TELKOMNIKA Telecommunication, Computing, Electronics and Control
Vol. 19, No. 6, December 2021, pp. 1975~1981
ISSN: 1693-6930, accredited First Grade by Kemenristekdikti, Decree No: 21/E/KPT/2018
DOI: 10.12928/TELKOMNIKA.v19i6.21592

Suport visual details of X-ray image with plain information

Nashwan Jasim Hussein[1], Sabah Khudhair Abbas[2]
[1]Department of Information Security, College of Information Technology, University of Babylon, Hilla, Iraq
[2]Department of computer engineering Techniques Imam Al-Kadhum University College, Najaf, Iraq

Article Info

Article history:

Received Aug 16, 2020
Revised Jul 17, 2021
Accepted Jul 27, 2021

Keywords:

Feature extraction
Image analysis
Image enhancement
Medical image
Tumor classification

ABSTRACT

The objective of content-based image retrival (CBIR) is to retrieve relevant medical images from the medical database with reference to the query image in a shorter span of time. All the proposed approaches are different, yet the research goal is to attain better accuracy in a reasonable amount of time. The initial phase of this research presents a feature selection technique that aims to improvise the medical image diagnosis by selecting prominent features. The second phase of the research extracts features and the association rules are formed by the proposed classification based on highly strong association rules (CHiSAR). Finally, the rule subset classifier is employed to classify between the images. The last pert of our work extracts the features from the kidney images and the association rules are reduced for better performance. The image relevance inference is performed and finally, binary and the best first search classification is employed to classify between the images.

Corresponding Author:

Nashwan Jasim Husssein
Department of Information Security, College of Information Technology
University of Babylon
Hilla, Iraq
Email: alsalihnashwan@uobabylon.edu.iq, alsalihnashwan@yahoo.com, sf18nj@alkadhum-col.edu.iq

1. INTRODUCTION

Recently, with the advent of picture archiving and communication systems (PACS), there is an increasing trend in the incorporating all patient-related content, such as text, pictures, maps, and temporal details. picture archiving and communication (PACS) should incorporate techniques that allow the retrievals of medical image in a timely manner to increase the quality and effectiveness of care process. In order to offer appropriate support to the practitioner with their examination and treatment, the collection will provide photographs that follow the requirements set forth by the specialists. Add content-based image retrival (CBIR) capability to picture archiving and communication allows it more effective to aid diagnosis. Making it simpler and more productive to access and arrange processed images in hospitals. content based image retrival system is the retrieval system that takes the features of the system into account for distinguishing between the images. This work focuses only on the ultrasound images of the kidneys. The aim of content based image retrival system is to retrieve similar images from the database with respect to the query image [1]. Here, the goal is to find the similar images and it is achieved by means of image properties. This helps the healthcare professional to make decision by referring the similar case [2]. Traditional content based image retrival systems work in the following way and the basic functionality of the content based image retrival system relies on two important phases. In the training phase, the input database is processed by means of advanced image pre-processing and feature extraction activities. The discrimination ability of the content based image retrival system relies on the effectiveness of the features being extracted. However, the feature set must be crispy and precise, such that the time consumption can be reduced. The feature vector is formed from the extracted features and saved for future reference [3]. During the testing phase, when the test image is passed, the features of the test image are extracted and are matched against train feature vector. The top matching images are listed as the result to the user. The main challenges being faced by the content based image retrival systems are retrieval time and efficiency. Content based image retrival system is considered to be effective only when the better results are achieved in a short span of time [4]. Some of the noteworthy applications of content based image retrival systems are biometric systems, medical applications, and textile industry and so on. The biometric applications utilize finger print, palm print, face images as input for retrieving the matching entity. This kind of applications can be employed to ensure security [5]. The content-based image retrival systems in medical field support the healthcare professional in relating between the similar cases. Thus, the medical content based image retrival systems help in achieving better diagnosis. Textile industries employ content based image retrival systems for finding the related fabric images. which are rich in texture. A new content-based image retrieval method in that texture and color feature used. In the color image two types of information is extracted such as color and texture feature. In which it is more accurate for image retrieval based upon their query request [6]. By comparing to the conventional moments, the Zernike moments has less sensitive to noise in the descriptor for ideal region-based shape. Red green blue (RGB) image converted from the spot where his opponent's chromaticity space, the contents of the characteristics of the color of an image caught using distribution moments of Zernike chromaticity [7]. The margin of variation of the rotation and scale invariant image domain description of the system features are extracted and has less feature vector dimension. The low level image features depend on texture, shape and color in the content – based image retrival system. One of the main drawbacks of the content based image retrival system uses images of similar low-level features to vary the query image based on the objects that the user is predicting, and the complexity is identified as this type of semantic space. In recent times, content based image retrival research effort in the low-level visual features and high-level semantic gap is reducing between objects in the image [8]. Spatial communication aspect, approximation polygon-shaped features, moments, shape-space patterns and change the size are extracted using space feature. The similarity of images is to be calculate the various distance measures for semantic gap, and discuss about the retrieval of invariant image. The similarity of two images can be obtained by measuring the distance value between them [9], [10]. One of the unsupervised learning technique is image clustering. For any particular problem cannot be separated on the basis of a novel multi-dimensional lifting schematic structure of the bandwidth filter bank discussed [11], [12]. The content-based retrieval is worked with types of images, patterns of use, the sensory gap and the role of semantics [13], [14]. Object and shape features. Each feature types the similarity of objects and pictures are reviewed, through interaction with the feedback of the users of the systems and methods are capable of producing in close contact with it. Content-based retrieval applications are discussed in three broad categories: association search, target search, and category search.

2. OBJECTIVES OF THE RESEARCH

The main objective of the research is to present content based image retrival systems for the ultrasound images of the kidney. In order to attain this objective, the entire research work is divided into three separate phases and each phase works towards achieving the research goal [14]. The objectives of each and every phase are listed below. To propose a content based image retrival system with better feature selection model for ultrasound images of kidney. The idea of this phase is to reduce the computational complexity and time consumption of the content based image retrival system [15], [16]. To present a content based image retrival system for ultrasound images of kidney by means of association rule mining classification technique. In this phase, the association rules are generated, organized and then utilized to perform classification [17], [18]. Hence, the objectives of the research work are presented and the following section presents the overall flow of the proposed approach. Figure 1 overall structure of the proposed content based image retrival system.

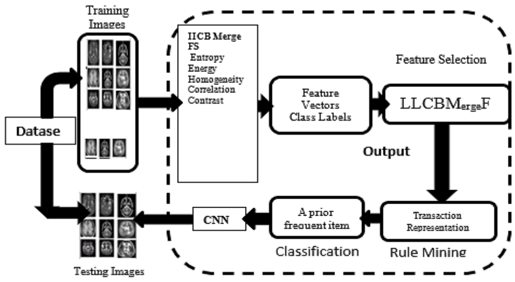

Figure 1. Structure of the proposed CBIR

3. PROPOSED CBIR SYSTEM

This proposes a new feature selection method called "IICBMergeFS". This helps to improve the performance of the CBIR system by using stable feature selection through discretization for ultrasound kidney image diagnosis. The proposed approach extracts the low-level features based on the high-level knowledge, in order to suggest a better diagnosis for the query images. The algorithm of this work is presented as follows. The overall structure of the new content based image retrival system is presented in algorithm 1. The proposed approach is subdivided into three phases, as listed: i) feature selection based on IICBMergeFS, ii) IICBMergeFS based association rule mining, and iii) classification using convolutional neural network (CNN) algorithm Figure 1. Overall structure of the proposed content based image retrival system explain the procedure of image analysis feature extraction. Following subsections describe the details explanation of these modules.

Algorithm 1 Proposed CBIR System

```
Procedure Overall
    Input: Image
    database
    Result: Relevant images with
    classes Training Phase:
    For all Images do
        Pre-Process the images
        Extract texture features from the training images
                                            End for
    Execute IICBMergeFS algorithm Mine
    Association Rules
    Test Phase:
    Extract texture features from the test image
    Classify the images by applying K-Nearest Neighbour (CNN) algorithm
    Return the relevant images and class name found
```

4. EXPERMENTAL RESULT AND DISCUSION

All the picture cuts accessible in database are under pivotal point of view with the framework size of 256×256 or 512×512 and 16 bits for every pixel. At the present time, the support-based data-set (SBD) contains emulated mind MRI data in perspective of two anatomical models: normal and multiple sclerosis (MS). For both of these, full 3-dimensional information volumes have been reenacted utilizing three arrangements (T1-, T2-, and proton density (PD-) weighted) and an assortment of cut thicknesses, clamor levels, and levels of power non-consistency. In Figure 2 sample 10 classes if CBIR, retrieved image with conclusion matrix for CBIR lung image explained in Figure 3. And comparative analysis based on accuracy, sensitivity and specificity of various feature selection presented in Table 1.

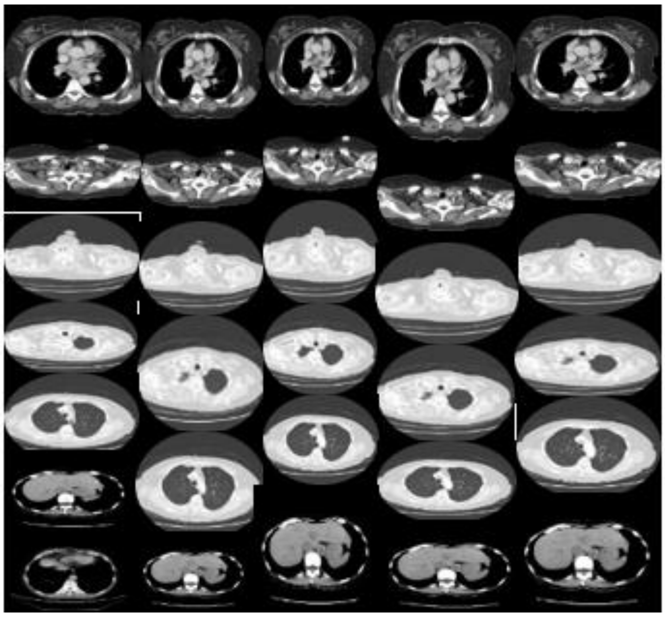

Figure 2. Sample 10 classes if CBIR

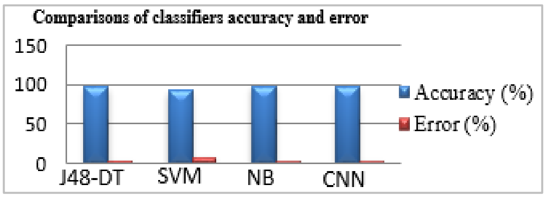

Figure 3. Classifier's accuracy and error comparisons

Table 1. Comparative analysis based on accuracy, sensitivity and specificity of various feature selection techniques

Techniques/Performance Metrics	Accuracy (%)	Sensitivity (%)	Specificity (%)
CAIMAI	89.17	86.7	83.26
EQWAI	88.9	81.05	76.1
ReliefF	87.09	80.3	79.5
F-Score	89.04	87.3	81.3
IICBMergeFS	97.24	90.6	96.3

Here, lung image is used to the query image. Based on the query image features are extracted. The feature vectors are used in place of the images as transactions which are then used in the classification or retrieval processes [19]. Retrieved image with conclusion matrix for CBIR lung image in Table 2 and recall rates analysis by varying feature selection techniques explained in Table 3. Additionally, the precision and recall rates of the proposed approach are evaluated and the results are presented in Table 4. From Table 4, it is concluded that the proposed approach shows maximum precision and recall rates, when compared to the existing techniques. In addition to this, the time consumption of the proposed approach is much lesser than the existing techniques. This section compares the performance of the proposed approach by varying the classification techniques [20]. The classifiers being considered for performance analysis are descreate wavelet transform, support vecter machine algorithm and convolution neural network classifiers. The proposed feature selection technique IICBMergeFS is [21]. Comparative analysis based on accuracy, sensitivity, specificity, precision and recall of various classification techniques presented in Table 3 and the time complexity of the classifiers with IICBMergeFS is analyzed and the results are presented in Table 5.

Table 2. Retrieved image with conclusion matrix for CBIR lung image

4.17% (1)	0	0	0	0	4.17% (1)	4.17% (1)	0	0	87.6(21)
0	0	0	0	0	0	0	0	84.6(18)	05.28%
0	0	0	0	0	0	0	86.6(20)		10.53%
0	0	0	0	0	0	84.9(19)	0	0	0
0	0	0	0	0	86.6(20.5)	0	0	0	0
0	0	0	0	82.6(14)	0	0	0		0
0	0	0	83.6(18)	0	0	0	0	0	0
0	0	83.6(18)	0	0	0	0	0	0	15.53%
0	8.6(20)	0	0	0	0	0	0	0	10.53%
100	0	0	0	0	0	0	0	0	0

Table 3. Precision and recall rates analysis by varying feature selection techniques

Techniques/Performance Metrics	Precision (%)	Recall (%)	Time Consumption (ms)
CAIMAI	85.1	52	1893
EQWAI	84.28	46	1922
ReliefF	70.34	34	2316
F-Score	69.3	31	2687
IICBMergeFS	89.12	69	1763

Table 4. Comparative analysis based on accuracy, sensitivity, specificity, precision and recall of various classification techniques

Techniques/Performance Metrics	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	Recall (%)
J48-DT	86.14	78.6	72.3	72.6	49
Naïve Bayes (NB)	86.48	76.4	69.1	79.3	53
Support vector machines (SVM)	88.24	81.3	78.9	83.2	61
CNN	97.24	90.6	96.3	99.12	79

Table 5. Comparative analysis based on time consumption of various classification techniques

Techniques/Performance Metrics	Time Consumption (ms)
J48-DT	2143
NB	1972
SVM	1738
CNN	1763

The proposed IICBMergeFS shows better accuracy rates on all the classifiers than the other feature selection techniques. However, [22] the maximum accuracy rate is registered as 97.24 percent, which is shown by IICBMergeFS in combination with CNN classifier [23]. The second better suitable classifier to the proposed IICBMergeFS technique is [24], [25]. SVM and the recorded accuracy rate is 88.24 percent. The NB classifier shows 86.48 percent and the J48-DT classifier shows 86.14 percent as accuracy, with IICBMergeFS technique. From the comparison Figure 3 the accuracy is accuracy and error comparisons high for CNN classifiers. IICBMergeFS based CNN classifier accuracy will be 97.3%. In overall performance analysis by varying classifiers and feature selection techniques presented in Table 6. Explained it and the retrieved result for similarity measures explain in Table 7 presented.

Table 6. Overall performance analysis by varying classifiers and feature selection techniques

Classifiers	Feature Selection Techniques	Accuracy (%)
J48-DT	CAIMI	84.24
	EQWAI	85.08
	ReliefF	82.41
	F-Score	83.33
	IICBMergeFS	86.14
NB	CAIMI	84.48
	EQWAI	82.71
	ReliefF	81.01
	F-Score	79.59
	IICBMergeFS	86.48
SVM	CAIMI	88.17
	EQWAI	87.9
	ReliefF	86.09
	F-Score	88.09
	IICBMergeFS	88.24
CNN	CAIMI	90.17
	EQWAI	93.9
	ReliefF	94.09
	F-Score	92.04
	IICBMergeFS	97.24

Table 7. Retrieved result for similarity measures

Method	Similarity measures			
	Euclidean	Manhattan	Spearman	Cosine
EQWAI	0.0817	0.3010	0.0897	0.3944
ReliefF	0.8001	0.4682	0.4342	0.4244
F-Score	0.3696	0.4049	0.2528	0.5672
IICBMergeFS	0.1034	0.3152	0.0917	0.3967

5. CONCLUSION

Computer aided medical image analysis is strongly influenced by a special application called CBIR. The CBIR application helps in retrieving medical images from the database, which strongly resembles the query image. The resemblance of the image is computed by different means and the effectiveness of relevance determination decides the efficiency of the CBIR system. However, achieving better results in medical CBIR systems is a crucial challenge, as the images share same structure. The final phase of this work proposes a CBIR system for ultrasound kidney images based on lenient relevance feedback. This CBIR system takes the search pattern of the user into account for presenting better image with greater relevance. The performances of all the proposed works are tested in terms of classification accuracy and relevant image retrieval time. The proposed approaches show better performance and the results are convincing. The network was successfully trained for 10 classes of image with an average classification accuracy of 97.24% is obtained using IICBMergeFS, classifier by comparing with the state of arts in MATLAB software.

REFERENCES

[1] S. Agarwal, A. K. Verma, and P. Singh, "Content based image retrieval using discrete wavelet transform and edge histogram descriptor," *International Conference on Information Systems and Computer Networks*, 2013, pp. 19-23, doi: 10.1109/ICISCON.2013.6524166.

[2] V. Balamurugan and P. AnandhaKumar, "An integrated color and texture feature-based framework for content-based image retrieval using 2D Wavelet Transform," *International Conference on Computing, Communication and Networking*, IEEE, 2008, pp. 1-16, doi: 10.1109/ICCCNET.2008.4787734.

[3] S. H. Jadhav and S. A. Ahmed, "Content based image retrieval system with hybrid feature set and recently retrieved image library," *International Journal of Computer Applications*, vol. 59, no. 5, pp. 46-55, 2012, doi: 10.5120/9548-4001.

[4] A. Mumtaz, S. A. M. Gilani, and T. Jameel, "A novel texture image retrieval system based on dual tree complex wavelet transform and support vector machines," *International Conference on Emerging Technologies*, 2006, pp. 108-114, doi: 10.1109/ICET.2006.335910.

[5] S. Soman, M. Ghorpade, V. Sonone, and S. Chavan, "Content based image retrieval using advanced color and texture features," *International Conference in Computational Intelligence (ICCIA)*, vol. 3, no. 4, 2012, pp. 1-5, doi: 10.13140/2.1.5092.0001.

[6] N. Dalal and B. Triggs "Histograms of oriented gradients for human detection," *IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'05)*, 2005, doi: 10.1109/CVPR.2005.177.

[7] A. Amanatiadis, V. Kaburlasos, A. Gasteratos, and S. E. Papadakis, "Evaluation of shape descriptors for shape-based image retrieval," *IET Image Processing* 5, no. 5, vol. 58, pp. 493-499, 2011, doi: 10.1049/iet-ipr.2009.0246.

[8] H. Assodiky, A. Basuki, and F. F. Hardiansyah, "Macro-sized basidiomycota species recognition using shape and color features," *International Electronics Symposium* (IES), 2016, pp. 309-314, doi: 10.1109/ELECSYM.2016.7861023.

[9] S. Li, M. C. Lee, and C. M. Pun, "Complex Zernike moments features for shape-based image retrieval," *IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans*, vol. 39, no. vol. 1, pp. 227-237, 2009, doi: 10.1109/TSMCA.2008.2007988.

[10] P. Desai, J. Pujari, and A. Kinnikar, "Performance evaluation of image retrieval systems using shape feature based on wavelet transform," *Second International Conference on Cognitive Computing and Information Processing (CCIP)*, 2016, pp. 1-5, doi: 10.1109/CCIP.2016.7802876.

[11] C. S. Gode and A. S. Khobragade, "Object detection using color clue and shape feature,"*2016 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)*, 2016, doi: 10.1109/WiSPNET.2016.7566177.

[12] E. Sokic and S. Konjicija, "Novel fourier descriptor based on complex coordinates shape signature," *International Workshop on Content-Based Multimedia Indexing (CBMI)*, IEEE, 2014, doi: 10.1109/CBMI.2014.6849843 4.

[13] N. Alajlan, M. S. Kamel, and G. H. Freeman, "Geometry-based image retrieval n binary image databases," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 30, no. 6, pp. 1003-1013, 2008, doi: 10.1109/TPAMI.2008.37.

[14] C. Rigaud, D. Karatzas, J. C. Burie, and J. M. Ogierand, "Color Descriptor for Content-Based Drawing Retrieval," *11th IAPR International Workshop on Document Analysis Systems*, 2014, doi: 10.1109/DAS.2014.70.

[15] E. Tiakas, D. Rafailidis, A. Dimou, and P. Daras, "MSIDX: multi-sort indexing for efficient content-based image search and retrieval," *IEEE Transactions on Multimedia*, vol. 15, no. 6, pp. 1415-1430, 2013, doi: 10.1109/TMM.2013.2247989.

[16] M. Kan, D. Xu, S. Shan, and X. Chen, "Semisupervised Hashing via Kernel Hyperplane Learning for Scalable Image Search," *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 24, no. 4, pp. 704-713, 2013, doi: 10.1109/TCSVT.2013.2276713.

[17] S. Paisitkriangkrai, C. Shen, and A. van den Hengel, "Large-Margin Learning of Compact Binary Image Encodings," *EEE Transactions on Image Processing*, vol. 23, no. 9, pp. 4041–4054, 2014, doi: 10.1109/TIP.2014.2337759.

[18] D. C. G. Pedronette, R. T. Calumby, and R. da S. Torres, "Semi-supervised Learning for Relevance Feedback on Image Retrieval Tasks," *SIBGRAPI Conference on Graphics, Patterns and Images*, 2014, doi: 10.1109/SIBGRAPI.2014.44.

[19] J. M. Guo, H. Prasetyo, and J. H. Chen," Content-Based Image Retrieval Using Error Diffusion Block Truncation Coding Features,"*IEEE Transactions on Circuits and Systems for Video Technology*, vol. 4, no. 3, pp. 466-481, 2014, doi: 10.1109/TCSVT.2014.2358011.

[20] X. Zhang, W. Liu, M. Dundar, S. Badve, and S. Zhang, "Towards large-scale histopathological image analysis: Hashing-based image retrieval," *IEEE Transactions on Medical Imagi*ng, vol. 34, no. 2, pp. 496-506, 2014, doi: 10.1109/TMI.2014.2361481.

[21] E. B. Candrasari, L. Novamizanti, and S. Aulia, "Hand gesture recognition using discrete wavelet transform and hidden Markov model," *TELKOMNIKA Telecommunication, Computing, Electronics and Control*, vol. 18, no. 5, pp. 2265-2275, 2020, doi: 10.12928/telkomnika.v18i5.13725.

[22] A. Suzain, R. A. Rashid, M. A. Sarijari, A. S. Abdullah, and O. A. Aziz, "Machine learning based lightweight interference mitigation scheme for wireless sensor network," *TELKOMNIKA Telecommunication, Computing, Electronics and Control*, vol. 18, no. 4, pp. 1762-1770, August 2020, doi: 10.12928/telkomnika.v18i4.14879.

[23] A. Tsaqifurrosyid, M. Rosmiati, and M. F. Rizal, “Image transmission using visible light communication in data communication,”*TELKOMNIKA Telecommunication, Computing, Electronics and Control*, vol. 18, no. 4, pp. 1771-1776, August 2020, doi: 10.1142/S0218001419500216.
[24] Y. Y. Al-Aboosi, R. S. Issa, and A. K. Jassim, “Image denosing in underwater acoustic noise using discrete wavelet transform with different noise level estimation,” *TELKOMNIKA Telecommunication Computing Electronics and Control*, vol. 18, no. 3, pp. 1439-1446, June 2020, doi: 10.12928/TELKOMNIKA.v18i3.14381.
[25] F. D. A. Rahman, A. I. Ibrahim, and D. Agrafiotis, “Reduced-reference Video Quality Metric Using Spatio-temporal Activity Information,” *TELKOMNIKA Telecommunication, Computing, Electronics and Control*, vol. 16, no. 2, pp. 909-914, 2018, doi: 10.12928/telkomnika.v16i2.9044.

BIOGRAPHIES OF AUTHORS

Nashwan Jasim Hussein received B.Sc. degree in Computer and software engineering from university of technology –Baghdad from Iraq, and the MSc Engineering. Degree in computer engineering and information technology from university of PUNE –VIT collage from 2010 to 2012, and he was joined in Ph.D. Research student in 2015 in electronics, communication engineering department, telecommunication in Huazhong University of science and technology, China. His general research interests lie in image processing, signaling analysis, and object detection.

Sabah Khudhair Abbas received B.Sc. degree in coputer science in 2006 from Kufa University, and the MSc at Art University Labanon in Labanon 2012 in computer science