

Fractal Analysis of Bone X-Ray Tomographic Microscopy Projections

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Abstract—Fractal analysis of bone X-ray images has received much interest recently for the diagnosis of bone disease. In this paper, we propose a fractal analysis of bone X-ray tomographic microscopy (XTM) projections. The aim of the study is to establish whether or not there is a correlation between three-dimensional (3-D) trabecular changes and two-dimensional (2-D) fractal descriptors. Using a highly collimated beam, 3-D bone X-ray tomographic images were obtained. Trabecular bone loss was simulated using a mathematical morphology method. Then, 2-D projections were generated in each of the three orthogonal directions. Finally, the model of fractional Brownian motion (fBm) was used on bone XTM 2-D projections to characterize changes in bone structure that occur during disease, such a simulation of bone loss. Results indicate that fBm is a robust texture model allowing quantification of simulations of trabecular bone changes.

Index Terms—Fractal analysis, projection, trabecular bone characterization, XTM.