

On Deep-Learning-Based Osteoporotic Vertebral Fracture Prediction and Risk Assessment in CT Images

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Osteoporosis is a metabolic bone disease that is underdiagnosed and undertreated. It can lead to vertebral fractures involving pain and decreased mobility. Recent advancements in artificial intelligence offer promising solutions to automatically check available medical images like computed tomography (CT) scans, which are acquired for other medical indications ("opportunistic screening"), for indicators of osteoporosis like vertebral fractures and to assess the risk of future fractures.

In this talk, we present our pipeline for automatic vertebral fracture prediction from CT images based on extracting individual vertebral patches which are analysed using a Convolutional Neural Network (CNN) to obtain a score to classify whether the subject will experience a vertebral fracture within 10 years. This score is then used in an age- and body mass index (BMI)-adjusted Cox proportional-hazards model to compute an individual vertebral fracture risk. We will also discuss experimental results to improve the CNN-based osteoporotic vertebral fracture prognosis by self-supervised pre-training as well as preliminary results and challenges of applying large vision language models (e.g., Merlin) for this task.

Experimental results are obtained on the publicly available MrOS (Osteoporotic Fractures in Men Study) dataset.