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Literature Survey for Bone Diseases Identification Using Thickness of Bone

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Abstract

In the current scenario, bone diseases pose a major threat to middle-aged women all over the world. Bone is a living tissue that breaks down and rebuilds its structure throughout our lives. Bone is made up of calcium that makes bone dense (hard and strong). Bone are affected by many disease. Diseases of bones are major causes of abnormalities of the human skeletal system. Although physical injury, causing fracture, fracture is one of several common causes of bone diseases. Bone disease are formerly regarded as conditions that are more mechanical than metabolic. This is caused by unhealthy lifestyle and improper diet. Some of the bone diseases are osteoporosis, Osteogenesis imperfecta, Paget disease of bone, Osteomalacia, Fibrous dysplasia, Osteitis fibrosa cystica, Osteopetrosis, Bone tumors and etc. we have to mention particularly the bone disease such as osteoporosis.

Keywords: bone diseases, osteoporosis,

Introduction

Bone disease such as osteoporosis lead to low bone mineral density (BMD) characterized by increased risk of fracture which is prevalent at a larger rate among the Asian woman in U.S. low bone mineral density, increasing the evidence suggests that the microarchitectural quality of trabecular bone (TB). TB is an important determination of bone strength and fracture risk. In 1983 a.m. Parfitt et al started the work about the disease, osteoporosis.

Osteoporosis is a progressive bone disease that is characterized by a decrease in bone mass and density which can lead to an increased risk of fracture. In osteoporosis, the bone mineral density (BMD) is reduced, the disease is progressive but silent. Primary risk factors include history of smoking, low body weight, female gender, menopause and advanced age. Any factor that interferes with the appropriate mineralization of bone can lead to osteoporosis. The disease may be classified as primary type 1, primary type 2, or secondary. The form of osteoporosis most common in women after menopause is referred to as primary type 1 or postmenopausal osteoporosis. Primary type 2 osteoporosis or senile occurs after age 75 and is seen in both females and males at a ratio of 2:1. Secondary osteoporosis may arise at any age and affect men and women equally. This form results from chronic predisposing medical problems or disease, or prolonged use of medications such as, glucocorticoids when the disease is called steroid- or glucocorticoid induced osteoporosis. There are no symptoms of osteoporosis.

Related works

In 2011 Yan.xu et al(1) estimated the detecting and quantifying coronary arterial stenosis in CTA using fuzzy distance transform (FDT) algorithm used in there are new skeletal pruning. Results of the phantom experiment indicate that the method, error is significantly more accurate as compared to both binary distance transform based error and conventional binary error methods

P.K saha et al(2) experimented about the topomorphologic approach for opening of iso-intensity objects fused at different locations and scales is presented and applied to separating arterial and venous trees in 3-D pulmonary multidetector X-ray computed tomography images is used in 2010.

Computed tomographic angiography (CTA) modality images were used by yan.xu(3) volumetric topological analysis (VTA) techniques was used. To detect the trabecular bone (tb) alterations at an early stage from plates to rods based on the etiology of the osteoporotic bone loss.

Masako Ito et al (4) evaluated higher risk of vertebral fracture using mdct by applying it on 3-D imaging of the trabecular micro architecture of human vertebra. The fracture risk was mainly assessed in postmenopausal women.

The binary images for applying gray-scale method in order to define the thickness of an object at a non-

axial point 'p' are explained. Moreno.M.et al(5) was estimating the thickness of trabecular bone.

High resolution computed tomography (HRCT) has been advocated for assessing the structural changes in the asthmatic lung was explained by N C Thomson(6).The airway wall is thickened in more severe asthma and is associated with gas transfer coefficient.

A.M.parfitt et al (7) analysis the structural changes in TB due to aging by evaluating the mean distance between the mid-points of structural elements.The trabecular bone volume was measured using the formula(7)

$$Tb_v = MTPD \times MTPT$$

Where MTPD refers to the mean trabecular plate density and MTPT refers to the mean trabecular plate thickness.

C.Arcelli et al(8) computed the sample depth values at axial voxels by making use of binary skeletonization.A distance-driven method to compute the surface and curve skeletons of 3D objects in voxel images is described.

wehshli(9) proposed a voxel size dependent global compensation factor to determine the local thickness at an axial voxel by sampling the distance transform(DT). It was successfully applied to μ -CT images.

HR-PQCT that monitored the bone quality longitudinally was analysed by J.A.MacNeil et al(10),by measuring 3 important indicators of bone quality.

Determining BMD in combination with measure of trabecular microarchitecture was explained by T.M.Link.et.al(11).use High resolution (HR) magnetic resonance(MR) images to investigate the trabecular structure of patients with and without osteoporosis.

Fuzzy distance transform(FDT) had been described by P.K.Saha et al(12) in detail.the vascular thickness has been computed using different approaches namely multiscale topomorphologic and FDT.

Microtomography (micro-computed-tomography, μ -CT) is a method to image and quantify trabecular bone. It has the capability to address the role of

trabecular architecture on the mechanical properties of bone and to study trabecular bone remodeling. The system described in this work is based on a compact fan-beam type tomograph that can work in spiral scanning or multislice mode. An X-ray tube with a microfocus is used as a source, a CCD-array as a detector. Microtomographic measurements may be employed to "calibrate" lower-dose, lower-resolution images in vivo as well as to nondestructively assess unprocessed surgical bone biopsy specimens is explained by(13) muller m.

In 2012(14) mina biria.et al described about case with osteogenesis imperfect associated with dentinogenesis imperfect.medical and dental treatments of systemic and dental manifestations of OI are discussed by using 5 year old child with the diagnosis of OI. Class III malocclusion are observed by the clinical examination of yellow/brown discoloration of primary teeth with the attrition.

Paul j counke et al(15) were investigated about the hearing loss by using subsample of above 40 years of age or had developed hearing loss below the age of 40 from 64 different families of 114 OI patients and shows a strong intrafamilial variability in 2011.additional modification in other genes are assumed to be responsible for the expression of hearing loss in OI.

Paget's diseases of bone (PDB) define normal bone architecture and deformity, deafness, fracture, osteoarthritis and causes pain. genetic factors play a role in PDB. (16)Anne L Langston investigate about the potential for a clinical programme of genetic testing and preventative treatment for people who have the family history of PDB .it particularly focus on treatment and illness representations as predictors of the acceptability and uptake of potential clinical programmes. By using leventhal's common sense self-regulation modal to examine illness representation in 2008.

Primary hyperparathyroidism has been associated with bone loss, especially at cortical skeletal sites. Results from studies evaluating the mineral density of cancellous bone have been more difficult to interpret. Aliya Khan and John Bilezikian(17) are analysis the Identification of the calcium receptor has improved our understanding of calcium homeostasis, and significant reductions in calcium receptor levels have been detected in parathyroid adenomas in 2000. Thus, a new class of therapeutics may include the

calcimimetic agents. Bisphosphonates are also currently being evaluated with regard to their impact on fracture prevention and their beneficial effects on bone mineral density.

Tumor-induced osteomalacia is a paraneoplastic syndrome of hypophosphatemia. Osteomalacia causes multiple bone fractures and severe pain. Isao Chokyu et al (18) report the case of a 57-year-old Japanese man with tumor-induced osteomalacia associated with a middle cranial fossa bone tumor. The tumor was successfully resected by using a middle fossa epidural approach. His phosphate level recovered to a normal range immediately after the surgery in 2012.

Osteopetrosis is a rare inherited genetic disease characterized by sclerosis of the skeleton. The absence or malfunction of osteoclasts is found to be strongly associated with the disease evolution. In 2013, four clinically distinct forms of the disease have been recognized by Ban Mousa Rashid et al (19): they are the infantile autosomal recessive osteopetrosis, the malignant and the intermediate forms, and autosomal dominant osteopetrosis, type I and type II forms. The autosomal recessive types are the most severe forms with symptoms in very early childhood, whereas the autosomal dominant classes exhibit a heterogeneous trait with milder symptoms, often at later childhood or adulthood.

Ultrasonic evaluation of intima-media thickness (IMT) is one method of assessing the development of early atherosclerosis. Paul L. Allan (20) describes the distribution of IMT within the general population and is one of the first to investigate its association with noninvasively assessed symptomatic and asymptomatic peripheral arterial disease. The results suggest that levels of atherosclerotic development in the common carotid artery are 5 to 10 years more advanced in men than in women.

Coronary heart disease (CHD) has been linked with cognitive decline and dementia in several studies. Soheil Damangir (21) investigate relations between CHD and cortical thickness, gray matter volume and white matter lesion (WML) volume on MRI, considering CHD duration and blood pressure levels from midlife to three decades later. No association was found between CHD and WML volumes. Based on these results, long-term CHD seems to have detrimental effects on brain gray matter tissue, and these effects are influenced by blood pressure levels and their changes over time in 2014.

Gray matter volume and cortical thickness are two indices of concern in brain structure magnetic resonance imaging research. Gray matter volume reflects mixed-measurement information of cerebral cortex, while cortical thickness reflects only the information of distance between inner surface and outer surface of cerebral cortex. In 2011 Using Scaled Subprofile Modeling based on Principal Component Analysis (SSM_PCA) and Pearson's Correlation Analysis, this study further provided quantitative comparisons and depicted both global relevance and local relevance to comprehensively investigate morphometrical abnormalities in cerebral cortex in Alzheimer's disease (AD) by (22) Jiachao Liu.

Arulmozhivarman Pachiyappan et al (23) describe a system for the automated diagnosis of diabetic retinopathy and glaucoma using fundus and optical coherence tomography (OCT) images. Automatic screening will help the doctors to quickly identify the condition of the patient in a more accurate way. The macular abnormalities caused due to diabetic retinopathy can be detected by applying morphological operations, filters and thresholds on the fundus images of the patient. Early detection of glaucoma is done by estimating the Retinal Nerve Fiber Layer (RNFL) thickness from the OCT images of the patient. RNFL thickness estimation involves the use of active contours based deformable snake algorithm for segmentation of the anterior and posterior boundaries of the retinal nerve fiber layer.

In the cerebral cortex, Segmentation of brain MR images plays an important role in longitudinal investigation of developmental, aging, disease progression changes. In this paper, Li Wang et al (24) propose a 4D segmentation framework for the adult brain MR images with the constraint of cortical thickness variations. Specifically, utilize local intensity information to address the intensity inhomogeneity, spatial cortical thickness constraint to maintain the cortical thickness being within a reasonable range, and temporal cortical thickness variation constraint in neighboring time-points to suppress the artificial variations. Finally compare qualitative and quantitative by 4D segmentation methods in 2013.

In 2013 Nisthula P., Mr. Yadhu R. B (25) described the easy, reliable and fast technique to detect cancerous tissue in bone by using different image processing techniques such as edge detection, image fusion and contrast enhancement. The result shows that it could obtain the smooth image with edge showing the

disease affected part without the spatial and spectral noises.

Helen R Buie et al (26) explain about the use of high resolution peripheral quantitative computed tomography (HR-pQCT) and in vivo micro-CT for studies of bone disease and treatment has become increasingly common, and with these methods comes large quantities of data requiring analysis in 2007. A simple, robust, and fully automated segmentation algorithm is presented that efficiently segments bone regions. The dual threshold technique refers to two required threshold inputs that are used to extract the periosteal and endosteal surfaces of the cortex. The method used was to tested against the gold standard, semi-automated hand contouring, using 45 datasets: mouse, rat, human, and cadaver data from the tibia or radius with nominal isotropic resolutions of 10–82 μm and analysis performance of segment cortical and trabecular compartments was evaluated qualitatively from visualizations and quantitatively based on morphological measurements. Visual inspection confirmed successful segmentation of all datasets using the new method, with qualitatively better results when applied to the human and cadaver data compared to the gold standard. The dual threshold algorithm was able to extract thin and porous cortices, whereas some clipping and perforations occurred for the gold standard

Xavier Rolland-Nevi et al (27) propose a robust thickness estimation approach for 3D objects based on the Shape Diameter Function (SDF) in 2013. The first method was to applies a modified strategy to estimate the local diameter with increased accuracy. then compute a scale-dependent robust thickness estimate from a point cloud, constructed using this local diameter estimation and a variant of a robust distance function. The robustness of this method is benchmarked against several operations such as remeshing, geometric noise and artifacts common in triangle soups. The experimental results show a more stable local thickness estimation than the original SDF, and consistent segmentation results on defect-laden inputs.

Conclusion

Osteoporosis disease are identified based on star-line based algorithm for an accurate and robust measure of TB thickness and marrow spacing at in vivo resolution in the presence of significant partial voluming.

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