ABSTRACT

Content Based Medical Image Retrieval (CBMIR) is a significant research area in the field of computer vision and substantial progress has performed during last few years. In image retrieval , indexing of the image content is performed using visual features such as texture, shape, and colour. CBMIR takes the present patient image as a query and searches the similar images from the past records of patients' image in the database .CBMIR has a high impact on the diagnosis , decision-making , research, and education. In this research , the image retrieval is performed using Feature extraction, Optimized feature selection, Classification of optimized features , and Similarity measurements. This type of CBMIR is called Feature Optimized Classification Similarity (FOCS) framework. The texture feature extraction methods are used in this thesis for extracting the content of images. If the retrieval process considers the vast number of features, then it results in lowering the performance of retrieval. The existing medical image retrieval systems are not optimal in visual feature dimensionality reduction.

In this Thesis, Bio-inspired Meta-Heuristic Algorithms (BMHA) are used to address the issues of high visual feature dimensionality by selecting the best subset of features. There are four steps for the selection of features such as feature subset generation, feature subset evaluation, stopping condition, and validation of the final feature subset during testing. The best feature subsets are selected based on classification techniques using Machine

Learning algorithms. When the image classification accuracy is high, and error rate is low then the selected subset features are very effective for retrieval. Finally, relevant images are retrieved from the database using similarity measurement technique. The classification accuracy and error rate are measured using the confusion matrix. The retrieval performance is evaluated using Precision and Recall. The proposed system retrieves all the human body anatomy images, for example, brain, lung, liver and kidney, with respect to different imaging modalities.

The first proposed FOCS framework uses a Gray Level Co-occurrence Matrix (GLCM) and Tamura Features (TF) for extracting the texture contents of the image. Fuzzy based Particle Swarm Optimization (FPSO) is used as a feature selection method in order to reduce the high feature dimension, to fine tune the parameters and also to overcome the problem of feature vectors being surrounded in local optima of original PSO. Fuzzy based Relevance Vector Machine (FRVM) is used for classifications that collect the optimized feature subsets for evaluation, decides the kernel function, and identifies its relevant model parameters and achieved 92% of classification accuracy. Euclidean Distance (ED) is used for similarity measurements between the query image and the target images based on the positions of relevant ranking. The precision of this proposed retrieval system has been improved significantly to 92.85% in comparing with PSO-SVM (Support Vector Machine) of 84.62% and PSO-RVM of 85.71%. The recall has also been from 73.33 % of PSO-SVM , and 80% of PSO-RVM to 86.66% of FPSO-FRVM.

The second proposed work uses Gabor Filter (GF) for texture feature extraction by calculating the mean and standard deviation of filtered image with four scales and six orientations in addition to GLCM and TF features .The feature selection work has integrated a smart decision-making method of Ant Colony Optimization (ACO) algorithm with FPSO, which selects the global best path for subset generation. FRVM is used for the classification of optimized features and achieves 94% of classification accuracy then images are retrieved based on ED. This hybridization of ACO with FPSO has improved the precision to 93.33 % and recall to 87.50%.

The third proposed method uses Local Binary Patterns (LBP) which captures the global features of the medical image. Fuzzy-based Cuckoo Search (FCKS) algorithm is used to select the best subset blocks of binary patterns with few parameters. FRVM achieves 94% of classification accuracy, and ED is used to retrieve the images. Even though the precision by this proposed system is 93.50% which is almost similar to that of FPSO-ACO-FRVM, the recall is improved to 88.24%.

In fourth FOCS framework, a new texture feature extraction technique called Local Octa Patterns(LOP) is proposed. LOP would take gray level differencesin horizontal, diagonal and vertical directions using eight directional code and represents the global features of the medical images. LOP is compared with Local Derivative Patterns (LDP),Local Ternary Patterns (LTP) and Local Tetra Patterns (LTrP). A hybrid method called FCKS and FPSO is used for feature selection of LOP that are stable to image rotation, noise and gray-scale transformation of medical images. FRVM

achieves 96% of classification accuracy and ED is used to retrieve the images. The precision has been improved from 91.30%, 92.85%, and 93.75% to 96%, as compared with the LTP, the LDP, and the LTrP respectively. The recall has been improved from 81.25%, 85.71%, 88.23% to 92% as compared with the LTP, LDP, and LTrP, respectively.

This integrated framework supports the physicians and researchers in diagnosis and decision-making.