Dedication

I dedicate this thesis to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this program and on His wings only have I soared. This work is also dedicated to my parents, Amaal and Mohammed Tom, who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve. To myfriend, Zeinab .A .Mustafa who has been a constantsource of support and encouragement during the doctoral program. I am truly thankful for having you in my life. To my children Hassan and Dorrar who have been affected in every way possible by this quest .Thank you. My love for you all can never be quantified. God bless you.

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Glossary

CBTUS	Central Brain Tumor Registry of the United
Csf	*Cerebrospinal Fluid*
GBM	*Glioblastomamultiforme*
MRI	magnetic resonance imaging
CT	computed tomography
PET	positron emission tomography
SPECT	Single photon emission tomography
MEG	Magneto encephalography
NMR	nuclear magnetic resonance
GE	gradient echo
SE	spin echo
IR	Inversion recovery
TE	echo time
TR	repetition time
RF	radio frequency
PD	Proton Density
PWI	perfusion-weighted imaging
DWI	diffusion-weighted imaging
MRS	Magnetic resonance spectroscopy
FMRI	Functional MRI
DTI	Diffusion Tensor Imaging
CBF	Cerebral blood flow
CBV	cerebral blood volume
MTT	mean transit time
MRA	magnetic resonance angiography
SNR	signal-to-noise ratio
PDF	probability density function
AWGN	additive white Gaussian noise

PVE	partial volume effect
SAR	synthetic aperture radar
ROI	Regions of Interest
VOI	Volume of Interest
VTK	Visualization Tool Kit
EM	expectation-maximization
ANNs	Artificial Neural Networks
KNN	k nearest neighbor
MRF	Markov Random Field
3 D	Three-dimensional
2D	TWO dimensional
EG	Energy
CO	Correlation
EN	Entropy
IN	Inertia
IDM	Inverse difference moment
SA	sum average
SE	Sum entropy
DE	Difference entropy
IMOC1	Information measures of correlation1
IMOC2	Information measures of correlation2
VA	Variance
CT	Computed Tomography
CAT	Computed Axial Tomography
PET	Positron Emission Tomography
MRI	Magnetic Resonance Imaging
MATLAB	Matrix Laboratory
NN	Neural Network

BP	Back-Propagation
CAD	Computer Aid Diagnoses System
SOM	Self-Organizing Map
GLCM	Gray-Level Co-occurrence Matrices
MSE	Mean Square Error
SE	Sensitivity
SP	Specificity
PPV	Positive Predictive Value
NPV	Negative Predictive Value
TP	True Positives
TN	True Negatives
FP	False Positives
FN	False Negatives
ROC	Receiver operating characteristics
TPR	True positive rate
FPR	false positive rate
CFNN	cascade forward back propagation
GFNN	Generalized regression Neural network
PNN	probabilistic neural network
FFNN	Feed forward back propagation

Abstract

Brain tumor is the major cause of cancer deaths in human which is due to uncontrollable cells growth in brain portion. It is evident that the chances of survival can be increased if the tumor is detected and classified correctly at its early stage. Conventional methods involve invasive techniques such as biopsy, lumbar puncture and spinal tap method, to detect and classify brain tumors into benign (non-cancerous) and malignant (cancerous). A computer aided diagnosis algorithm has been designed so as to increase the accuracy of brain tumor detection and classification, and thereby replace conventional invasive and time consuming techniques. This study introduces an efficient method of brain tumor detection and classification, where, the real Magnetic Resonance (MR) images are classified into normal, non-cancerous (benign) brain tumor and cancerous (malignant) brain tumor. MATLAB have been used through every procedures made. These include image processing and ANN procedures. In image processing procedures, process such as image Pre-processing, histogram equalization, image filtering, segmentation, and feature extraction have been discussed in detail, followed by the methods used for classification process using ANN. Image preprocessing have been used to improve the signal-to-noise ratio and to eliminate the effect of unwanted noise. It is important to distinguish the ROI from its surroundings. This can be done by using different segmentation methods and morphological operations. The segmented ROI was considered for texture analysis. By considering the entire segmented tumor region a set of textural descriptors was calculated for each ROI using Gray Level Co-occurrence Matrices (GLCM) based second order statistics. The discriminant features that are suitable for properly differentiating the two tumor types were selected from these descriptors. The results of Co-occurrence matrices are then fed into four neural networks for further classification and tumor detection.The system was able to achieve an accuracy of 99.0%, sensitivity98.7%, specificity 100%, and an overall accuracy of classification 99.3% and of detection 99.2 %.The created systems have therefore, proved to effectively enhance the quality of the brain images and discriminate between normal and abnormal with an effective level of precision.