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Texture-based classification of brain tissues in non-contrast computed tomography images of stroke patients

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Aim: To classify brain tissues into ischaemic, haemorrhagic and normal tissue in computed tomography (CT) images of stroke patients using statistical texture descriptors.

Patients and Methods: Non-contrast CT images of 164 stroke patients were obtained in contiguous slices from two radiodiagnostic centres. Two experienced radiologists blinded to each other identified and categorized the lesions into ischaemic and haemorrhagic subtypes. Four regions of interest (ROIs) in each CT slice that demonstrated the lesion; two each representing the lesion and normal tissue were selected for analysis. The co-occurrence matrix, run-length matrix, absolute gradient and histogram parameters were calculated for them using MaZda® texture analysis software. Artificial neural network (ANN) algorithm was used to classify the ROIs into normal tissue, ischaemic and haemorrhagic lesions using the radiologists' identification and categorization as the gold standard.

Results: The sensitivity was 0.637, specificity 0.753, false positive rate (FPR) 0.247, and false negative rate (FNR) 0.363 with co-occurrence matrix parameters. With run-length matrix parameters the sensitivity was 0.544, specificity 0.607, FPR 0.393, and FNR 0.456 while with absolute gradient parameters the sensitivity was 0.546, specificity 0.586, FPR 0.414, FNR 0.454. With histogram parameters the sensitivity was 0.947, specificity 0.962, FPR 0.038, and FNR 0.053. The histogram parameter-based classification was significantly better than parameters of the other statistical texture descriptors ($p < 0.05$).

Conclusion: The histogram class of texture features showed the highest sensitivity and specificity in classification of brain tissues and therefore is most suitable for computer-aided diagnosis of stroke on non-contrast CT images.

Biography

Christopher Chukwuemeka Ohagwu is a faculty member at the Nnamdi Azikiwe University, Nigeria. He started his career in the academia at the University of Maiduguri, Nigeria. His research interests and activities are in the area of imaging in medicine, medical image analysis and other disciplines related to diagnostic imaging. He loves to connect with other academics with similar interests and welcomes external collaboration.

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