Automatic Liver CT Image Clustering based on Glowworm Swarm Optimization

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ABSTRACT
The diversity of human life invite number of medical problem such as liver disease, cancer disease and many more. The liver disease infects the human body system. And infect liver caused the death of human. For the prediction of liver infected disease used various mining algorithm such as clustering and classification. In this paper modified the clustering algorithm using self-organized neural network model and glowworm swarm algorithm. the glowworm swarm algorithm is new family of swarm intelligence and used for the process of feature selection and optimization. The optimized set of liver image data perform better cluster in near to symptoms of liver cancer and infection. The infected area mapped in counter value. The modified algorithm implemented in MATLAB software and used reputed liver cancer image dataset for the validation of process. Our empirical result shows better result instead of pervious algorithm.

Keywords: -Medical Image, Clustering, SOM, Glowworm Algorithm.

INTRODUCTION

Now a day's image processing plays vital role in the field of medical science. In medical science used various digital devices for serious disease prediction of critical disease issue. For the detection and prediction of major critical disease used some data mining technique and swarm intelligence. The data mining offering various clustering and classification technique. the clustering technique estimate the infected region of disease. But the large number of iteration loss some data related to cluster input data. For the reduction of iteration and improvement of clustering performance used neural network and swarm intelligence. Now a day's various optimization algorithm is used for the optimization of cluster generation. Now in current decade various authors proposed various algorithm for the diagnose of medical disease. The diagnoses algorithm decomposed the process of heuristic function such as genetic algorithm and animal formed intelligence for the better prediction. In this paper proposed the automatic liver cancer detection based on self-organized map(SOM) neural network with optimization algorithm glowworm. Here glowworm swarm algorithm work for the process of optimization. The glowworm swarm algorithm basically based on the process of optimization for the selection of data point in cluster generation. The self-organized neural network model used the concept of cluster generation based on the concept of winner and successor matrix. The winner part of matrix generators the formation of cluster. The formed cluster decides the value of counter and detected the area of infected liver. In many real life problems, there are several objectives that may be conflicting that need to be optimized simultaneously. Under such problems there no exists a single optimal solution but rather a whole set of possible solutions of equivalent quality. Recently, many studies were executed with inspirations from ecological phenomena for developing optimization techniques. This paper is motivated by a common phenomenon in agriculture that is colonization behavior of invasive weeds [5]. The rest of paper describe as in section II discuss related work in the field of automatic liver cancer detection. In section III. Discuss the algorithm of SOM neural network and glowworm swarm algorithm in section IV discuss the proposed methodology for the detection of cancer. In section V discuss the experimental result analysis and finally discuss conclusion & future work.
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II RELATED WORK

In this section discuss the related work in the field of medical image diagnose based on different clustering and classification technique. the clustering and classification technique play major role in the process of detection. For the improvement of clustering technique various authors used heuristic based function for the optimization process.

[1] They define a "good image cluster" as one in which images can be easily composed (like a puzzle) using pieces from each other, while are difficult to compose from images outside the cluster. The larger and more statistically significant the pieces are, the stronger the affinity between the images. This gives rise to unsupervised discovery of very challenging image categories. They further show how multiple images can be composed from each other simultaneously and efficiently using a collaborative randomized search algorithm. This collaborative process exploits the "wisdom of crowds of images", to obtain a sparse

yet meaningful set of image affinities, and in time which is almost linear in the size of the image collection.

[2] They discuss an unsupervised clustering method for axially symmetric directional unit vectors. Their method exploits the Watson distribution and Bregman Divergence within a Model Based Clustering framework. They empirically validate the proposed method using synthetic data. Next, they apply the method for clustering image normal and demonstrate that the proposed method is a potential tool for analyzing the depth image.They propose a novel unsupervised clustering method with the aim to cluster axially symmetric directional data. It exploits Bregman Divergence within the Model Based Clustering (MBC) framework.

[3] According to author, Liver cancer is one of the leading death causes, it cause 1.25 millions deaths per year worldwide. Additionally, during the last 2 decades, the mortality rate from primary liver cancer is reported to have increased by 41%. In this research, an automated liver CT image clustering approach based on evolutionary meta-heuristic algorithm called invasive weed optimization is presented without any prior information about the number of naturally occurring groups in the images. The fitness function used in the genetic algorithm is k-means objective function for searching of the smoothed compact cluster.

[4] According to researcher, Clustering is one of the branches of Statistics with more research activity in the recent years. As noted by Meila, “clustering is a young domain of research, where rigorous methodology is still striving to emerge”. Indeed, some authors have recently expressed their concerns about the lack of theoretical or formal developments for clustering. This paper aims to contribute to this regularization. This paper aims to provide some insight into the theoretical foundations of the usual nonparametric approach to clustering, which understands clusters as regions of high density, by presenting an explicit formulation for the ideal population clustering.

[5] They discuss an unsupervised method for indoor RGB-D image segmentation and analysis. They consider a statistical image generation model based on the color and geometry of the scene. Their method consists of a joint color-spatial-directional clustering method followed by a statistical planar region merging method. They evaluate their method on the NYU depth database and compare it with existing unsupervised RGB-D segmentation methods.They discussed an unsupervised indoor RGB-D scene segmentation method. Their method is based on a statistical image generation model, which provides a theoretical basis for fusing different cues of an image.

[6] They describe, to pre-processing of microarray data can be thought of as a pipeline, with a series of stages through which the data must travel before useful results can be extracted. The analytical pipeline is virtually identical for single-channel and dual channel arrays, although different algorithms are employed for different platforms. Clustering has become an integral part of microarray data analysis and interpretation. The algorithmic basis of clustering: the application of unsupervised machine learning techniques to identify the patterns inherent in a data set is well established. This review discusses the biological motivations for and applications of these techniques to integrating gene expression data with other biological information, such as functional annotation, promoter data and proteomic data.

[7] They discussed, to addresses unsupervised discovery and localization of dominant objects from a noisy image collection with multiple object classes. The setting of this problem is fully unsupervised, without even image-level annotations or any assumption of a single dominant class. This is far more general than typical co-localization, co-segmentation, or weakly-supervised localization tasks. They tackle the discovery and localization problem using a part-based region matching approach: They use off-the-shelf region proposals to form a set of candidate bounding boxes for objects and object parts. These regions are efficiently matched across images using a probabilistic Hough transform that evaluates the confidence for each candidate correspondence considering both appearance and spatial consistency.

[8] They represent unsupervised method for discovering recurring patterns from a single view. A key contribution of this project is the formulation and validation of a joint assignment optimization problem where multiple visual words and object instances of a potential recurring pattern are considered simultaneously. This report mentions two methods with and without pre-knowledge of objects. First approach is achieved by segmentation techniques whereas the optimization is achieved by a greedy randomized adaptive search procedure (GRASP) with moves specifically designed for fast convergence. They have quantified systematically the performance of their approach under stressed conditions of the input. They demonstrate that their proposed algorithm outperforms state of the art methods for recurring pattern discovery on a diverse set of real images.

[10] They described, an object category discovery system is to annotate a pool of unlabeled image data, where the set of labels is initially unknown to the system, and must therefore be discovered over time by querying a human annotator. To improve the accuracy and efficiency of category discovery, they propose an iterative framework which alternates between optimizing nearest neighbor classification for known categories with multiple kernel metric learning, and detecting clusters of unlabeled image regions likely to belong to a novel, unknown categories.They have introduced a novel framework for iterative object class discovery. The proposed method iteratively discovers new object categories by efficiently and accurately grouping image regions under the optimized distance metric.

III PROPOSED ALGORITHM

In this section discuss the proposed algorithm for image clustering. For clustering used SOM neural network model and for the minimization and optimization of feature contains used glowworm optimization algorithm. The glowworm optimization algorithm works on the principle of nearest neighbor. For the extraction of features used partial feature extraction process. The partial feature extraction process extracted the feature of image in terms of partial boundary value. The image features are extracted from the image using energy function. SOM acts as a clustering mechanism that projects N-dimensional features from the energy function into an M-dimensional feature space [15]. The resulting vectors are fed into an SOM that categorizes them onto one of the relearned n classes [9,6]. The transformed feature vectors are fed into the SOM, which classifies them. We call the feature space generated from the Energy function output as primary feature space and M-dimensional feature space from SOM output as secondary feature space. The vectors from the secondary feature space are called secondary feature vectors. The concept behind the use of SOM as an intermediate stage is that it can perform and enhanced it. Topology preserving feature mapping from its input space to output space, and these mapped features, which are of reduced dimension, can represent the necessary information in the input features [20]. Thus, the training and segmentation of the upper stage (SOM) can be done in a reduced dimension compared to the higher dimension of the primary feature space.

Step1. Initially input image passes through partial feature extractor

Step2.the extracted feature passes through glowworm optimization algorithm.

Step3. The glowworm optimized the feature of input image

Step4. In phase of feature mapping in feature space of SOM network create a fixed cluster according to objective function.

Step5. Here show steps of processing of SOM network

1) Define weight of each node value.

2) Select a random cluster from training data and present it to the SOM.

3) All nodes satisfied the minimization of objective function.

4) The radius of the area around the objective is calculated. The size of the area decreases with each iteration.

5) Each node in the objective function area has its weights adjusted to become more like the objective. Nodes closest to the objective are altered more than the nodes furthest away in the neighborhood.

6) Repeat from step 2 for enough iteration for convergence.

7) Calculating the objective is done according to the Euclidean distance among the node's weights (W_1, W_2, … ,W_n) and the input vector's values (V_1, V_2, … , V_n).

   1) This gives a good measurement of how similar the two sets of data are to each other.

8) The new weight for a node is the old weight, plus a fraction (L) of the difference between the old weight and the input vector… adjusted (theta) based on distance from the BMU.

9) The learning rate, L, is also an exponential *decay* function.

   1) This ensures that the SOM will converge.

10) The lambda represents a time constant, and t is the time step

Step6. After processing of SOM network out data of image is segmented is done

Step7. Finally gets segmented image and estimate the value of global consistency error rate.

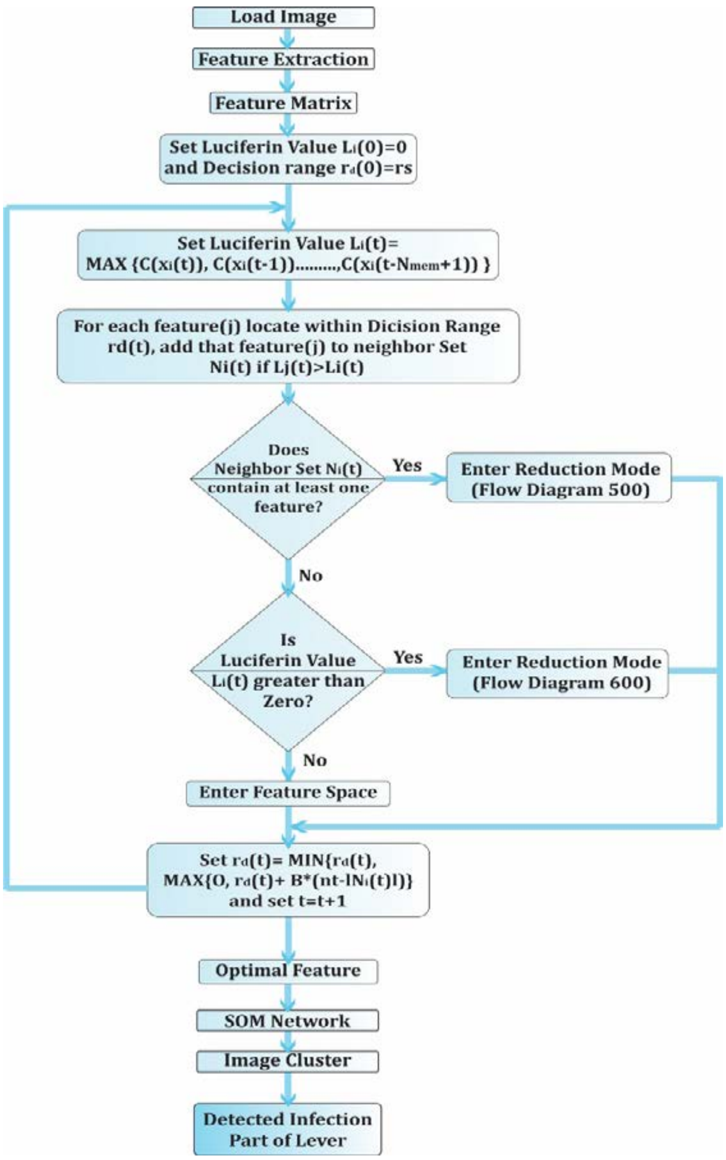

Figure 1 Proposed model of liver image clustering.

IV EXPERIMENTAL ANALYSIS

In this section discuss the experimental result analysis of image clustering of CT and MRI image. The clustering algorithm simulated in MATLAB software. For the evaluation of performance used accuracy parameter corresponding to their cluster value K.

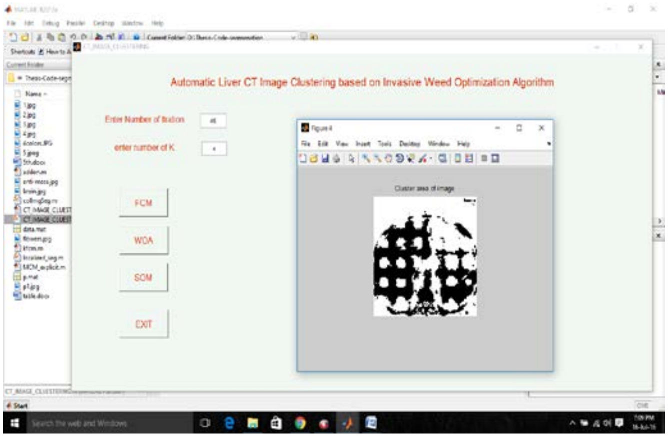

Figure 2: Shows thatthe result, Cluster Area of Image for 1 image using SOM Method with input value of k is 4.

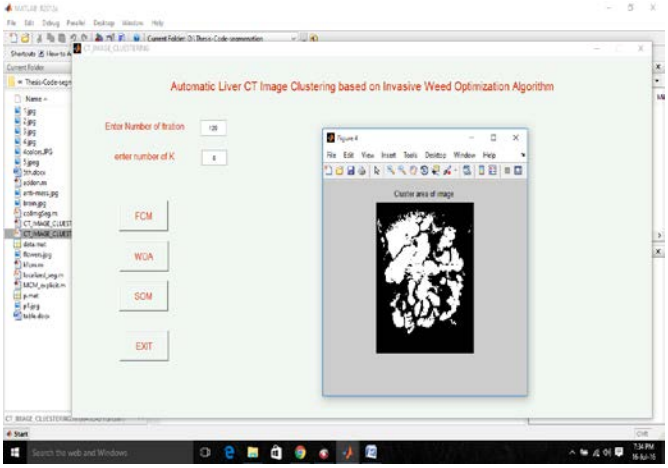

Figure 3: Shows thatthe result, Cluster Area of Image for 3 image using FCM Method with input value of k is 8.

METHOD	K	ACCURACY
FCM	2	0.850000
WOA	2	0.900000
SOM	2	0.950000
FCM	4	0.850000
WOA	4	0.900000
SOM	4	0.950000
FCM	6	0.850000
WOA	6	0.900000
SOM	6	0.950000
FCM	8	0.850000
WOA	8	0.900000
SOM	8	0.950000

Table 1: Shows thatthe value of K and Accuracy with FCM, WOA and SOM for image 1.

METHOD	K	ACCURACY
FCM	2	0.880000
WOA	2	0.900000
SOM	2	0.950000
FCM	4	0.850000
WOA	4	0.870000
SOM	4	0.880000
FCM	6	0.800000
WOA	6	0.950000
SOM	6	0.970000
FCM	8	0.700000
WOA	8	0.800000
SOM	8	0.900000

Table 2: Shows thatthe value of K and Accuracy with FCM, WOA and SOM for image 4.

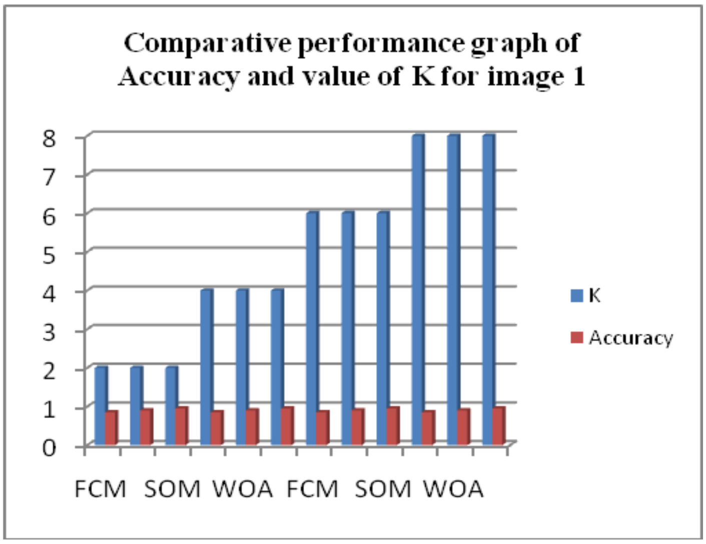

Figure 4: Shows that the comparative result of FCM, WOA and SOM method for image 1 with input of K is 2, 4, 6 and 8.

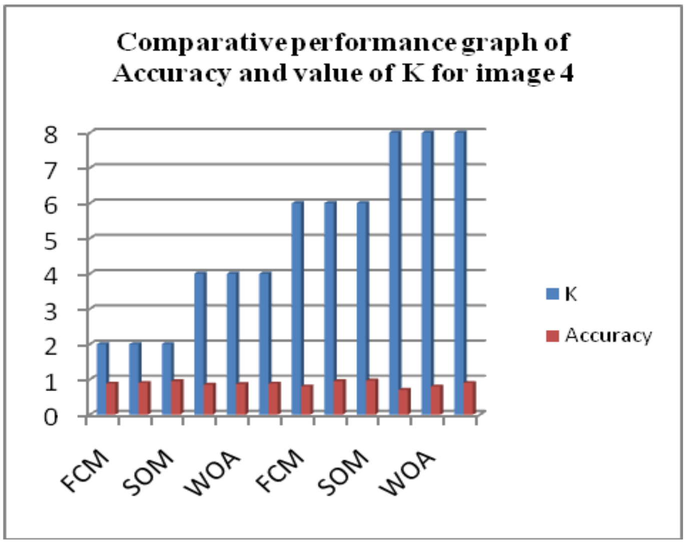

Figure5: Shows that the comparative result of FCM, WOA and SOM method for image 4 with input of K is 2, 4, 6 and 8.

V CONCLUSION & FUTURE SCOPE

In this paper proposed a hybrid method for image clustering. The process of image clustering is combination of glowworm optimization algorithm and SOM network. The proposed algorithm is very efficient in terms of global consistency error rate. In the case of proposed algorithm global consistency error rate is decrease. The glowworm optimization algorithm is basically part of swarm intelligence. The intelligence of swarm provides the optimization of feature for the minimization of size of input neurons in clustering process. We compare the proposed method with different set parameter for image clustering methods of which are also performed another clustering method such as FCM and WTO. The proposed method on liver image. Intensity in homogeneities can be clearly seen in the image. it also used for normal image for boundary detection. Our experimental result shows that the proposed method gives the best clustering results whatever the shape and the position of the initial contour and the resulting contours are thin and present no discontinuities. This allows it to be efficient in automatic systems. The method by FCM and the method of WTO both based on an edge stopped function fail because the objects in the image have weak edges.

REFERENCES

[1] Alon Faktor and Michal Irani ""Clustering by Composition"—Unsupervised Discovery of Image Categories", IEEE, 2014, Pp 1092-1106.

[2] Md. AbulHasnat, Olivier Alata and Alain Tremeau "Unsupervised Clustering of Depth Images using Watson Mixture Model", IEEE, 2014, Pp 214-219.

[3] Walaa H. El-Masry, EidEmary and Aboul Ella Hassanien "Automatic Liver CT Image Clustering based on Invasive Weed Optimization Algorithm", IEEE, 2014, Pp 1-5.

[4] Jose E. Chacon "Clusters and water flows: a novel approach to modal clustering through Morse theory", arXiv, 2014, Pp 1-25.

[5] Md. AbulHasnat, Olivier Alata and Alain Tremeau "Joint Color-Spatial-Directional clustering and Region Merging (JCSD-RM) for unsupervised RGB-D image segmentation", arXiv, 2015, Pp 1-15.

[6] Paul C. Boutros and Allan B. Okey "Unsupervised pattern recognition: An introduction to the whys and wherefores of clustering microarray data", BRIEFINGS IN BIOINFORMATICS, 2016, Pp 331-343.

[7] Minsu Cho, SuhaKwak, Cordelia Schmid and Jean Ponce "Unsupervised Object Discovery and Localization in the Wild: Part-based Matching with Bottom-up Region Proposals", IEEE, 2015, Pp 1201-1210.

[8] Rajat Aggarwal, Krishnam Gupta and Sakshee Vijay "Discovering Recurring Patterns in an Image", IEEE, 2013, Pp 1-7.

[9] Dengxin Dai and Luc Van Gool "Unsupervised High-level Feature Learning by Ensemble Projection for Semi-supervised Image Classification and Image Clustering", arXiv, 2016, Pp 1-22.

[10] Carolina Galleguillos, Brian McFee and Gert R. G. Lanckriet "Iterative Category Discovery via Multiple Kernel Metric Learning", Springer, 2014, Pp 115-132.

[11] SuhaKwak, Minsu Cho, Ivan Laptev, Jean Ponce and Cordelia Schmid "Unsupervised Object Discovery and Tracking in Video Collections", IEEE, 2015, Pp 3173-3181.

[12] Roberto J. Lopez-Sastre "Unsupervised Robust Feature-based Partition Ensembling to Discover Categories", IEEE, 2016, Pp 114-122.

[13] Michael Rubinstein, Armand Joulin, Johannes Kopf and Ce Liu "Unsupervised Joint Object Discovery and Segmentation in Internet Images", IEEE, 2013, Pp 1-8.

[14] Pravin Kumar Rana, JalilTaghia, Zhanyu Ma and Markus Flierl "Probabilistic Multiview Depth Image Enhancement Using Variational Inference", IEEE, 2015, Pp 1-15.

[15] Hongxing Wang, Gangqiang Zhao and Junsong Yuan "Visual pattern discovery in image and video data: a brief survey", WIREs Data Mining KnowlDiscov, *2014, Pp 24-37.*