AI-Assisted Detection of Osteoporotic Vertebral Compression Fractures on Chest and Abdominal Radiographs

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Abstract

As a result of Thailand's rapid transition to a super-aged society, osteoporotic vertebral compression fractures (OVCF) are becoming increasingly prevalent. Because routine chest and abdominal radiographs are interpreted primarily for non-musculoskeletal pathology, these fractures are often missed. The goal of this project is to close the early identification gap in current clinical workflows by creating an AI-assisted system for opportunistic detection of OVCF on routine radiographs. A multicenter retrospective dataset of 579 anteroposterior/posteroanterior (AP/PA) radiographs was collected, including 481 training cases with expert vertebral box and pedicle heatmap annotations and 98 independent test cases. A U-Net-like convolutional backbone without skip connections was employed for vertebral keypoint detection, followed by post-processing to extract vertebral midpoints and height-related indicators. The system was implemented as a browser-based application to enable rapid screening without requiring local installation. On the independent test set, the proposed system detected an average of 14.81 out of 23 vertebral levels per image (vertebral detection rate, VDR-23 = 0.644; 95% confidence interval [CI] 0.631–0.656), with a mean inference time of less than 1 second per image on an NVIDIA T4 Graphics Processing Unit (GPU). Stable performance was observed across internal validation dataset, including lower-quality radiographs. The developed system demonstrates that automated detection of vertebral compression fractures is feasible in routine clinical practice.

Keywords**:** *osteoporotic vertebral compression fracture, radiography, artificial intelligence, opportunistic screening*