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Trends and Analysis of medical images using image processing Techniques, Applications, challenges

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ABSTRACT

Biomedical image processing has experienced dramatic expansion, and has been an interdisciplinary research field attracting expertise from applied mathematics, computer sciences, engineering, statistics, physics, biology and medicine. The advent of computer aided technologies image processing techniques has become increasingly important in a wide variety of medical applications. The medical image plays an important role in clinical diagnosis and therapy of doctor and teaching and researching etc. Medical imaging is often thought of as a way to represent anatomical structures of the body with the help of X-ray computed tomography and magnetic resonance imaging. But often it is more useful for physiologic function rather than anatomy. With the growth of computer and image technology medical imaging has greatly influenced medical field. As the quality of medical imaging affects diagnosis the medical image processing has become a hotspot and the clinical applications wanting to store and retrieve images for future purpose needs some convenient process to store those images in details. Intervention between the protection of useful diagnostic information and noise suppression must be treasured in medical images. Image denoising is an applicable issue found in diverse image processing and computer vision problems. The principal objectives of this paper are to provide an Introduction to basic concepts and techniques for medical image processing and to promote interests for further study and research in medical imaging processing. This paper gives the details about the methods of biomedical image processing and after that it also describe about medical imaging modalities. Some of the medical imaging modalities are described in this paper like X-ray imaging, CT, MRI, and ultrasound. The optical modalities like endoscopy, photography and microscopy are also more important in this field. The following steps of image analysis are explained in this paper, feature extraction, segmentation, classification, quantitative measurements and interpretation.

***Keywords*: —** Magnetic Resonance Imaging, Pre-processing, Segmentation, Image Segmentation

I. INTRODUCTION

Medical image processing is an area of increasing interest. It includes a wide range of methods and techniques, starting with the acquisition of images using specialized devices (for example, CT devices), image enhancement and analysis, to 3D model reconstruction from 2D images. Thus, the research in this field represents a point of interest for both doctors and engineers, in their attempt to improve medical techniques, with computer assistance, in order to obtain more accurate results in treating the patients.[1] Medical Image Processing (MIP) is a novel research discipline based on the application of computer vision methods to data sets acquired *via* medical imaging modalities such as ultrasound, magnetic resonance imaging (MRI), computed tomography (CT), single photon emission computed tomography (SPECT), positron emission tomography (PET) and fundus photography. The cost-efficient health-care and effective diagnosis of medicine were revolutionized by the medical images in all major disease areas. Scientists and physicians use less invasive techniques to understand potential life-saving information from these medical images. The accuracy of these medical images depends on the image acquisition where the multi-pronged functions like, performing reconstruction, post-processing of the image data [2], storing the scans and controlling imaging hardware were assisted by computers. Due to the sufficient volume of data, the technology driven MIP research should also be an application oriented field. In recent years, effective work in the medical image processing has been initiated [3]. In-order to assist the physician many applications are being developed that can interpret an image for diagnosing possible abnormalities. The recent

research community have received considerable attention to develop automatic screening systems for eye related pathologies. The patients, especially in rural areas were affected from obtaining regular inspection due to the shortage of ophthalmologists and high examination cost [4]. Hence, an automated retinal image processing system that can screen the irregularities at the initial stage is a need of the hour.

1.1 Trends in Medical Image Processing:

There are many types of imaging modalities used for medical diagnosis of various diseases, and are described in the following subsections.

1.1.1 Computed Tomography (CT):

CT images are produced using X-ray photons with digital reconstruction technique [4]. The X-ray beam is generated by the X-ray tube that passes through the patient and is captured by the detectors. This captured beam is reconstructed to produce a three dimensional image. This CT scanner uses different reconstruction algorithm at different angle to produce an image. The most commonly used clinical applications in CT studies are CT Brain, Pelvic CT, CT angiography and Cardiac CT. These are used to locate abnormalities in the body such as tumours, abscesses, abnormal blood vessels etc [5].

1.1.2 Ultrasound:

Ultrasound image provides the cross-sectional images of the body, which are constructed using high-frequency sound waves. In ultrasound procedure there is no radiation exposure and hence it is a very safe process with minimum known adverse. The sound waves are emitted by the transducer at some frequency and the returning echoes are captured at frequencies dependent on the tissues through which the waves traverse [6]. The returned sound wave is digitized that appears as dots or echoes on the screen. These echoes are used in cardiovascular ultrasound to visualize the peripheral vascular structures of heart, and abdominal ultrasound to assess the anatomy of the liver and gallbladder.

1.1.3 Magnetic Resonance Imaging (MRI):

This imaging technique is commonly used in radiology which uses magnetic radiation to assess detailed internal structures. It is mainly used in medical diagnosis to produce high quality images of soft tissues of the human body. Normally an MRI scanner consists of two powerful magnets. Initially the first magnet causes the body's water molecules to align in one direction which are normally scattered. The alignment of the hydrogen atom is then altered by turning on and off the second magnetic field. When turning off the magnetic field these hydrogen atoms will switch back to its original state. These changes are detected by the scanner to create a detailed cross-sectional image. This image helps to visualize internal structures such as joints, muscles, and other structures in an effective way[7].

1.1.4 Fluoroscopy:

The body structures are visualized in a real time environment using an imaging modality termed fluoroscopy [8]. These real time images are generated by continuously emitting and capturing the X-ray beam on the screen. To differentiate various structures, high density contrast agents may be used which helps in the assessment of anatomy and its functions of this structure.

1.2.5 Ophthalmic Imaging

In addition to other medical imaging modalities, there exist several ophthalmic imaging methods like fluorescein angiography (FA) and optical coherence tomography (OCT), which plays a significant role in the diagnosis of several eye related pathologies[9]. In FA a fluorescent dye is infused over the patient's eye in a systematic flow, and the fluorescent properties are activated by passing light in a specific wavelength. The higher light energy is stimulated by the transmitted light and the fundus photograph captures it when the molecules returned to the original state. The captured image is termed as angiogram that provides valuable information to the ophthalmologists about the progression of the disease related to the retinal vasculature. Sodium fluorescein angiography and indocya-nine green angiography are the other types used in diagnosis[10]. In OCT, the ocular tissue structure is further stretched into a two dimensional cross-sectional image, where propagation direction of the light and the perpendicular spatial direction were its dimensions. The transparent vascular tissue is scanned with laser light beam and the reflected light is collected by the OCT and the

propagation time delay is measured by the low coherence interferometer. Numerous axial scans and numerous OCT images combines to form an optical coherence tomography image where it is mainly used in the diagnosis of macular swelling and to analyse its type. Fundus imaging is highly preferred for diagnosing retinal diseases due to its low cost, portability and less risk to the patients. The eye disorders such as glaucoma, diabetic retinopathy (DR) and age-related macular degeneration (ARMD), can be diagnosed for follow-up management of patients from the digital fundus images. The detection of abnormalities such as drusen can be predicted using effective image processing algorithms, to detect the severity of the disease. Appropriate algorithms are needed to make an effective screening process. It can be implemented using suitable software in which the accurate screening of retinal images for various anatomical and pathological feature extraction and analysis is possible.

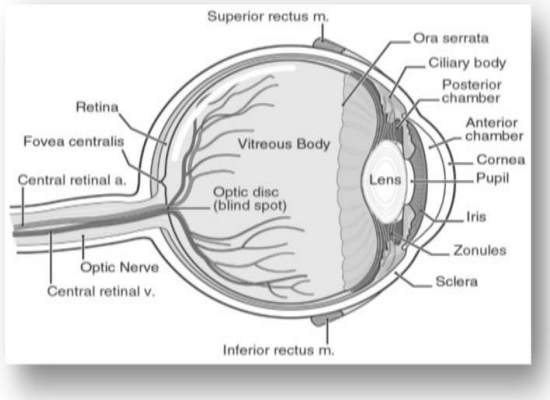

Fig1.1: Human Eye [11]

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1.3 APPLICATIONS OF MEDICAL IMAGE ANALYSIS:

The arrival of digital medical imaging technologies has reformed modern medicine. Extensive use of digital imaging in medicine today, the quality of digital medical images has becomes an important issue. To achieve the best possible diagnosis it is most important that medical images should be sharp, clear, noise free and artifacts . With the advancement in the technologies continuing for gaining digital medical images with higher resolution and quality, removing noise in these digital images remains one of the major challenges in the study of medical imaging. Image de-noising still remains a challenge for researchers because noise removal introduces artifacts and causes blurring of the images. Image processing has a wide spectrum of applications and can be measured into different domains where images are used [12].

a) **Brain Tumor Detection:** Brain is the most important and vital organ of the human body. The control and coordination of all the other vital structures is carried out by the brain. A brain tumor is a very serious-type among all life threatening diseases which is increasing drastically among the humans. A brain tumor is a mass of tissue formed by an unregulated growth of the abnormal cells in the brain. CT and MRI are the best technologies currently being used for diagnosing brain tumor. It helps the doctors to classify the tumor from either least aggressive (benign) or most aggressive (malignant)[12].

b) **Craniofacial Fractures** : Craniofacial Fractures Imaging is one of the most important tools for orthodontists to evaluate and record size and form of craniofacial structures [13]. Craniofacial fractures are faced frequently. Major causes are vehicle accidents & sports related injuries. During the treatment of craniofacial fractures, 3-D imaging is an imaging technology ultrasound, CT-scan which provides high quality of image to the orthopedics to diagnoses.

c) **Breast Cancer Detection**

Breast cancer is most commonly diagnosed cancer worldwide. Pal et al. [14] state that, annually more than a million women have breast cancer and 400 thousand of those cases lead to death. This fatal disease affects not only developing countries but also developed countries. In order to find the cure it is necessary to quickly diagnose the disease accurately and

treat it based on the kind of symptoms appeared. Cheng et al. [15] state that early diagnosis should not only include breast cancer detection but also specify whether the breast cancer is benign or malignant.

d) **Congenital Heart Defects** :Congenital heart defects are problems with the heart's structure that are present at birth. Doctors usually diagnose holes in heart based on a physical exam and result from test and procedures. Noise suppression of echocardiography images still is a challenging issue for accurate interpretation. One of the major problems associated with echocardiographic image enhancement is the speckle noise [16].

e) **Diagnosis Heart Valve Diseases** Heart valve disorders are of importance among the heart diseases. For this reason, early detection of heart valve disorders is one of the most important medical research areas [17]. Cardiologists have access to diverse techniques such as electrocardiograms, chest X-rays, ultrasound imaging, Doppler techniques and angiography etc. for examine the functionality of heart more accurately for the diagnosis. Echocardiography is a clinical procedure for diagnosing heart diseases, especially valve ones.

f) **Tuberculosis (TB)** Tuberculosis continues to represent a major public health problem worldwide. Accurate diagnosis and effective treatment are fundamental to reducing illness, mortality and restricting spread of infection[17].

g) **Pathological Brain Detection (PBD**) Labeling brain images as healthy or pathological cases is an important procedure for medical diagnosis. Pathological brain detection can help physicians to detect subjects with brain diseases by an automatic method . Zhang et al. [17] proposed an automatic PBD to distinguish pathological brains from healthy brains in magnetic resonance imaging scanning. This technique provides clearer soft mass dataset of tissue details without causing damages to the patient's tissues.

h) **Birth Defects** :A birth defect is a health problem or physical change, which is present in a baby at the time he or she is born. Birth defects have been present in babies from all over the world, in families of all nationalities and backgrounds. Anytime a couple becomes pregnant, there is a chance that their baby will have a birth defect. Most babies are born healthy. In fact, 97 out of 100 babies are born healthy [18].

II. IMAGE PROCESSING TECHNIQUES IN DIGITAL IMAGES

a. Background:

An image is a collection of measurements in two-dimensional (2-D) or three dimensional (3-D) space. In medical images, these measurements or 'image intensities' can be radiation absorption in X-ray imaging, acoustic pressure in ultra sound, or radio frequency (RF) signal amplitude in MRI. If a single measurement is made at each location in the image, then the image is called a scalar image. Medical imaging has been undergoing a revolution in the past decade with the advent of faster, more accurate, and less invasive devices. This has driven the need for corresponding software development which in turn has provided a major impetus for new algorithms in signal and image processing [19].

Mathematical models are the foundation of biomedical computing. Basing those models on data extracted from images continues to be a fundamental technique for achieving scientific progress in experimental, clinical, biomedical, and behavioural research. Today, medical images are acquired by a range of techniques across all biological scales, which go far beyond the visible light photographs and microscope images of the early 20th century. Modern medical images may be considered to be geometrically arranged arrays of data samples which quantify such diverse physical phenomena as the time variation of

haemoglobin deoxygenating during neuronal metabolism, or the diffusion of water molecules through and within tissue. The broadening scope of imaging as a way to organize our observations of the bio physical world has led to a dramatic increase in our ability to apply new processing techniques and to combine multiple channels of data into sophisticated and complex mathematical models of physiological function and dysfunction. A key research area is the formulation of biomedical engineering principles based on rigorous mathematical foundations in order to develop general-purpose software methods that can be integrated into complete therapy delivery systems. Such systems support the more effective delivery of many image-guided procedures such as biopsy, minimally invasive surgery, and radiation therapy[20].

The two types of methods used for Image Processing are Analog and Digital Image Processing. Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. The image processing is not just confined to area that has to be studied but on knowledge of analyst. Association is another important tool in image processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing. Digital Processing techniques help in manipulation of the digital images by using computers. As raw data from imaging sensors from satellite platform contains deficiencies. To get over such flaws and to get originality of information, it has to undergo various phases of processing. The three general phases that all types of data have to undergo while using digital technique are Pre- processing, enhancement and display, information extraction [21].

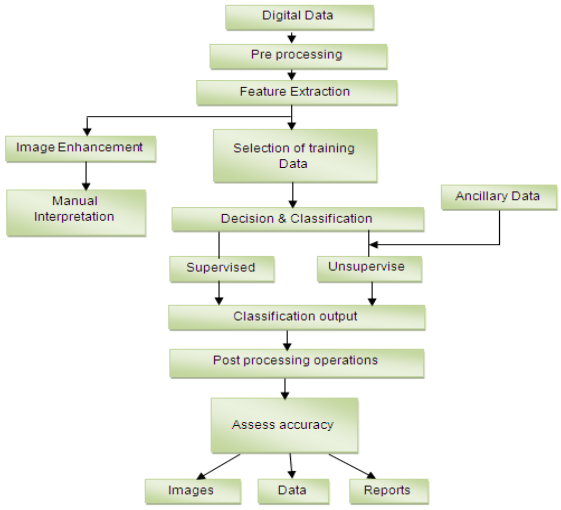

Fig2.Digital Techniques [22]

Fundamental steps in image processing:

1) Image acquisition: to acquire a digital image

2) Image preprocessing: to improve the image in ways that increases the chances for success of the other processes.

3) Image segmentation: to partitions an input image into its constituent parts or objects.

4) Image representation: to convert the input data to a form suitable for computer processing.

5) Image description: to extract features that result in some quantitative information of interest or features that are basic for differentiating one class of objects from another.

6) Image recognition: to assign a label to an object based on the information provided by its descriptors.

7) Image interpretation: to assign meaning to an ensemble of recognized objects [22].

III. LITERATURE REVIEW

In [23]authors highlights a very effective and fully automatic tooth isolation method for bitewing dental Xray images. As per their study, upper-lower jaw separation mechanism is based on gray-scale integral projection to avoid possible information loss and incorporates with angle adjustment to handle skewed images. In single tooth isolation, the study proposes an adaptive windowing scheme for locating gap valleys to improve the accuracy.

In[24] authors study is based on techniques developed in the field allow many real-life

applications with great societal value. For example, urban monitoring, fire detection or flood prediction can have a great impact on economical and environmental issues. From a machine learning and signal/image processing point of view, all the applications are tackled under specific formalisms, such as classification and clustering, regression and function approximation, image coding, restoration and enhancement, source un mixing, data fusion or feature selection and extraction.

In[24] authors presented a hybrid approach for classification of brain tissues, such as white matter (WM), gray matter (GM), cerebral spinal fluid (CSF), background (BKG) and tumour tissues, in MRI based on Artificial neural Networks and Genetic Algorith (GA). In the proposed technique after seeded region growing segmentation and connected component labelling, two texture and intensity feature sets are taken as input. First set consists statistical features such as: Entropy, Kurtosis, Skewness, Mean, Energy, Momentum, correlation and second feature sets, are derived from wavelet transformation.

In [25] this paper worked on states the risk of having cancer in dense breast on mammogram is higher compared to those who have less. This is due to presence of glandular cells in the breast parenchyma. Therefore, it is important for radiologists to pay more attention to denser breasts in order to detect abnormalities. The suggested method works based on the statistical parameters including kurtosis, skewness, median and mean. The system evaluated 180 mammogram images and it was found to be 92.8% accurate with a strong correlation between the system and radiologists' estimation (K=0.87, p=0.0001).

In[26] The study states that Breast-tissue microarrays facilitate the survey of very large numbers of tumours but their scoring by pathologists is time consuming, typically highly quantised and not without error. This paper proposes a computationally efficient approach that approximates the density of colour and local invariant features by clusters in the feature space, and characterises each spot by a frequency histogram of nearest cluster centres. Spots are classified into four main types based on their histograms.

In [27] this paper discusses about various image processing techniques and tools which are available for identification of printing technologies. Printing technology identification and associated problems in document forensics have been projected as challenges in image processing application. Various image processing approaches based on textures, spatial variation, HSV colour space, spatial correlation, and feature based on histogram and some of the pattern recognition methods, like gray level co-occurrence matrix, roughness of the text, perimeter of edge are highlighted.

In[28],The research depicts a comprehensive survey of the technical achievements in the research area of image retrieval, especially content-based image retrieval, an area that has been so active and prosperous in the past few years. Based on the state-of-the-art technology available now and the demand from real-world applications, open research issues are identified and future promising research directions are suggested.

In[29], This research work introduce a family of first-order multidimensional ordinary differential equations (ODE's) with discontinuous right-hand sides and demonstrate their applicability in image processing. An equation belonging to this family is an inverse diffusion everywhere except at local extrema, where some stabilization is introduced.

In[30],The study shows that an original coding scheme is introduced to take advantage of the two-dimensional structural information of images within the genetic algorithm framework. Results are presented showing that this new technique outperforms classical optimization methods for the optimization of 32 × 32 and 128 x 128 holograms.

In[31],This research primarily focuses on the predictive technology of identifying the state of tumors in the breast tissues. In breast cancer diagnosis, patients are forced to undergo a series of biopsies just to identify and confirm on the state of tumour, as whether malignant or benign. In this research however, an algorithm will be developed using MATLAB Image Processing Toolbox to indentify the state of a tumor solely based on ultrasound images. Ultrasound images of breast tumors are imported into MATLAB and are passed through a set of filters to remove background

noise. Next, the filtered images are run through a set of edge detection algorithms which identifies and defines the region of interest. The results are compared with the actual biopsy results from the IIUM Breast Cancer Research Institute, Kuantan and all the analyzed results matched the biopsy results.

In[32],authors study shows that Mammography is at present one of the available method for early detection of masses or abnormalities which is related to breast cancer. The most common abnormalities that may indicate breast cancer are masses and calcifications. Breast cancer is diagnosed at advanced stages with the help of the digital mammogram image. In this paper, a method has been developed to make a supporting tool.

In[33],Their study is based on a novel, fully automatic, adaptive, robust procedure for brain tissue classification from 3D magnetic resonance head images (MRI) is described in this paper. Starting from a set of samples generated from prior tissue probability maps in a standard, brain-based coordinate system, the method first reduces the fraction of incorrectly labelled samples in this set by using a minimum spanning tree graphtheoretic approach.

In[34],The Authors study suggested, Digital mammography systems allow manipulation of fine differences in image contrast by means of image processing algorithms. Different display algorithms have advantages and disadvantages for the specific tasks required in breast imaging—diagnosis and screening.

In[35], Their study suggested, Mammography is the primary tool for the early detection of breast cancer. The depiction of fine micro-calcifications and subtle soft-tissue masses on mammograms is key to the detection of early breast cancer.

In[36],In this paper authors have made an attempt to classify the breast tissue based on the intensity level of histogram of a mammogram, Statistical features of a mammogram are extracted using simple image processing techniques. The proposed scheme uses texture models to capture the mammographic appearance within the breast. The statistical features extracted are the mean, standard deviation, smoothness, third moment, uniformity and entropy which signify the important texture features of breast tissue. Based on the values of these features of a digital mammogram, the authors have made an attempt to classify the breast tissue in to four basic categories like fatty, uncompressed fatty, dense and high density.

In [37], In this study they state that Breast cancer produces a high rate of mortality worldwide. Early diagnosis is essential for treatment, however it is difficult to analyse high density breast tissues. Computer aided diagnosis systems have been proposed to classify the density of mammograms, having as a major challenge to define the features that better represent the images to be classified.

In[38],Authors present a neural networkbased method for automatic classification of magnetic resonance images (MRI) of brain under three categories of normal, lesion benign, and malignant. The proposed technique consists of six subsequent stages; namely, pre-processing, seeded region growing segmentation, connected component labelling (CCL), feature extraction, feature Dimension Reduction, and classification.

In[39],This paper states that A novel, fully automatic, adaptive, robust procedure for brain tissue classification from 3D magnetic resonance head images (MRI) is described in this paper. The classification procedure is robust against variability in the image quality through a non-parametric implementation: no assumptions are made about the tissue intensity distributions.

In [40], the study on this project is based on machine learning techniques to perform tumour vs. normal tissue classification using gene expression microarray data, which was proven to be useful for early-stage cancer diagnosis and cancer subtype identification. We compare the results of both supervised learning (k-nearestneighbours, SVMs, boosting) and unsupervised learning (k-means clustering, hierarchical clustering) routines on three datasets.

In[41],The research is based on analysis of composition of concrete mixture digital image. The concrete mixture is combination of various Cement, Air-voids and Aggregates. To analyze the compositions of the concrete mixture, the X-ray CT images are used. Digital image processing algorithm is applied to analyze the obtained image. Using this Digital image

processing algorithm the obtained image is processed and filtered. The resultant image is compared with the X-ray CT image and the measured and predicted mixture proportions are compared to analyze the absolute errors. The threshold range T1 and T2 were found for aggregates, cement materials and air-voids.

In[42],authors stateed that an automated digital image processing (DIP) algorithm called Volumetric based Global Minima (VGM) thresholding algorithm for processing asphalt concrete (AC) X-ray computed tomography (CT) images. It utilizes known volumetric properties of AC mixtures as the main criterion for establishing the air-mastic and mastic-aggregate gray scale boundary thresholds. Several DIP techniques were utilized to characterize the AC microstructure.

In[43], authors state that many problems in imaging are actually inverse problems. One reason for this is that conditions and parameters of the physical processes underlying the actual image acquisition are usually not known. Material parameters in geological structures as unknown parameters for the simulation of seismic wave propagation with sparse measurement on the surface, or temporal changes in movie sequences given by intensity changes or moving image edges and resulting from deformation, growth and transport processes with unknown fluxes.

In[44],This paper concludes that Image registration is the fundamental task used to match two or more partially overlapping images taken. It is a fundamental image processing technique and is very useful in integrating information from different sensors, finding changes in images taken at different times, inferring three-dimensional information from stereo images, and recognizing model-based objects.

In[45],authors found that In digital image forensics, it is generally accepted that intentional manipulations of the image content are most critical and hence numerous forensic methods focus on the detection of such `malicious' post-processing. The researcher presented a simple yet effective technique to detect median filtering in digital images a widely used de-noising and smoothing operator.

In [46], This paper concludes that the luminance emitted from a cathode ray rube (CRT) display is a nonlinear function (the gamma function) of the input video signal voltage. In most analogy video systems, compensation for this nonlinear transfer function is implemented in the camera amplifiers.

In[47], They discussed on Kilo- to Terabyte challenges regarding (i) medical image management and image data mining, (ii) bio imaging, (iii) virtual reality in medical visualizations and (iv) neuro-imaging. Due to the increasing amount of data, image processing and visualization algorithms have to be adjusted. Scalable algorithms and advanced parallelization techniques using graphical processing units have been developed. They are summarized in this paper.

In [48], They described some central mathematical problems in medical imaging. The subject has been undergoing rapid changes driven by better hardware and software. Much of the software is based on novel methods utilizing geometric partial differential equations in conjunction with standard signal/image processing techniques as well as computer graphics facilitating man/machine interactions.

In [49], Their study describes CT scanner, Ultrasound and Magnetic Resonance Imaging took over x-ray imaging by making the doctors to look at the body's elusive third dimension. With the CT Scanner, body's interior can be bared with ease and the diseased areas can be identified without causing either discomfort or pain to the patient.

In [50], They studied on quantitatively assess caries changes of teeth by using digital analysis. They studied on the digital images of stained sections of crowns of teeth were acquired with a computer-assisted light microscope. In these images, they found spots representing the main and total demineralization of enamel were segmented to determine their area. The area of total demineralization was significantly different between premolars with sealed fissures and unprotected premolars as indicated by the Mann–Whitney test.

In [51], Their study is on Classification of dental caries is important for the diagnosis and treatment planning of the dental disease, which has been affecting a very large population throughout the globe. It is also helpful for

conducting detailed study and investigations about the nature of the dental disease. Dental caries are, clearly visible in the x-ray changes and it can be detected from the caries lesion present in the radiographs.

In [52], They state in her study on medical image researches for brain tumor detection are attaining more curiosity since the augmented need for efficient and objective evaluation of large amounts of data. Medically, tumours are also known as neoplasms, which are an abnormal mass of tissue resulting from uncontrolled proliferation or division of cells happening in the human body.

In [53], authors carried out their study on "x-ray clinical medical image". The study suggests that the use of LoG filter for contrast improvement process in place of methods discussed in. An adaptive technique is suggested to improve the contrast quality of dental Xray image using the Laplacian-of-a-Gaussian (LoG) Filter. Biologically, LoG Filter has a
similar profile to the response of the receptive fields in the Human Visual System (HVS).

In [54] studied on "Image processing and cryptography". The study focus on Improvement of pictorial information for betterment of human perception like de-blurring, de-noising in several fields such as satellite imaging, medical imaging etc are renewed research thrust. Specifically we would like to elaborate our experience on the significance of computer vision as one of the domains where hardware implemented algorithms performs far better than those implemented through software.

In [55] authors studied on "One dimensional image processing for eye tracking using derivative dynamic time warping." The study shows that one dimensional image processing for eye tracking approach is presented using a low cost webcam. It was found that the algorithm is resistant to illumination variation and is able to track eyes of users with and without glasses in multiple orientations. The size and location of the region of interest (ROI), which contains both eyes, is adaptive.

In [56],authors studied on "Wavelets in Medical Image Processing: De-noising, Segmentation, and Registration." The study shows that Wavelet transforms and other multiscale analysis functions have been used for compact signal and image representations in denoising, compression and feature detection processing problems for about twenty years.
Numerous research works have proven that space-frequency and space-scale expansions with this family of analysis functions provided a very efficient framework for signal or image data. **In [57],** Authors studied on "Morphological Image sequence processing." The study presented morphological multi-scale method for image sequence processing, which results in a truly coupled spatio-temporal anisotropic diffusion. The aim of the method is not to smooth the level-sets of single frames but to de-noise the whole sequence while retaining geometric features such as spatial edges and highly accelerated motions. This is obtained by an anisotropic spatio-temporal level-set evolution, where the additional artificial time variable serves as the multi-scale parameter.

In [58], Authors studied on "Real time Image Processing Algorithms for the Detection of Road and Environmental Conditions" The study depicts image processing algorithms for the recognition of environmental and road conditions from real-time camera images. This study addresses various implementation techniques for and considerations of the implementation of algorithms to extrapolate various features from images taken by stationary traffic cameras.

In [59]authors show in their study on "Reconstruction of mechanically Recorded Sound by Image Processing". The study shows Audio information stored in the undulations of grooves in a medium such as a phonograph record may be reconstructed, with no or minimal contact, by measuring the groove shape using precision metrology methods and digital image processing. The effects of damage, wear, and contamination may be compensated, in many cases, through image processing and analysis methods.

In [60]authors study depicts "Real Time Image Processing based on Reconfigurable Hardware Acceleration". The research is concerned with a substantial speed
up of image processing methods on 2D and 3D images making use of modern FPGA (Field programmable Gate Array) technology. The applications of this class of methods ranges

from 2D and 3D image de-noising and restoration, segmentation, morphological shape recovery and matching to vector field visualization and simulation.

In [61],authors studied on "Paper-based Watermark Extraction with Image Processing". The study presents frameworks for the digitisation, localisation, Extraction and graphical representation of paper-based watermark designs embedded in paper texture. These operations determine a suitable configuration of parameters to allow optimal content processing, in addition to the detection and extraction of chain lines. The second approach uses a model of the back-lighting effect to locate a watermark in pages of archaic documents. It removes recto information, and highlights remaining 'hidden' data, and then presents a statistical approach to locate watermarks from a known lexicon.

IV. CONCLUSION

In this paper, we sketched some of the fundamental concepts of medical image processing. It is important to emphasize that none of these problem areas has been satisfactorily solved, and all of the algorithms we have described are open to considerable improvement. A relative study is made on various techniques. This paper also deals with the different methods in image classification as i) Image Pre-processing and Segmentation ii) Feature Reduction and iii) Classification. Many algorithms have been proposed in the literature for each image processing stage. After evaluation, it is clearly shown the various methods which can detect the medical disease efficiently and provide accurate result.. From the previous review, we classify the current methods and summarize their features. Also each method has its suitable application fields, and researchers should combine the application background and practical requirements to design proper algorithms. Accuracy, complexity, efficiency and interactivity of a segmentation method should all be the considered factors.

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