Bone Mineral Density Prediction Challenge

Overview

Osteoporosis is a common condition characterized by low **bone mineral density (BMD)**, which significantly increases the risk of fractures especially in elderly women. Early detection is essential for effective management and treatment. However, osteoporosis often goes undiagnosed due to the cost and limited accessibility of standard diagnostic tools such as DXA scans.

This challenge simulates an intelligent system designed to screen for bone health using X-ray images, offering a low-cost, automated alternative to current diagnostic methods.

A DXA scan is a medical test that uses very low-dose X-rays to meas
bone density and body composition (fat, lean muscle, and bone ma

Task

In this challenge, you will implement and compare a variety of **machine learning** and **deep learning** models to predict **BMD values directly from hand/ wrist X-ray images**.

From predicted BMD values you will derive **T-scores**, which are used by the World Health Organization (WHO) to classify bone health as follows:

T-Score Range	Classification
≥ –1.0	Normal
Between –1.0 and –2.5	Osteopenia (Low Bone Mass)
≤ –2.5	Osteoporosis

T-Score is a measurement from a bone density test that compares your bone density to that of a healthy yo

Note: T-score = (Patient BMD – Reference BMD) / Standard Deviation
Reference BMD is typically the mean BMD of a young healthy adult population. *In this assignment, the reference BMD is 0.86 with a standard deviation of 0.12.*

You will be provided with a dataset containing:

- **Hand/wrist X-ray images**
- **Corresponding BMD values** (continuous numerical targets)
- **Metadata** (e.g. patient's age and sex)

A separate **test set** (images only) will be used for **automatic evaluation**. The test labels will be hidden. For simplicity, you will classify each image into one of two categories:

- Normal
- Low BMD (includes both **osteopenia** and **osteoporosis**)

You are expected to compare model performance and critically reflect on their effectiveness in this real-world medical application. Please refer to **Assignment 1 and Assignment 2 instructions** for full details on:

- Specific tasks and deliverables
- Evaluation criteria
- Submission format and deadlines