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A Survey on Medical Image Diagnosis Features and Techniques

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Abstract- Medical science works in different field for increasing the understanding of living organism. Medical image is great tool to understand the status of different disease. To improve the diagnosis of health reports researcher introduce automation. In this paper different type of medical images were introduce with their requirements. Methodology proposed by various scholars was detailed in the paper. This paper has summarized image features used for the processing of image. Medical image diagnosis genera techniques were also summarized in the paper for clearing the use of techniques with outcomes. As image pass through medium hence disturbance occur in original data, so attacks on image were also detailed.

Keywords- Data analysis, Digital image processing, Information Extraction, visual processing.

I. INTRODUCTION

Medical imaging is the process of producing visible images of inner structures of the body for scientific and medicinal study and treatment as well as a visible view of the function of interior tissues. This process pursues the disorder identification and management. This process creates data bank of regular structure and function of the organs to make it easy to recognize the anomalies.

This process includes both organic and radiological imaging which used electromagnetic energies (X-rays and gamma), sonography, magnetic, scopes, and thermal and isotope imaging. There are many other technologies used to record information about the location and function of the body. Those techniques have many limitations compared to those modulates which produce images. Annually billions of images have been done globally for different diagnostic purposes. About half of them use ionizing and non ionizing radiation modulates [1].

Medical imaging produces the images of the internal structures of the body without invasive procedures. Those images were produced using fast processors and due to conversion of the energies arithmetically and logically to signals [2].

Those signals later are converted to digital images. Those signals represent the different types of tissues inside the body.

Ever since the first images from inside the human body were taken using X-Rays in 1895, the field of medical imaging has progressed at a considerable rate. While traditional X-Ray imaging has stood the test of time and is still used today, it has been joined by ultrasound, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), and Single Photon Emission Computed Tomography (SPECT), among others. Each of these imaging modalities fills an important and often complementary niche in clinical practice providing greater insight into the human body in both health and disease than would have ever been possible without them.

The modern-day clinician now has an large amount of techniques at their disposal allowing for highly detailed images of individual brain structures, as well as precise measures of brain activity and processes such as metabolism and the accumulation of proteins.

As imaging equipment becomes more and more prevalent, so too does the demand for computational solutions to process and analyze the complex images being produced increase. As such,

the field of medical image computing has grown in parallel with that of medical imaging, and now has many journals and conferences dedicated to its advancement. The overriding goal is to develop computing techniques which can leverage the acquired imaging data to extract the maximum amount of useful information to improve patient outcomes.

In pursuance of this, Machine Learning (ML) algorithms have become popular with applications all across the medical imaging spectrum: from identifying regions of interest (segmentation), to categorizing whole images (classification), to deriving characteristics from images (feature extraction), to aligning multiple images (registration), to creating images from the raw data provided by the scanner (reconstruction).

In order to strengthen the medical work, diagnosis learning models were proposed by researchers. Image features were extract from the reports for classification, hence various visual contents edge, histogram, DWT, DCT, etc. [3], were used in the work. Extracted features were train in different learning models named as CNN, RNN, DNN, etc. [4]. Each of models was tested on single image medical dataset. So scholars need to developed a model that can work on more than one disease with high accuracy.

II. RELATED WORK

This section brief different methods proposed by researcher in field of image diagnosis.

H.N. et. al.in 2017 [5] proposed using a blind source separation technique for the extraction of MRSI data from the tissue-specific profiles and their distribution. A novel algorithm is used for the detection of the tumor, necrotic, and normal tissues from the MRSI signals. In which firstly this algorithm uses the window method for the peaks enhancing an reducing the length, which later builds the 3-D MRSI tensor. Thus, for finding the tissue-specific spectral profiles of the NCPD (nonnegative polyadic decomposition), there occurs the decomposition of the tensor using this NCPD by allowing in mode 1 and mode 2 common factor to retrieve tissues.

Alexander Zotina et. al. in 2017 [6] describes the solution of the image clarity and clearance by using the minimum number of the configuration parameters upon input image. For this, they acquired the medical specialist procedure by distributing into two sets of digital procedures. In which in set one they concentrate upon the quality of image and segmentation of object of concern that is tumor by forming the edge map. In the set two, they made the analysis of data by calculating those parameters obtained by the diagnosis.

M. Li. Et. al. in 2019 [7] experiments the two-methods combination of the multi-modal combination fusion and convolution neural network detection method. In this paper, there wa use of the 2D CNN and 3D CNN multimodal extension by getting brain lesion for different characteristics in 3D. by solving the 2CNN of raw input for the different modal information at raw input faults. To eliminate the problem of over fitting there ws the addition of real normalization layer in the convolution and pooling layer to improve the convergence speed. Resulting in the improvement of loss function, so weighted loss function is added in the lesion area to develop the feature learning.

Hong huang et. al. in 2019 [8] for the image segmentation method uses the FCM clustering algorithm with a rough set theory. The author's construction the attribute table by the values obtained from the FCM segmentation result and the image is divided into small areas on the basis of the attributes. Weighted values are obtained by value reduction and used for the calculated difference between the region and similarity of the region. Later was realized through equivalence difference degree. This final value of equivalence degree is used to evaluate the segmentation of images and merge regions. The method has the limitations up to only MRI images of brain and CT, artificially generated images.

N. Noreen et. al. in 2020 [9] utilizes the techniques of multilevel feature extraction and concatenation to detect early diagnosis of the tumor. In this project uses the two models that are Inception V-3 and DensNet201 for the creation of the two different modes for the identification and diagnosis of tumors. At initially the features of the inception model were extracted from the pre-trained inception model V3 and concatenated also for the tumor detection. Later passed through the SoftMax classifier for the classification of the brain tumor. Similarly done with the DensNet201 for the extraction of features from

the Dens Netblock and concatenation completed and later passing through SoftMax classifier for determining the tumor. Thus, both modes are check by three class tumor datasets which is publicly available.

Hari Mohan Rai et. al. in 2020 [10] develops the deep neural network with a minimum number of layers and less complexity in the design of U-Net for diagnosing tumor. There the motive of classification of normal and Abnormal images of the MRI images from the data sets of 253 images. Before this MRI images were resized, cropped, pre-proceed, and augmented for the accurate result and fast training for the deep neural network.

Mehedi Masud et. al. in [11] proposed an algorithm that detects a deadly and common disease called malaria specially designed as a mobile healthcare solution for the patients. The main objective of the paper focuses on convolution or deep learning architecture and it proves to be useful in detecting malaria disease in real-time accurately by imputing images and thus reduces the manual labor in the detection of the disease.

Fuhad et. al. in [12], given a deep learning technique by which analysis can be done automatically. By this, the need for trained professionals will be drastically reduced as the model will give accurate and automatic results. This model is based on CNN (Convolutional Neural Network) and can be used in the diagnosis of malaria by taking input in form of microscopic blood images. These techniques include Auto encoder, knowledge distillation, and data augmentations features and are classified in form of k-nearest neighbors or support vector machine. This was further performed by three training procedures namely auto encoder, general distillation, and distillation training to improve the accuracy of the model.

P. A. Pattanaik et. al. in [13] given a comprehensive computer-aided diagnosis (CAD) concept to identify the parasites of malaria in the blood images. The parameters of this model were trained by using artificial neural network techniques followed by a stacked auto encoder. 12500-2500-100-50-2 was the optimum size kept for this CAD scheme out of which the input layer consists of 12500 nodes and the output layer of the softmax classifier possesses 2 nodes. A 10 fold cross-validation system was also used to prove the reliability of this model by comparing it with blood smear images of any new patient.

III. TECHNIQUES OF MEDICAL IMAGE DIAGNOSIS

1. Artificial Neural Network Based Segmentation Method:

The artificial neural network based segmentation methods simulate the learning strategies of human brain for the purpose of decision making. Now days this method is mostly used for the segmentation of medical images. It is used to separate the required image from background. A neural network is made of large number of connected nodes and each connection has a particular weight.

This method is independent of PDE. In this the problem is converted to issues which are solved using neural network. This method has basic two steps: extracting features and segmentation by neural network [14].

2. Edge Based Segmentation Method:

The edge detection techniques are well developed techniques of image processing on their own. The edge based segmentation methods are based on the rapid change of intensity value in an image because a single intensity value does not provide good information about edges. Edge detection techniques locate the edges where either the first derivative of intensity is greater than a particular threshold or the second derivative has zero crossings.

In edge based segmentation methods, first of all the edges are detected and then are connected together to form the object boundaries to segment the required regions. The basic two edge based segmentation methods are: Gray histograms and Gradient based methods. To detect the edges one of the basic edge detection techniques like sobel operator, canny operator and Robert‟s operator etc can be used. Result of these methods is basically a binary image. These are the structural techniques based on discontinuity detection [15].

3. Thresholding Method:

Thresholding methods are the simplest methods for image segmentation [16]. These methods divide the image pixels with respect to their intensity level.

These methods are used over images having lighter objects than background. The selection of these methods can be manual or automatic i.e. can be based on prior knowledge or information of image features.

4. Region splitting and merging methods:
The region splitting and merging based segmentation methods uses two basic techniques i.e. splitting and merging for segmenting an image into various regions. Splitting stands for iteratively dividing an image into regions having similar characteristics and merging contributes to combining the adjacent similar regions. Following diagram shows the division based on quad tree. The basic algorithm steps for region growing and merging are [18].

The clustering based techniques are the techniques, which segment the image into clusters having pixels with similar characteristics [19]. Data clustering is the method that divides the data elements into clusters such that elements in same cluster are more similar to each other than others. There are two basic categories of clustering methods: Hierarchical method and Partition based method. The hierarchical methods are based on the concept of trees.

In this the root of the tree represents the whole database and the internal nodes represent the clusters. On the other side the partition based methods use optimization methods iteratively to minimize an objective function. In between these two methods there are various algorithms to find clusters. There are basic two types of clustering [17] [20].

IV. FEATURE FOR IMAGE WATERMARKING

1. Discrete Wavelet Transform (DWT):
It divides the image into 4 parts 1. HH: Diagonal details coefficients matrix 2. HL: Horizontal details coefficients matrix 3. LH: Vertical details coefficients matrix 4. LL: Approximation coefficients matrix. The LL sub-band can be obtained after applying a low pass filter to filter the rows and columns to obtain a rough explanation of the image.

The HH sub band uses a high pass filter in both directions which has high-frequency components in the diagonal region. The HL and LH are obtained by applying a low pass filter from one side and high pass from the other side. The image is processed by wavelet transform after this.

The LL image determines most of the information of the host image. While LH contains the vertical detail corresponding to horizontal edges. And HL determines the horizontal detail from vertical edges.

2. Color Feature:
The intensity value of any image represents the kind of color of the picture. One has to use a low computation cost method to determine the color of the object. Several images have different types of color which can be identified through standard RGB(red, green, blue). It is the representation of the two-dimensional image. In the third dimension which is the collection of the matrix.

To calculate, the intensity of the picture gray format is used which is in two dimensions ranging from 0 to 255. It is 0 and 1 in the case of black and white photos. With this method, one can effectively determine the color of any image.[8]

3. Edge Image:
As the image is a collection of intensity values and sudden changes in it introduce the edge feature. Figure 4. This feature uses different types of features to detect the types of image and object detection in roads, scenes, etc [5]. Sobel, canny, and per with are such algorithms that detect that point out the difference in the image. Out of them canny was found the best for edge detection or finding the boundaries in the image.

4. Texture Feature:
Determine the difference in texture quality of any image such as smoothness and regularity. [1] Texture requires a step-by-step process, unlike the color determination process. The texture feature is similar to the edge feature and is less sensitive than the color feature.

5. Histogram Feature:
In this, the image vector is found out after pre-processing the image to find the bins. It can be considered as a let scale of the color in fig 4.2 ranging from 1 to 10. So as per this Hi=[0, 0, 0, 4, 3, 5, 2, 1 2, 0] in which the I represents the position in the H matrix together with the color value and H is the color pixel value.

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V. ATTACK ON IMAGE

There are many types of attack which are done in data hiding video. The reason behind this is to check how much difficult to extract the data from the source. These are all the precautions taken before sending the data to the digital media.

1. Noise Attack:
as the video is passed into the secret channel some sort of noise is generated into the channel to see whether it hampers the integrity and security of the video. Types of noise are gaussian nice attack, Salt and Pepper Noise, Speckle noise attack, and many more.

2. Filter Attack:
In this attack, the video is passed through different types of filters and the process is done after receiving the signals from the network. The video cryptography and the embedding and extraction algorithm should be robust for this. Some popular types of filtering attacks are median filter, sharpen filter, motion filter, etc.

3. Compression attack:
Here ate video is passed through several compression techniques which are normally done after signal reception from the network. The embed and extraction algorithm should be robust to save the video from such types of attack. Some popular filtering attacks are MPEG compression, MP4 compression, etc.

4. Detection-disabling attack:
In this to check the security of the data the secret message is detection is done by changing its correlation to make it impossible to extract the secret message from the received data. This type of attack fails when the rotation of scaling is done on the secret message because the secret message does not share the same spatial pattern. In many cases, they perform some types of geometric distortion such as cropping or pixel permutation, the shift in the temporal direction, rotation, zooming, or insertion.

5. Ambiguity Attacks:
Here there is the introduction of several fake messages to confuse the detector with the actual message. This is done to discredit the authority of the original secret message several watermarks are embedded.

VI. CONCLUSIONS

In medical diagnosis researcher proposed different techniques that directly or indirectly improve the health system around the globe. Medical image diagnosis is done by scholars to reduce the disease detection efforts with more efficiency. This paper has cover features of image, with techniques and attacks.

As per different approaches proposed by scholars it was found that selection of feature for image diagnosis need to be improved by training same model with different feature set. Further it is also required that single model will detect more than one disease.

REFERENCES

[1] Muhammad Imran Razzak, Saeeda Naz and Ahmad Zaib. "Deep Learning for Medical Image Processing: Overview, Challenges and Future". Lecture Notes in Computational Vision and Biomechanics, vol 26. Springer, 2018.

[2] Geert Litjens, Thijs Kooi, Babak Ehteshami Bejnordi, Arnaud Arindra Adiyoso Setio, Francesco Ciompi, Mohsen Ghafoorian, Jeroen A.W.M. van der Laak, Bram van Ginneken, Clara I. Sánchez. "A survey on deep learning in medical image analysis, Medical Image Analysis". Medical Image Analysis, Elsevier Volume 42, 2017.

[3] Astha Singh, Asst. Prof. Jayshree Boaddh, Asst. Prof. Jashwant Samar. "A Survey on Digital Image Retrieval Technique and Visual Features Authors". IJSRET, volume issue 7 issue 1, 2021.

[4] Alexander Selvikvåg Lundervold, Arvid Lundervold. "An overview of deep learning in medical imaging focusing on MRI" Zeitschrift für Medizinische Physik, Volume 29, Issue 2, 2019.

[5] H. N. Bharath, D. M. Sima, N. Sauwen, U. Himmelreich, L. De Lathauwer and S. Van Huffel, "Nonnegative Canonical Polyadic Decomposition for Tissue-Type Differentiation in Gliomas," in IEEE Journal of Biomedical and Health Informatics, vol. 21, no. 4, pp. 1124-1132, July 2017.

[6] Alexander Zotina, Konstantin Simonovb, Mikhail Kurakoc, Yousif Hamadc, Svetlana Kirillova. "Edge detection in MRI brain tumor images based on fuzzy C-means clustering" International Conference on Knowledge-Based and Intelligent Information & Engineering Systems, 2018.

[7] M. Li, L. Kuang, S. Xu and Z. Sha, "Brain Tumor Detection Based on Multimodal Information Fusion and Convolutional Neural Network," in IEEE Access, vol. 7,.

[8] Hong Huang, Fanzhi Meng, Shaohua Zhou, Feng Jiang, And Gunasekaran Manogaran. "Brain Image Segmentation Based On Fcm Clustering Algorithm And Rough Set". IEEE Access Special Section On New Trends In Brain Signal Processing And Analysis, February 6, 2019.

[9] N. Noreen, S. Palaniappan, A. Qayyum, I. Ahmad, M. Imran and M. Shoaib, "A Deep Learning Model Based on Concatenation Approach for the Diagnosis of Brain Tumor," in IEEE Access, vol. 8, pp. 55135-55144, 2020.

[10] Hari Mohan Rai, Kalyan Chatterjee. "Detection of brain abnormality by a novel Lu-Net deep neural CNN model from MR images". Machine Learning with Applications 7 October 2020.

[11] Mehedi Masud, Hesham Alhumyani, Sultan S. Alshamrani, Omar Cheikhrouhou, Saleh Ibrahim, Ghulam Muhammad, M. Shamim Hossain, Mohammad Shorfuzzaman, "Leveraging Deep Learning Techniques for Malaria Parasite Detection Using Mobile Application", Wireless Communications and Mobile Computing, 2020.

[12] Fuhad, K.M.F.; Tuba, J.F.; Sarker, M.R.A.; Momen, S.; Mohammed, N.; Rahman, T. "Deep Learning Based Automatic Malaria Parasite Detection from Blood Smear and Its Smartphone Based Application". Diagnostics vol. 10, 5, 2020,

[13] P. A. Pattanaik, M. Mittal and M. Z. Khan, "Unsupervised Deep Learning CAD Scheme for the Detection of Malaria in Blood Smear Microscopic Images," in IEEE Access, vol. 8, pp. 94936-94946, 2020,

[14] N. Senthilkumaran and R. Rajesh, "Edge Detection Techniques for Image Segmentation – A Survey of Soft Computing Approaches", International Journal of Recent Trends in Engineering, Vol. 1, No. 2, May 2009.

[15] S. Saleh, N. V. Kalyankar and S. Khamitkar, "Image segmentation by using edge detection", (IJCSE) International Journal on Computer Science and Engineering Vol. 02, No. 03, 2010.

[16] G. S. Rawat, J. Bhattacharjee and R. Soni, "Proposed Method for Image Segmentation Using Similarity Based Region Merging Techniques",(IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3, 2012.

[17] M. Yambal and H. Gupta, "Image Segmentation using Fuzzy C Means Clustering: A survey", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 7, July 2013.

[18] H. G. Kaganami and Z. Beij, "Region Based Detection versus Edge Detection", IEEE Transactions on Intelligent information hiding and multimedia signal processing, pp. 1217-1221, 2009.

[19] L. Aurdal, "Image Segmentation beyond thresholding", Norsk Regnescentral, 2006.

[20] V. K. Dehariya and S. K. Shrivastava, R. C. Jain, "Clustering of Image Data Set Using K-Means and Fuzzy K- Means Algorithms", International conference on CICN, pp. 386- 391, 2010.