CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S1430

Project Title

An Automated Process of Calculating Bone Mineral Density Using 3D Image Processing Algorithms

Abstract

Objectives/Goals

An abnormal bone density leads to fractures and/or osteoporosis. Currently, the way to measure patient#s bone density is to take a bone mineral density (BMD) measurement. This process requires a patient to take a CT scan, which is analyzed by image-processing software. Currently, the most frequent method for BMD is Quantitative Computed Tomography (QCT), where the doctor draws three rectangles for each vertebral unit, capturing the area of the trabecular bone. From this, the software calculates the mean density. However, this process has several problems. The rectangles do not cover the entire area of the bone and inexact sections will be drawn for each scan because the doctor cannot perfectly determine the correct position.

The objective of this project was to write new software that would calculate a more accurate region of the trabecular bone by using 3D image processing algorithms and minimizing human labor.

Methods/Materials

The materials used were an Macintosh computer, Objective-C language, Osirix, and 158 samples of data. The software was written from scratch using the language Objective-C, as a plugin for the Imaging Software Osirix. The user interface allows the doctor to click points in each vetebral unit.

158 samples (one sample consists of one patient's CT scan) were experimented on by testing both the new software, and the QCT method. The BMD's outputted by both softwares were computed.

Results

The new software generated BMD's that were on average about 3% greater than the results from the QCT method. The individual BMD's of patients ranged from a diference of -10% to 10% between the result generated by the new software, and the result generated by the QCT software.

Conclusions/Discussion

From the pictures, the new software gets a better approximation of the area of trabecular bone. The areas which the new software approximated were more accurate than those using the QCT method, which probably resulted in the differing results. By having a more accurate and faster process of measuring BMD, doctors can give better diagnosis and prevent the diseases caused by an abnormal BMD.

Summary Statement

The project is about increasing the accuracy of calculating Bone Mineral Density from CT scans by having the software calculate the areas of trabecular bone rather than having a radiologist draw the area of trabecular bone

Help Received

Used computer and data samples at Los Anglese Biomedical Research Institute under the supervision of Chris Dailing