

Automated Opportunistic Screening for Osteoporosis

Osteoporosis affects millions of the aging United States population, yet screening for it is below recommended rates. By using pre-existing data to opportunistically search for fractures in vertebral bodies that could indicate osteoporosis, many more cases could be found. This approach uses deep learning technology to search for spinal osteoporotic compression fractures within commonly taken radiograph images acquired for other purposes.

What is the Problem?

What is the problem?

Spinal Osteoporotic Compression Fractures (OCFs) are a significant health concern, often leading to severe pain and a decreased quality of life. One in three individuals living in developed countries will incur one over the course of their life, increasing the risk for subsequent fractures. Screening for osteoporosis, which affects around 9% of individuals over 50 in the United States, occurs nowhere near as frequently as recommended. Screening by detecting OCFs can improve over current screening approaches using bone mineral density which have known limitations. Early detection of these fractures is crucial for effective treatment, but current methods can be time-consuming and require expert interpretation.

What is the Solution?

The solution is to use existing data in the form of common imaging of the chest, spine, or abdominal images to opportunistically screen for OCFs. The approach uses a pair of deep learning classifiers that can identify spinal OCFs on radiographs. The first classifier automatically finds the vertebral bodies that are of interest to search, narrowing the given data down to the most relevant piece. The second classifier then determines whether the vertebral body is fractured. Using these two classifiers, the patient is given an overall classification that considers all of the data collected to inform doctors. These classifiers can analyze thousands of vertebral bodies and accurately label them as normal or fractured, providing a fast and efficient method for OCF detection.

What is the Competitive Advantage?

Efficiency: These classifiers can analyze a large number of vertebral bodies quickly, making them suitable for large-scale screenings.

Technology ID

BDP 8631

Category

Software/Healthcare IT
Selection of Available
Technologies

Authors

Nathan Cross

Learn more



Accuracy: Both classifiers have demonstrated high positive predictive values (PPV) and areas under the receiver operating characteristic curve (AUC-ROC), indicating their accuracy in identifying OCFs.

Adaptability: The classifiers can be adapted to different criteria systems, providing flexibility in their application.

Potential for Automation: As a critical component of future automated opportunistic screening tools, these classifiers could significantly streamline the process of OCF detection.

References

1. Qifei Dong, Gang Luo, Nancy E. Lane, Li-Yung Lui, Lynn M. Marshall, Sandra K. Johnston, Howard Dabbous, Michael O'Reilly, Ken F. Linnau, Jessica Perry, Brian C. Chang, Jonathan Renslo, David Haynor, Jeffrey G. Jarvik, Nathan M. Cross(2023-12) , <https://linkinghub.elsevier.com/retrieve/pii/S1076633223002210>, <https://www.academicradiology.org/>, 30, 2973–2987
2. Qifei Dong, Gang Luo, Nancy E. Lane, Li-Yung Lui, Lynn M. Marshall, Deborah M. Kado, Peggy Cawthon, Jessica Perry, Sandra K Johnston, David Haynor, Jeffrey G. Jarvik, Nathan M. Cross(2022-12) , <https://linkinghub.elsevier.com/retrieve/pii/S1076633222001301>, <https://www.academicradiology.org/>, 29, 1819–1832