MRI-ADC image texture feature analysis to differentiate benign and malignant brain tumors

Vijithananda S.M.[1], De Silva W.M.K.[2*], Jayatilake M.L.[3], Hewavithana P.B.[1], Gonçalves T.C.[4], Rato L.M.[4], Weerakoon B.S.[3], Kalupahana T.D.[5].

[1]Department of Radiology, Faculty of Medicine, University of Peradeniya, Sri Lanka.
[2]Department of Physics, Faculty of Science, University of Ruhuna, Wellamadama, Matara, Sri Lanka.
[3]Department of Radiography/Radiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Peradeniya, Sri Lanka.
[4]Department of Informatics, University of Evora, Evora, Portugal.
[5]Department of Computer Engineering, Faculty of Engineering, University of Sri Jayewardenepura, Sri Lanka.

Apparent Diffusion Coefficient (ADC) is one of the most common magnetic resonance imaging (MRI) techniques that are frequently used in the brain tumor diagnosis process. This study is based on extracting statistical texture features from MRI-ADC images of human brain tumors to observe correlations of feature values between malignant and benign brain tumors. This study was carried out using 980-malignant, 813-benign labeled MRI brain ADC image slices acquired from 253 subjects presented to the National Hospital of Sri Lanka. The pathological condition of each subject was identified by the radiological reports and confirmed it using histopathological reports. Pixel values within the tumor region of the selected ADC images were delineated by drawing region of interest (ROI) surrounding the tumor area. The features; mean pixel value, higher-order moments of ADC, Grey Level Co-occurrence Matrix (GLCM) texture features; mean, variance, energy, entropy, contrast, homogeneity, correlation, prominence and shade, and patients' age were extracted from each ROI. The extracted features were tested with a one-tailed P-value test with a 95% confidence level. The values for kurtosis of ADC, mean pixel value of ADC, patient age, and the GLCM texture features; mean1, mean2, variance1, variance2, energy, and contrast showed significantly (P-value<0.05) higher feature values for benign tumors while the entropy, homogeneity correlation, prominence, and shade showing significantly high values for malignant tumors. The facts for the skewness of ADC were not enough (P-value 0.05<0.0734) to reject the null hypothesis. The study concludes the feasibility of utilizing the above features except for skewness, as potential biomarkers to differentiate benign and malignant brain tumors.

Keywords: MRI, Malignant, Benign, GLCM texture features

*Corresponding author: desilva@phy.ruh.ac.lk