Medical Imaging – Gastroenterology- A Literature Assessment

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Abstract: The present day life styles are changing the food habits of the human beings by force and these food styles are leading towards problems related to health care in particular. Because of the dynamic changes, the impact of the health is being deteriorated and many diseases are therefore getting triggered to the mankind. Among the various diseases, gastroenterology related diseases are being growing exponentially because of the in healthy food styles. This indirectly leading towards diseases in particular to liver and pancreas. Many researchers and eminent practitioners in the field of domain are experimenting to compact the disease from further complications. The complications include liver cancer, enlargement of liver, shrinkage of liver, pancreas problems which eventually leads to diabetic diseases. The present article aims at bringing out the different methodologies and techniques that are developed by the eminent researchers to highlight the state of work in the present domain.

Keywords: diabetes, liver, liver enlargement, pancreas, shrinkage of liver.

I. INTRODUCTION

With the current developments in the field of medical sciences, many automated technologies have been brought into light in order to assist the practitioners in treating the patient more effectively. These methodologies are mostly focused on electronic based computer assisted tools. In order to understand about the various diseases that are prone to the man kind can be broadly classified into text based and context based systems. Using these techniques the experts can visualize the various insights and developments about a particular disease and also help them towards better understanding about the treatment administer for a specific complicated disease around the globe.

In spite of the evolutionary growth in medical diagnosis and tools associated for the identification of the diseases. Still there are many challenges and these challenges are leading towards the issues related to problems related to mankind.

There are many diseases which need further precise knowledge and still many patients are reported of mortality due to improper or timely identification of the diseases.

Among the various diseases that hamper the individual’s health, gastroenterology’s is one such disease which is mostly populated now days.

If these diseases not identified in prior, it leads to further complications right from damaging the liver, pancreas and other surrounding parts of the intestine. Therefore, to assist the researchers in developing new methodologies which can more precisely identify the diseases of gastroenterology.

In this article the detailed literature about the works carried out, in this field of domain are presented in chronological order along with the diseases focused by each of the reviewers together with the methodologies populated. A brief review is presented as in the following section.

II. REVIEW OF LITERATURE

This section highlights the reviews presented by eminent reviewers during the last one and half decade in the field of medical sciences.

Table I: Detailed literature about the works carried out, are presented in chronological order along with the diseases focused by each of the reviewers together with the methodologies populated.

| Year of publication | Diseases focused | Techniques used |
|---------------------|------------------|-----------------|
| 2019                | brain tumor [1], Lung Nodule, Alzheimer’s Disease [2], lung cancer, | deep convolutional neural network VGG19 [1], Guided Latent Dirichlet Allocation (GuidedLDA) method, position weighted Precision (wPrecision), swarm intelligence feature selection technique and multitask Naive Bayes classifier [2], K-nearest neighbor (KNN)[2], and support vector machine [2], three dimensional local circular difference wavelet patterns (3D LCDWP), three dimensional local circular difference patterns (3D LCPD), enhanced residual network |
| 2018                | Alzheimer’s disease, gastrointestinal diagnosis [3], breast tumours, Computed Tomography (CT) brain images, liver and biliary system [4], brain magnetic resonance images, breast cancer | landmark-based deep feature learning (LDFL) framework, Convolutional neural network, Ontology Construction and retrieval [3], deep convolutional neural network (CNN), Densely-Connected Multi-Magnification (DCMMH) framework, local binary patterns and the histogram of oriented gradients, SVM with radial basis function, sift technique, GLCM and Hu-moments [4], Self-organising map algorithm |

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| Year | Disease/Technique |
|------|------------------|
| 2017 | Chest disease diagnosis, Anatomical categorization, Breast cancer diagnosis, Vertebral irregularity diagnosis, Lung cancer diagnosis, Alzheimer disease, Metastatic Neoplasm, noncancerous tumor, non-Neoplasm disease, normal infusion, esophageal, stomach -colorectal cancer, Lung Diseases [6], spine MRI images |
| 2016 | Interstitial lung diseases [7], tomography images of the liver, x-rays images [8] |
| 2015 | breast cancer, computed tomography images, adrenal, cardiac, chest, kidney, small bowel, and stomach [9], Skin diseases, lung cancer [10], knee, chest, brain, and leg |
| 2014 | X-ray images [11], melanoma - Skin Cancer, mammography images, MRI images [12] |
| 2013 | Stomach and esophagus [13], breast cancer, Brain Tumor, Brain diseases [14], CT images, MRI images, Digestive System Diseases [15] |
| 2012 | esophagus, Neuroblastoma (NB) and follicular lymphoma (FL), Lung Tumours / Cancers, Liver Tumor, Dental images, Human Retinal [16], endoscopy images, skull images |
| 2011 | microscopic pathology or dermatology, cell carcinoma, Heart Diseases [17], radiological image, Skin Cancer, CT images [18], MRI images [18], X-ray and sonography images [18], mastography Images [18], Lung Cancer, MRI images of the head and neck [19] |
| 2010 | Screening Mammmography, Normal brain [20], Atrophy [20], Stroke [20], Cysts [20], Tumor [20], Trauma/haemorrhage [20], Skin cancers, Ultrasound images, X-Ray images, MRI images, Mamogram images, breast cancer, Diabetic retinopathy follow up [21] |
| 2008 | Multi-modal correlation Gabor feature(AGF), multi-modal correlation homogeneous texture(AHT), CIE Lab, HSV, co-occurrence histograms, adaptive thresholding algorithm, ROF, graph edit distance calculation, Fourier Descriptors, MPEG-7 Gabor filter and edge histogram descriptors, PCA, cluster based indexing, Local Binary Pattern(LBP), Euclidean distance method, canny based edge detection [16], Fourier descriptor, Euclidean space, Manhattan distance, Daubechies wavelet transform |
| 2017 | multi-level semantic mining and retrieval framework with latent Dirichlet allocation [5], speedup technique of LSH [5], hadoop File System, MapReduce algorithm, Convolution neural network(CNN), multi-task learning in deep learning(TFL), Dijkstra's shortest path first to capture the basic organization of the data [6], Fused Context-Sensitive Similarity algorithm [6], supervised learning approach, Stochastic Gradient Descent (SGD) with backpropagation, k-means clustering |
| 2016 | Supervised learning [7], metric learning algorithm [7], Adapted SVM and nearest neighbor search, convolutional neural network [8], Radon Barcode (RBC) [8], Region of Interest (ROI) [8] |
| 2015 | Scale-invariant feature transform, kernelized and supervised hashing method, wavelet decomposition, wavelet coefficients [9], k-means segmentation algorithm [9], border region detection method, Seed region growing [10], GLCM [10]. Support vector machines [10], Linear kernel function [10], Polynomial kernel function [10], Radial basis function [10], K-SVD, Orthogonal Matching Pursuit (OMP) algorithm, quadratic mean, amplitude, root-mean square deviation using Gabor filter, fuzzy edge detection, Feed Forward back propagation neural network algorithm |
| 2014 | Simultaneous Clustering and Attribute Discrimination (SCAD) algorithm [11], case-adaptive classification, Support Vector Machine, Scale Invariant Feature Transform Fusion Technique [12] |
| 2013 | Normalized Cut Algorithm [13], MapReduce computing algorithm, Hadoop File System model, BEMD-GGD, BEMD-HHT, relative entropy, Euclidean space, Wavelet Transform, Modified fuzzy pseudo-partitioning technique, Two-Layer K-Means Algorithm, PCA, KD tree, Modified Local Binary pattern [14], Gray-level histogram, Gray level co-occurrence matrix |
| 2012 | Auto correlation Gabor feature(AGF), auto correlation homogeneous texture(AHT), CIE Lab, HSV, co-occurrence histograms, adaptive thresholding algorithm, ROF, graph edit distance calculation, Fourier Descriptors, MPEG-7 Gabor filter and edge histogram descriptors, PCA, cluster based indexing, Local Binary Pattern(LBP), Euclidean distance method, canny based edge detection [16], Fourier descriptor, Euclidean space, Manhattan distance, Daubechies wavelet transform |
| 2011 | RRIrelevance feedback based similarity fusion technique, BIC (Border/Interior classification), Gabor Transform, Haralick, GLCM, intersection kernel support vector machines, Genetic Algorithm [17], Relevance Feedback [17], IRMAcon scheme, minimum redundancy maximum relevance feature, co-clustering analysis, SVM, Gray level co-occurrence matrix, Edge histogram descriptor, euclidean distance, Fourier descriptor (FD) [18], Daubechies wavelet transformation, Empirical weight optimization technique [19] |
| 2010 | modified DCT, two-dimensional PCA (2DPCA) technique, support vector machine [20], singular value decomposition (SVD), 2D Gabor filter, PCA, LDA, symmetric short kernel filters, arithmetic coding, non-negative tensor factorization [20], K-nearest neighbour [20], Genetic algorithm, Bhattacharyya distance metric or euclidean distance, Generalized gaussian density, BEMD-Hilbert [21], BEMD-GGD [21]. |
Patterns for next generation database systems (PANDA), raster scan technique using sliding window size of user choice, Gaussian distribution Region based searching tool [22], Omega algorithm, least square linear regression, Zamora hierarchical segmentation, Howe hierarchical segmentation, Euclidean Distance, Correlation, Histogram Euclidean Distance, Histogram Intersection, Gustafson Kessel Fuzzy classifier, Fuzzy unit classifiers, Ensemble Technique [23], Empirical weight optimization technique [23], The Limited Rank Matrix Learning Vector Quantization (LiRaM LVQ), statistical machine learning algorithm-Large margin nearest neighbor (LMNN), K- nearest neighbor search], incremental learning technique, Adaptive support vector machine, principle component analysis, k-NN algorithm

### III. METHODOLOGY

In order to identify the diseases related to liver and pancreas, many modals have been developed and projected by the reviewers. However, in most of these cases, the identification is based on symptoms. In general, they may be several diseases within the liver and pancreas which share common symptoms. If these symptoms are not identified clearly leads to further complications. Therefore, to have a precise view of these symptoms feature play vital role.

There are many feature extraction techniques that are existing in the literature. Some of them include edge based techniques, shape based, color based, texture based etc. However, in this area of proposed research work we have considered the feature vectors like GLCM (Gray-Level Co-

### IV. RESULTS

| Input (Features) | Actual Output | Expected Output | Test case Pass/Fail |
|------------------|---------------|-----------------|---------------------|
| 65, 1, 0.7, 0.1, 187, 16, 18 | 1 | 1 | Pass |
| 40, 1, 0.9, 0.3, 293, 232, 245 | 1 | 1 | Pass |
| 17, 0, 0.9, 0.3, 202, 14, 11 | 0 | 0 | Pass |
| 33, 0, 0.5, 1.4, 111, 777, 156 | 1 | 0 | Fail |
| 25, 0, 0.6, 0.1, 183, 91, 53 | 0 | 0 | Pass |

The first column in the result table describes the features or values from the reports given by the hospital. If these values are matched with our trained database values, we can predict the disease. The second, third and fourth columns describes whether the disease is identified or not.

### V. CONCLUSION

The present article is developed with a focus on various developments that are carried out in particular in the field of gastroenterological diseases together with the various methodologies that are being used to counter attack each of the diseases that are identified. This article helps the budding researchers to explore a comprehensive review about the domain and understand about the tools and techniques considered against each of the disease and helps in planning out further developments that can strengthen their probability of ratifying the diseases more precisely.

### REFERENCES

1. Zar Nawab Khan Swati, Qinghua Zhao, Muhammad Kabir, Farman Ali, Zakir Ali, Saeed Ahmed, Jianfeng Lu, “Content-Based Brain Tumor Retrieval for MR Images Using Transfer Learning”, IEEE, vol. 7, pp. 17809 - 17822, Jan. 2019.
2. K.R.Kruthika, Rajeswari, H.D.Maheshappa, “Multistage classifier-based approach for Alzheimer’s disease prediction and retrieval”, Elsevier, Journal of Biomedical Informatics, Volume 14, Pages 34-42, 2019.
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3. Ying Shen, Yaliang Li, Yang Deng, Jin Zhang, Min Yang, Jingsong Chen, Shangchun Si, Kai Lei, “Gastroenterology Ontology Construction Using Synonym Identification and Relation Extraction”, IEEE Transactions on Medical Imaging, Volume 6, Pages 52095 – 52104, August 2018.

4. Manoj Kumar, Kh. Manglem Singh, “Content Based Medical Image Retrieval System (CBMIRS) to Diagnose Hepatobiliary Images”, Springer, Pages 663-676, June 2018.

5. Yibing Ma, Zhiguo Jiang, Haopeng Zhang, Fengying Xie, Yushan Zheng, Huaqiang Shi, Yu Zhao, “Breast Histopathological Image Retrieval Based on Latent Dritchet Allocation”, IEEE Journal of Biomedical and Health Informatics, Volume: 21, Issue: 4, July 2017.

6. LingMa, XiabLi, YanGao, YanFengZhou, XinningZhao, ChunwuZhou, “A new method of content based medical image retrieval and its applications to CT imaging sign retrieval”, Elsevier, Journal of Biomedical Informatics, Volume 66, Pages 148-158, February 2017.

7. José Ramos, Thessa T. J. P. Kockelkorn, Isabel Ramos, Rui Ramos, Jan Grutters, Max A. Viergever, Bram van Ginneken, Aurélio Campilho, “Content-Based Image Retrieval by Metric Learning from Radiology Reports: Application to Intestinal Lung Diseases”, IEEE Journal of Biomedical and Health Informatics, Volume: 20, Pages 281 - 292, Jan. 2016.

8. Xmran Liu, H.R. Tzhoosh, J. Kofman, “Generating binary tags for fast medical image retrieval based on convolutional nets and Radon Transform”, IEEE, July 2016.

9. Kaimei Zheng, “Content-Based Image Retrieval for Medical Image”, International Conference on Computational Intelligence and Security (CIS), IEEE, Dec. 2015.

10. Ritika Agarwal, Ankti Shankhbadhar, Raj Kumar Sagar, “Detection of lung cancer using Content-Based Image Retrieval”, International Conference on Advanced Computing & Communication Technologies, IEEE, Feb. 2015.

11. Heelah A. Arafqiah, Ouiem Bchir, Mohamed Maher Ben Ismail, “X-Ray Image Retrieval System Based On Visual Feature Discrimination”, Proc. of SPIE Vol. 9159, 2014.

12. Alba García Socio de Herrera, Henning Müller, “Fusion Techniques in Biomedical Information Retrieval”, Springer, Pages 209-228, March 2014.

13. Farhan Riaz, Francisco Baldaque Silva, Mario Dina Ribeiro, Miguel Tavares Coboira, “Impact of Visual Features on the Segmentation of Gastroenterology Images Using Normalized Cuts”, IEEE Transactions on Biomedical Engineering, Volume: 60, Issue: 5, Pages 1191 – 120, May 2013.

14. Abraham Varghese, Kannan Balakrishnan, Reji R. Varghese, Joseph S. Paul, “Content based image retrieval of T2 Weighted brain MR images similar to T1 weighted images”, Springer, Pages 474–481, 2013.

15. Dumitru Dan Burdescu Cristian, Gabriel Mihai, Liana Stanescu, Marius Brezovan, “Automatic image annotation and semantic based image retrieval for medical domain”, Elsevier, Neurocomputing, Volume 109, Pages 33-48, June 2015.

16. J. Sivakumundar, G. Kavitha, V. Nataranar, S. Ramakrishnan, “Content Based Human Retinal Image Retrieval using Vascular Feature Extraction”, Springer, Pages 468-476, March 2012.

17. Sérgio Franciscoda Silva, Marcela XavierRibeiro, João do S.Batista Neto, CaetanoTraina-Jr., Agma J.M.Traina, “Improving the ranking quality of medical image retrieval using a genetic feature selection method”), Elsevier, Decision Support Systems, Volume 51, Issue 4, Pages 810-820, November 2011.

18. Anikta Chandrakar, A. S. Thoke, Bikesh Kumar Singh, “Indexing and Retrieval of Medical Images Using CBIR Approach”, Springer, Pages 393–403, September 2011.

19. Kehong Yuan, ZhenTian, JiyingZou, YanlingBai, QingshanYou, “Brain CT image database building for computer-aided diagnosis using content-based image retrieval”, Elsevier, Information Processing & Management, Volume 47, Issue 2, Pages 176-185, March 2011.

20. Lucia Ballerini, Xiang Li, Robert B. Fisher, Ben Aldridge, Jonathan Rees, “Content-Based Image Retrieval of Skin Lesions by Evolutionary Feature Synthesis”, Springer, Pages 312-319, 2010.

21. Said Jia-Andaloussi, Mathieu Lamard, Guy Cazuguel, Hamid Taari, Mohamed Meknassi, Beatrice Coche, Christian Roux, “Content Based medical Image Retrieval based on BEMD: Optimization of a similarity metric”, IEEE, November 2010.

22. Zhiyun Xue, Sameer Antani, L. Rodney Long, George R. Thoma, “A Systems for searching uterine cervix images by visual attributes”, IEEE International Symposium on Computer-Based Medical Systems, September 2009.

23. GowriAllampalli-Nagaraj, IsabelleBidichandaritz, “Automatic semantic indexing of medical images using a web ontology language for case-based image retrieval”, Elsevier, Engineering Applications of Artificial Intelligence, Volume 22, Issue 1, Pages 18-25, February 2009.

24. Gang Zhang, Z. M. Ma, Qiang Tong, Ying He, Tienan Zhao, “Shape Feature Extraction Using Fourier Descriptors with Brightness in Content-Based Medical Image Retrieval”, IEEE, August 2008.

25. Hossein Pourghassem, Hassan Ghasssemian, “Content-based medical image classification using a new hierarchical merging scheme”, Elsevier, Pages- 651–661, July, 2008.

26. Hayit Greenspan, Adi T. Pinhas, “Medical Image Categorization and Retrieval for PACS Using the GMM-KL Framework”, IEEE Transactions on Information Technology in Biomedicine, Volume: 11, Issue: 2, Pages 190 – 202, March 2007.

27. Md. Mahmudur Rahman, Prabin Bhattacharya, Bipin C. Desai, “A Framework for Medical Image Retrieval Using Machine Learning and Statistical Similarity Matching Techniques with Relevance Feedback”, IEEE Transactions on Information Technology in Biomedicine, Volume: 9, Issue: 4, Pages 538 – 553, Dec. 2005.

28. I. El-Naqy, Yongyi Yang, N.P. Galatsanos, R.M. Nishikawa, M.N. Wernick, “A similarity learning approach to content-based image retrieval: application to digital mammography”, IEEE Transactions on Medical Imaging, Volume: 23, Issue: 10, Pages 1233 – 1244, Oct. 2004.

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