MRS	Magnetic Resonance Spectroscopy
MS	Multiple Sclerosis
NSF	National Science Foundations
OAR	Organ At Risk
PACS	A Picture Archiving and Communication System

PENT	Primitive Neuroendocrine Tumors
PTV	Planning Target Volume
RF	Radiofrequency
RGB	red, green, and blue
RT	Radiotherapy
SFS	Sectional Forward Search
SGLD	Spatial Gray Level Dependence Matrix
SPSS	Statistical Package for Social Sciences
ST	Slice Thickness
SVM	Support Vector Machine
T	Tessla
T1_T2	T1-T2 Magnetic Resonance Time
TE-TR	Time to Echo and Time to Repeat
TIA	Transient Ischemic Attack
VHL	Von Hippel Landau Gene
WHO	World Health Organization

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