Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 3, Issue. 6, June 2014, pg.708 – 712

RESEARCH ARTICLE

HAND BONE AGE ESTIMATION USING ENERGY BASED SEGMENTATION

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ABSTRACT- Bones in our body are living tissue. They have their own blood vessels and are made of living cells, which help them to grow and to repair themselves. As well, proteins, minerals and vitamins make up the bone. We are born with about 300 soft bones. During childhood and adolescence, the cartilage grows and is slowly replaced by hard bone. Some of these bones later fuse together, so that the adult skeleton has 206 bones. Bone age is the degree of maturation of a child's bones. As a person grows from fetal life through childhood, puberty, and finishes growth as a young adult, the bones of the skeleton change in size and shape. These changes can be seen by x-ray. The "bone age" of a child is the average age at which children reach this stage of bone maturation. A child's current height and bone age can be used to predict adult height. Bone age x-rays helps to evaluate children for advanced or delayed growth and physical development. The most commonly used method is based on a single x-ray of the left hand, fingers, and wrist. A hand is easily x-rayed with minimal radiation and shows many bones in a single view. The bones in the x-ray are compared to the bones of a standard atlas, usually "Greulich and Pyle". In our proposed method bone age is determined by detailed morphological analyses of left hand x-ray, using discrete wavelet transformation or image transformation, energy based segmentation, Jacobi method, EMROI and CROI for feature extraction, ISEF edge detector and k-mean classifier.

Keywords – Bone age assessment, CROI, EMROI, Jacobi method, TW2 method

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I INTRODUCTION

The assessment of bone age is ubiquitous in academic and private radiology practices. The importance of accurate aging cannot be overstated because of the medical implications for the paediatric patients involved. While a variety of bone aging methods have been described, the most widely accepted and employed technique is that of Greulich and Pyle. This is in no small part attributable to the extensive data and painstaking efforts behind their reference standards. The bone age study can help evaluate how fast or slowly a skeleton is maturing, which can help doctors diagnose conditions that delay or accelerate physical growth and development. This bone age assessment is usually ordered by paediatricians. Bone age can be used to predict: how much time a child will be growing, when a child will enter puberty, what the child's ultimate height will be. The problem associated with the determination of the age and the treatment to be given has become a vital issue as there is no simple method for age determination. As DNA testing, Blood sampling which will cost time and money.

A. Problem Statement

The objective of this paper is to develop a system for skeletal hand bone age estimation using region of extraction. By analysing left hand x-ray image, bone age must be estimated.

II LITERATURE SURVEY

D. Giordano, R. Leonardi, F. Maiorana, G. Scarciofalo, and C. Spampinato [1], The system is based on TW2 (Tanner Whitehouse) evaluation, histogram processing and DoG filtering. A more complex method also based on hand x-rays is the "TW2" method. An atlas based on knee maturation has also been compiled. The TW2 method relies on the systematic evaluation of the maturity of all the bones in the hand and wrist.

P. Thangam ,K. Thanushkodi ,T. V.[2] “Comparative Study of Skeletal Bone Age Assessment Approaches using Partitioning Technique” it presents comparative study on four computerized skeletal BAA methods by using segmentation pattern.

N. Olarte L, A. Rubiano F, A. Mejia F [3], “Comparison of Valuation Techniques for Bone Age Assessment”. As a preliminary to the Design and development a treatment system of hand and wrist radiological images for children aged 0-6 years to skeletal maturity.

Markus Brunk, Heike Ruppertshofen, Sarah Schmidt, Peter Beyerlein, Hauke Schramm [4], presented an approach for automatic bone age classification from hand x-ray images using the Discriminative Generalized Hough Transform (DGHT).The DGHT automatically locate and classify regions of interest for bone age determination. For this purpose, two models are used.

III EXISTING SYSTEM

A. Greulich and Pyle

Greulich and Pyle method is commonly used method which is based on a single x-ray of the left hand, fingers, and wrist. A hand is easily x-rayed with minimal radiation and shows many bones in a single view. The bones in the x-ray are compared to the bones of a standard atlas, usually "Greulich and Pyle". The Greulich and Pyle method as originally described involves a complex comparison of all of the bones in the hand and wrist against reference “normal” radiographs of different ages.

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B. Tanner Whitehouse

A more complex method also based on hand x-rays is the "TW2" method. An atlas based on knee maturation has also been compiled. The TW2 method relies on the systematic evaluation of the maturity of all the bones in the hand and wrist. The hands of infants do not change much in the first year of life and if precise bone age assessment is desired, an x-ray of approximately half of the skeleton may be obtained to assess some of the areas such as shoulders and pelvis which change more in infancy.

IV OBJECTIVES

- The goal of this paper is to provide a system for hand bone age estimation using region of extraction. By analyzing left hand x-ray image, bone age must be estimated.
- The proposed system helps to decrease the time factor in examining the images.
- Adopting the new technique like Energy Base Segmentation in the work to increase the efficiency and accuracy

V PROPOSED SYSTEM

The proposed system contains the following modules as shown in "Fig 1". Image Pre-processing is done to remove noise and eliminate irrelevant, visually unnecessary information and to crop the image. The input for pre-processing is the standard set of images. The feature extraction phase starts with testing input image. Image transformation is a function in which Discrete Wavelet Transformation is used in this method. The proposed system contains the following modules:

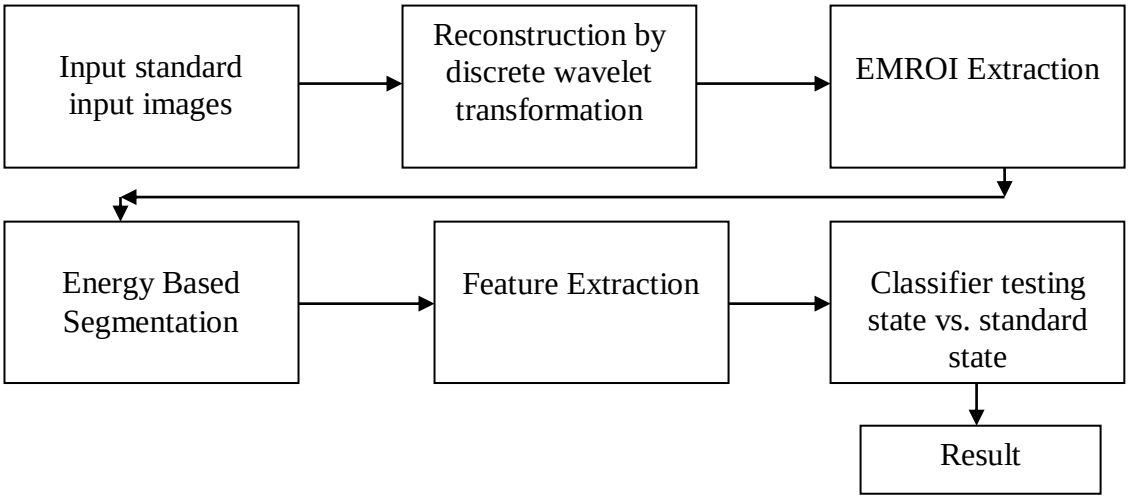

Fig 1: Functional diagram of system

For image analysis proposed system investigate more closely a specific area within the image, called region of interest (ROI). The operation that modifies the spatial coordinates of the image, and these are categorized as image geometry operations. The image geometry operations include Crop, Zoom, enlarge, shrink, translate and rotate. The image crop process is the process of selecting a small portion of the image, a sub image and cutting it away from the rest of the image. The region of interest for bone age estimation is phalangeal features, (EMROI) and carpal bones features (CROI).

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The Energy based segmentation introduces the energy-based segmentation approach wherein the energy of reconstructed surface(s) is directly used to segment the data. Image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image.

Jacobi method is an algorithm used for determining the solutions of a system of linear equations with largest absolute values in each row and column dominated by the diagonal element. The input images are compared with standard images and bone age is obtained via result phase. And the process is repeated for different set of images.

VI SYSTEM ANALYSIS

Bones are rigid organs that constitute part of the endoskeleton of vertebrates. They support and protect the various organs of the body, produce red and white blood cells and store minerals. Bone tissue is a type of dense connective tissue. Bones come in a variety of shapes and have a complex internal and external structure, are lightweight yet strong and hard, and serve multiple functions. One of the types of tissue that makes up bone is the mineralized osseous tissue, also The carpus is the sole cluster of bones in the wrist between the radius and ulna and the metacarpus. The bones of the carpus do not belong to individual fingers (or toes in quadrupeds), whereas those of the metacarpus do. Carpal bone, any of several small angular bones that in humans make up called bone tissue, that gives it rigidity and a coral-like three-dimensional internal structure.

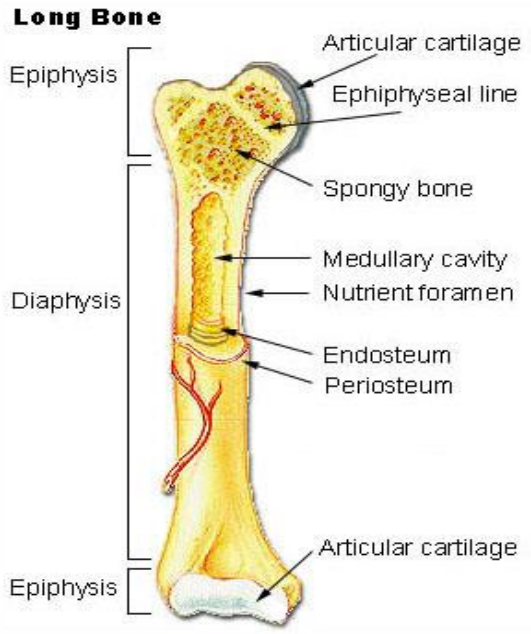

Fig 2: Structure of Bone

The structure of long bone is a shown in fig 2.The epiphysis is the rounded end of a long bone, at its joint with adjacent bone(s). Between the epiphysis and diaphysis lies the metaphysis, including the epiphyseal plate. At the joint, the epiphysis is covered with articular cartilage; below that covering is a zone similar to the epiphyseal plate, known as subchondral bone. The diaphysis is the main or midsection of a long bone. It is made up of cortical bone and usually contains bone marrow and adipose

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tissue the wrist (carpus), and in horses, cows, and other quadrupeds the "knee" of the foreleg. They correspond to the tarsal bones of the rear or lower limb. Their number varies. Primitive vertebrates typically had 12. In modern amphibians, reptiles, and birds, the number is reduced by fusion. In humans there are eight, arranged in two rows. The bones in the row toward the forearm are the scaphoid, lunate, triangular, and pisiform.

VII CONCLUSION

Possible outcome of the work will be an accurate identification of the human age based on the input image given to the system. The proposed system is based on CROI extraction, EMROI extraction. It is used for bone age assessment comparing standard images with input images. It is use EMROI, CROI, in addition with morphological features in proposed system. Region of extraction is done on carpal bones, later on Epiphyseal/Metaphyseal Region of Interest. It is found that using carpal bones extraction bone age assessment found 92-98% for x-ray images. Concerning classification, the average matching Percentage between the obtained results and the radiologist's evaluations is about 87%.

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