ABSTRACT

The objective of this research is to automatically segment the region of interest from medical images obtained from a Magnetic Resonance Imaging (MRI) scanner. The Magnetic Resonance (MR) images of the human femur are used in the segmentation algorithms.

MR images are complex images, providing details of different types of tissues. This poses a challenging segmentation problem. A region of interest (ROI) is therefore defined manually, in order to reduce image complexity.

Two hybrid algorithms, namely the neural fuzzy algorithm and the fuzzy neural algorithm were explored for the segmentation of the bone from MR images. In the neural fuzzy algorithm, the Self Organizing Maps (SOM) neural network classifies the MR data set. The output classes from the SOM neural network are used to calculate the membership functions of the different tissues in the MR data set. The bone tissue has the lowest mean value, as it is the darkest region in the MR data set. The overlapping area between the first two membership functions is then defuzzified to obtain the defuzzification value. Pixel values lower than the defuzzification value are labeled as bone. An interactive artifact removal algorithm is then used to select the bone region and to remove artifacts. Finally, a three-dimensional (3D) model of the femur is constructed from the results of the neural fuzzy segmentation.

ABSTRACT

The fuzzy neural algorithm uses the entropy minimization principle to calculate the membership functions of the different tissues in the MR image. The user selects sample data points from the different tissues present in the MR image. The membership functions of the different tissues are calculated using the entropy minimization principle. The overlapping areas between the membership functions are then defuzzified. The defuzzification values are used to reduce the gray level values of the MR images. Finally, these images are fed into the SOM neural network for finer classification.