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Analysis of Rheumatoid Arthritis from Bio Medical MRI Images

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Abstract— In present project my aim is to analyse the medical images and is to identifying the intensity of diseases present in MRI/ULTARA-SOUND/X-RAY images. My work will be based on image analysis of Rheumatoid Arthritis (RA) from MRI image analysis through Matlab-Image Processing Tool-B.

Keywords— Rheumatoid Arthritis Mode/Max, Median/Max, Min/Max, Variance, Max-Min, Comparison of images after Laplacian mask and Edge-enhancement filter mask

I. INTRODUCTION

Rheumatoid arthritis (RA) is a chronic inflammatory disease that causes pain, swelling, stiffness, and loss of function in the joints. The disease basically affects the joints, mainly in the wrist and the fingers. Also other parts of the body besides the joints can be affected. Current treatments mainly focus on pain relief, inflammation reduction, and slowing down or stopping joint damage, as there is no proven cure for Rheumatoid Arthritis (RA) available till yet. In order to prevent irreversible joint damage, early detection of Rheumatoid Arthritis (RA) is essential. Close monitoring of the disease for an effective medical treatment is important. Joint damage assessment in hand radiographs is a frequently used method for monitoring the progression of RA. Joint damage assessment in hand radiographs is a frequently used method for monitoring the progression of RA. [1][2].

Signs and Symptoms of Rheumatoid Arthritis (RA): Basically Rheumatoid Arthritis (RA) basically affects joints; problems involving other organs of the body are known to occur. The Extra-articular ("outside the joints") manifestations other than anaemia are clinically evident in about 15–25% of individuals with rheumatoid arthritis. It can be difficult to determine whether disease manifestations are directly caused by the rheumatoid process itself, or from side effects of the medications commonly used to treat it – for example, lung fibrosis etc. [1].

II. LITERATURE REVIEW

Achieving Parallelism is now a necessity to improve the performance of computer system. One of the main Issues is how to effectively utilized parallel computer that has become increasingly complex. It is estimated that many modern supercomputers and parallel processor deliver only 10 percent or less of their peak performance potential in a variety of applications. Yet high performance degradation are many. Performance losses occur because of mismatches among applications software and hardware. Research is active in the direction of developing new multiprocessor architectures and schedule the partitioned program on to it to achieve higher performance.[1,3,4].

Effort concentrated on the Study of all factors for developing a novel multiprocessor Architecture and after developing we will evaluate the performance of a multiprocessor architecture for server and networking with on study and to schedule the arriving load on to it in order to achieve higher performance. The other important issue are accessing delay and downloading the information while using multiprocessor technique. Comparable with similar architecture. In addition to designing an

appropriate network, the efficient management of parallelism on the network involves optimizing performance needs, like the minimization of communication and scheduling over head. A simulation studies are carried out to compare the performance of different multiprocessor architecture (such as LEC, LET, Hypercube, Debruinju etc) with the various standard dynamic scheduling algorithms like Sender initiated diffusion (SID), receiver initiated diffusion (RID) etc .The simulation result will show that our Multiprocessor architecture (linearly extensible triangle) gives better performance as compare to other existing multiprocessor architecture with low cost and reduce the load balancing time and scheduling over head. Exploiting parallelism is now a necessity to improve the performance of computer systems one of the most important issues is how to effectively utilize parallel computers that has become increasingly complex to improve the performance. Such systems are constructed by different processor connected with communication link to operate in parallel with relatively low cost known as multi processor system [3,5].

Multiprocessor system is very efficient at solving problems that can be partitioned into tasks with uniform computation and communication patterns. However, there exists a large class of non uniform problems with uneven and unpredictable computation and communication requirements. Therefore Dynamic load balancing (DLB) schemes [1,2,7] are needed to efficiently solve non-uniform problems on multiprocessor systems. Over the year, much different multiprocessor architecture, having different topological structure and For the literature survey of my project, I have undergone many Research papers, and I have listed some of the major contributions and findings of some of the research papers are:

i. Rheumatoid arthritis (RA) is basically an inflammatory disease causing pain, swelling, stiffness, and loss of function in joints; it is difficult to diagnose in early stages. An early diagnosis and treatment can delay the onset of severe disability. Infrared (IR) imaging offers a potential approach to detect changes in degree of inflammation. In 18 normal subjects and 13 patients diagnosed with Rheumatoid Arthritis (RA), thermal images were collected from joints of hands, wrists, palms, and knees. Regions of interest (ROIs) were manually selected from all subjects and all parts imaged. For each subject, values were calculated from the temperature measurements: Mode/Max, Median/Max, Min/Max, Variance, Max-Min, (Mode-Mean) 2, and Mean/Min. The data sets did not have a normal distribution, therefore non parametric tests (Kruskal-Wallis and Ranksum) were applied to assess if the data from the control group and the patient group were significantly different. Results indicate that: (i) thermal images can be detected on patients with the disease; (ii) the best joints to image are the metacarpophalangeal joints of the 2nd and 3rd fingers and the knees; the difference between the two groups was significant at the 0.05 level; (iii) the best calculations to differentiate between normal subjects and patients with RA are the Mode/Max, Variance, and Max-Min. We concluded that it is possible to reliably detect RA in patients using IR imaging. Future work will include a prospective study of normal subjects and patients that will compare IR results with Magnetic Resonance (MR) analysis. [2].

ii. This paper is part of a project that investigates the possibilities of automating the assessment of joint damage in hand radiographs. Our goal is to design a robust segmentation algorithm for the hand skeleton. The algorithm is based on active appearance models (AAM)[3][4], which have been used for hand segmentation before . The results will be used in the future for radiographic assessment of rheumatoid arthritis and the early detection of joint damage. New in this work with respect to[3] [5] is the use of multiple object warps for each individual bone in a single AAM.This method prevents modeling and reconstruction defects caused when warping overlapping objects. This makes the algorithm more robust in cases where joint damage is present. The current implementation of the model includes the metacarpals, the phalanges, and the carpal region. For a first experimental evaluation a collection of 50 hand radiographs has

been gathered. The image data set was split into a training set (40) and a test set (10) in order to evaluate the algorithm's performance. First results show that in 8 images from the test set the bone contours are detected correctly within 1.3 mm (1 STD) at 15 pixels/cm resolution. In two images not all contours are detected correctly. Possibly this is caused by extreme deviations in these images that have not yet been incorporated in the model due to a limited training set. More training examples are needed to optimize the AAM and improve the quality and reliability of the results. [3][4][5].

iii. Breast cancer is the most common cancer among women and men in both the developed and the developing country. The most pragmatic solution to early detection lies in breast cancer education of women. Few studies have examined the effect of breast implants after mastectomy on long-term survival in breast cancer patients, despite growing public health concern over potential long-term adverse health effects. Early diagnosis was stressed as the best protection against breast cancer morbidity. Some risk factors, such as smoking, drinking, and diet are linked to things a person does. Others, like a person's age, race, or family history, can't be changed. Screening for breast cancer has been extensively endorsed and most women of 40 years old participate in screening activities. Blackman, et al., (1999) and Weir et al., (2003). In the community mammography remains the main screening tool. Elmore, et al., (2005). However, there have been several important developments in the ability to predict and modify breast cancer risk. Recently, data have become available regarding the evaluation of risk, screening strategies for high- risk women, and medical and surgical approaches that can decrease breast cancer risk. Data mining techniques was employed to extract hidden knowledge about the interaction between these parameters. This study explored and analyzed the massive data generated from the breast cancer patients from the reputable teaching hospital for several years and and these data were transformed in a way that can be accepted to neural network data mining software. The Artificial Neural Network (back propagation learning Algorithms on multilayer perceptrons) was used to detect the existence of cancer in a patient. The System was trained using back propagation learning algorithm (pattern-by pattern and delta-delta) on dataset acquired from a teaching hospital, in Ibadan. The Multi-Layer perceptron and the two learning algorithms are implemented using Java programming language. The implemented algorithms are tested on a real world problem, the breast cancer Classification and Prediction Problem. The result obtained after the application of the learning algorithms are reported and compared. Additionally the basic UML design and other analysis tools are used in the design.[6].

iv. The degree of research on the use of irreversible compression in digital radiology is still in its infancy, since the technologies for digital radiology are still evolving. However, 90 papers reviewed address research examining the use of various compression ratios on image quality and observer performance on several detection tasks such as identifying structures and lesion detection, on chest, CT, skeletal, angiography, mammography, MRI, Nuclear Medicine, ultrasound, and teleradiology images. In general, the results of these studies show that image types in digital radiology are different based on their mode of generation, as well as their spatial and contrast resolution, determined by their matrix size/pixel size, and bit depth respectively. Furthermore, there are several forms of irreversible compression algorithms, and they are not all equal in terms of performance. Additionally, of the three evaluation methods used to measure observer performance on compressed images, the ROC methodology is most commonly used. Some types of images such as digitized chest images, CT, MRI and Ultrasound images have different "compression tolerance" and therefore a single compression ratio cannot be assigned to a modality, even for a given organ system. Chest images for example can be compressed at ratios as high as 10:1 - 20:1 using CR and DR without compromising image quality. Other image types such as CT images for example, can be

compressed at ratios as high as 20:1 in the detection of coronary artery calcification. The results of these studies would appear to indicate that image compression in digital radiology would have to be optimized based on the types of images being generated, interpreted for primary diagnosis, stored, and transmitted to remote sites for clinical review by physicians other than radiologists. The survey of several radiology professional and related organizations reveals that no professional practice standards exist for the use of irreversible compression. Currently, the only standard for image compression is stated in the ACR's Technical Standards for Teleradiology and Digital Image Management. The opinions from notable radiologists in the US and Canada are varied indicating no consensus of opinion on the use of irreversible compression in primary diagnosis, however, they are generally positive on the notion of the image storage and transmission advantages. Almost all radiologists are concerned with the litigation potential of an incorrect diagnosis based on irreversible compressed images. [7].

v. Basically Image Compression is technique in which "Removing unnecessary data to reduce information using one or more of many software and/or hardware techniques is generally referred as Digital Compression. The remaining information is then encoded and either transmitted or stored in an archive or storage media, such as tape or disk. In decompression process, the user's equipment later decodes the information and fills in a representation of the data that was removed during compression". [7].Generally there are two types of image compression techniques: "Lossless" or reversible compression Lossy" or irreversible compression. [7].

In Lossless Compression basically there is no loss of data and information in the compressed image data and also it does not involve the process of quantization, but makes use of image transformation and encoding to provide a compressed image while Lossy Compression basically involves techniques: image transformation, quantification, and encoding. [7].

III. PROBLEM STATEMENT

RQ1: To analyse the MRI images of bones (hand/finger/leg)

RQ2: Co-relate the images with patient medical report.

RQ3: Comparison of images after Laplacian mask and Edge-enhancement filter mask.

RQ4: Conclusion for images and declaration of patient disease.

IV. DESCRIBING HOW YOU SOLVED THE PROBLEM

My Project work is started from the study of previous work done on enhancing the medical images for Rheumatoid arthritis (RA). This flow chart shows step-by-step methodology

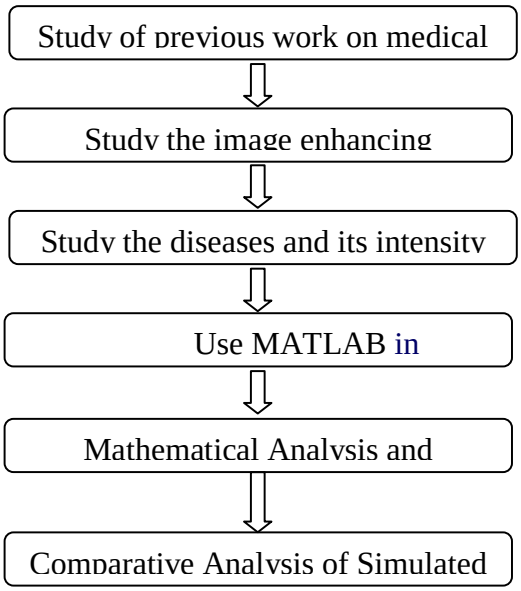

Figure 1: Research methodology flow chart[8]

V. EXPECTED OUTCOME

5.1. Collection of Bone images using Ultrasound-Ray or MRI image.

5.2. Restore the image in MATLAB.

5.3. Apply the image tools technique on sample of bones.

5.4. Comparison of images obtained after simulation.

5.5. Concluding the result obtained and diagnosing the disease.

VI. CONCLUSION AND FUTURE SCOPE

To develop an image technique this will become fruitful for medical imaging bones. Doctors will not be able to diagnose the diseases in the earlier stages. If Rheumatoid Arthritis doctor will not be occurs at earlier stage, doctors asks for X-Rays, Ultra sound again and again. By this project they can diagnose the disease in the first X-Ray, MRI and Ultra-sound.

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