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Organ-Based Medical Image Classification Using Support Vector Machine

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ABSTRACT

Computer-Aided Detection/Diagnosis (CAD) through artificial Intelligence is emerging ara in Medical Image processing and health care to make the expert systems more and more intelligent. The aim of this paper is to analyze the performance of different feature extraction techniques for medical image classification problem. Efforts are made to classify Brain MRI and Knee MRI medical images. Gray Level Co-occurrence Matrix (GLCM) based texture features, DWT and DCT transform features and Invariant Moments are used to classify the data. Experimental results shown that the proposed system produced better results however the training data is less than testing data. Support Vector Machine classifier with linear kernel produced higher accuracy 100% when used with texture features.

KEYWORDS

Computer Aided Detection/Diagnosis (CAD) System, Discrete Cosine Transforms (DCT), Discrete Wavelet Transform (DWT), Magnetic Resonance Imaging (MRI), Support Vector Machine (SVM)

INTRODUCTION

Medical Imaging techniques used to visualize internal anatomy of human body parts. Now a day these modern techniques are able to capture each and every part of Human body. Single visualization generates hundreds of images from which radiologists find the pathological or abnormal images. The big size of data makes the diagnosis procedure difficult and time consuming task. To reduce this burden many different types of CAD systems are evolved and used in practice. Such systems work as second opinion systems. To make CAD system more intelligent Data Mining and Machine learning techniques are used. The purpose of such CAD systems is not only access the quantitative data but also produce quality results. To achieve this objective different feature extraction techniques are used to extract features from medical images.

The purpose of this paper is to evaluate the strength of machine learning algorithm for the MRI Medical image classification problem. MRI technique is used to visualize the anomalies associates with different organs like Brain, spine, Chest, Blood vessels, Abdomen, Bones and joints etc. Different diseases or problems are associated with each of these organs which also required unique diagnosis procedure. Hence the CAD system designed to recognize one disease associated with one of these organs is not suitable for the other. Also, the shape and texture is different of each organ. Hence the medical images need to differentiate according to organ. In this work, Brain MRI and Knee MRI

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images are considered. Brain MRI images are of three views sagittal, Axial and coronal. For the current work, Support vector machines are used for image classification. The feature extraction techniques used for current work are Texture feature extraction, Invariant Moment feature extraction and wavelet feature extraction.

LITERATURE REVIEW

Review of earlier research during last six years in Medical Image classification is conducted and summarized in the Table 1.

Sundos Abdul-ameer Hameed et. al (2016) presented a work to classify the heart, liver and kidney organ medical images. GLCM is used for feature extraction purpose and image is classified using minimum distance calculation. Namely contrast, Entropy, Homogeneity and Energy features are extracted from images and Euclidean distance based Minimum Distance Classifier classified the total 30 images 10 images of each organ. The results achieved by the method are 80% for Heart images, 50% for liver images and 80% for kidney images. Shroti Paliwal et. al analyzed the performance of various methods proposed by five earlier researchers. Brain MRI image processing methods are assessed based on time and accuracy parameters shows that SVM produce better accuracy but required higher computation time. Redouan Korchiyne et. al (2014) proposed a combined fractal and GLCM feature based method for prevention of osteoporosis on the initial MRI and CT Scan images. The technique produce 85.71% recognition rate which is better than individual fractal feature based or GLCM feature based recognition. Wessam Lahmod Nados et. al (2014) reported their work to identify tumor regions from MRI Brain images as benign and malignant. K-means clustering where K=4 is used to segment the image into set of regions. GLCM technique is used for feature extraction.With kNN classifier 86% recognition rate is achieved. Nayana Suresh et. al. (2015) discussed the various techniques used for tumorous brain image Segmentation and classification. Josephine Sutha V et. al (2016) proposed a Hybrid technique for automated detection and classification of brain MRI images. Data set contains T2 weighted 970 MRI images from which 670 used for training and 300 used for testing. Proposed classifier is the combinations of shift-invariant discrete wavelet transform (SIDWT) and adaptive neuro-fuzzy inference system (ANFIS). GLCM is used for Feature Extraction produces 99.8% accuracy rate. Anita Chandra et. al used five GLCM features Contrast, Correlation, Entropy, Homogeneity and Energy and SVM classifier for Brain MRI image classification as normal or abnormal. Priyanka Udayabhanu et. al presented brain tumor classification and detection technique. The image decomposed using DWT transform and GLCM features are extracted and used to train the probabilistic neural network. 90.0% accuracy reported by the researcher. The abnormal image segmented using k-means clustering and tumor region identified. Kshitija V. Shingare et. al (2015) worked on brain tumor image classification and detection. The MRI images enhanced using Contrast Limited Adaptive Histogram Equalization (CLAHE) and extracted Texture features using GLCM technique. Probabilistic neural network classified image into normal and abnormal. Dilated Gradient mask is used to detect tumor region. Ingrid Nurtanio et. al (2013) used first-order statistics texture (FO), Gray Level Co-occurrence Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM) feature extraction techniques and SVM classifier for cyst and tumor lesion detection from 133 dental images. Researcher achieved 87.18% accuracy using combination of these all features. Nitish Zulpe et. al (2012) designed automatic brain tumor classification system based on GLCM feature extraction and two layered feed forward Neural Network. The proposed approach tested on 80MRI images produce 97.5% accuracy rate. P. Muthu Krishnammal et. al proposed brain tumor classification and detection technique. The image decomposed using discrete curvelet transform and texture features using GLCM technique extracted