

Deep learning for bone mineral density and T-score prediction from chest X-rays: A multicenter study

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Although the number of patients with osteoporosis is increasing worldwide, diagnosis and treatment are presently inadequate. In this study, we developed a deep learning model to predict the bone mineral density (BMD) and T-score from chest X-rays, which is one of the most common, easily accessible, and low-cost medical imaging examination methods. The dataset used in this study contained 17,899 images corresponding to 10,102 patients who underwent both dual-energy X-ray absorptiometry (DXA) and chest radiography at six hospitals between 2010 and 2021. For the learning labels, we used (1) BMD (g/cm²) of the hip and lumbar spine and (2) diagnosis based on the T-score of the hip or lumbar spine (normal, osteopenia, and osteoporosis). Then, we trained the deep learning model through ensemble learning of chest X-rays, age, and sex to predict the BMD using regression and T-score for multiclass classification. We assessed the following two metrics to evaluate the performance of the deep learning model: (1) correlation between the predicted and true BMDs and (2) consistency in the T-score between the predicted class and true class. The correlation coefficients for BMD prediction were hip = 0.75, lumbar spine = 0.63. The areas under the curves for the T-score predictions of normal, osteopenia, and osteoporosis diagnoses were 0.89, 0.70, and 0.84, respectively. These results suggest that the proposed deep learning model may be suitable for screening patients with osteoporosis by predicting the BMD and T-score from chest X-rays.