Stress-based femur fracture risk evaluation from bone densitometry

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ABSTRACT

Osteoporosis, characterised by a decrease in bone mineral density, is responsible for millions of fractures. The reference test for this disease is bone densitometry. The diagnosis, based on statistical parameters obtained from an X-ray image, evaluates the patient's risk of fracture. Their results are not accurate enough, since about 40% of patients with a low fracture risk diagnosis end up suffering from an osteoporotic fracture. Therefore, it is necessary to develop diagnosis techniques of greater accuracy [1]. The CIIM has developed an analysis technique, called cgFEM [2], based on the use of Cartesian finite element (FE) meshes, that allows the generation of FE models directly from medical images. This method has been adapted to obtain an indication of the stress distribution on the femur that enriches the information available to evaluate the risk of osteoporotic failure.

The multidisciplinary collaboration of this work has allowed analysing densitometries from a large set of patients. The information provided from the analysis of the densitometries will be used to feed a machine-learning algorithm called Locally Linear Embedding [3]. The preliminary results obtained show that it will be able to improve the evaluation of fracture risk in femurs due to osteoporosis.

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