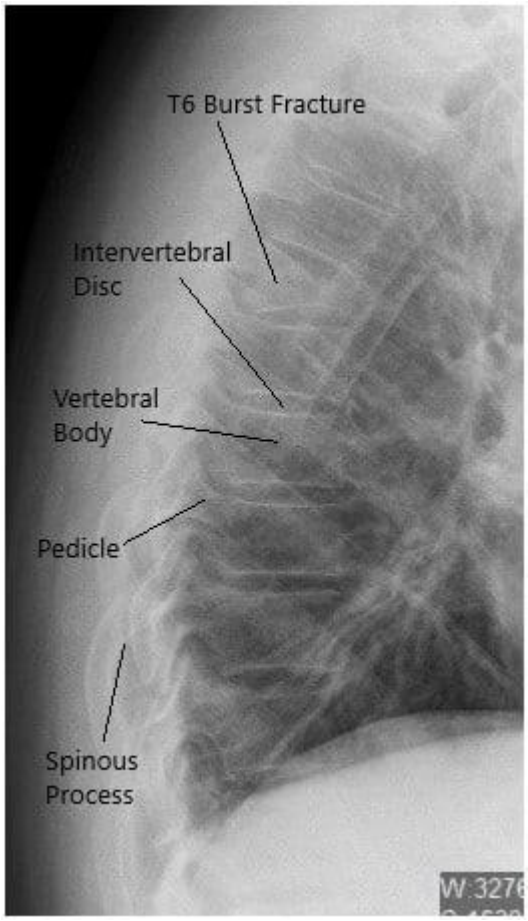
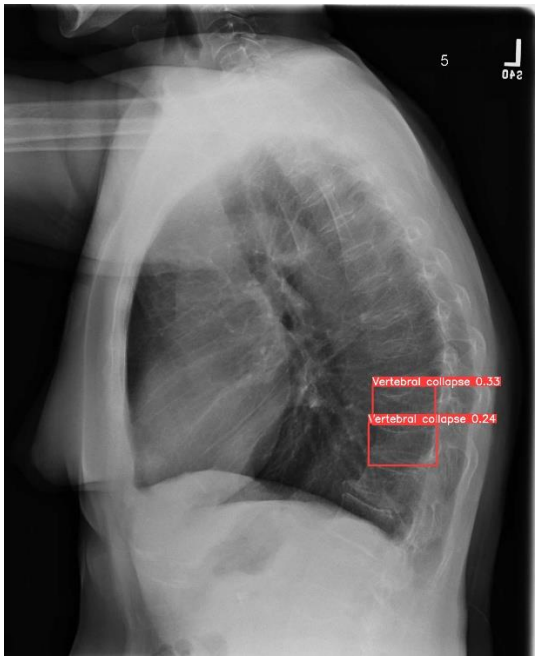
Problem Statement

Vertebral fractures are among the most common spinal injuries, often resulting from osteoporosis or high-energy trauma. These fractures primarily affect the thoracolumbar spine and can lead to significant pain, mobility issues, and an increased economic burden. Accurate and timely diagnosis is essential for guiding appropriate treatment and improving patient outcomes.

Currently, detecting vertebral fractures from X-ray scans require manual interpretation by radiologists, which can be time-consuming and prone to human error. Given the high volume of imaging studies, radiologists often face challenges in efficiently identifying fractures, especially in emergency settings where rapid decision-making is critical.



Source: https://www.cortho.org/case-studies/spine/management-of-58-year-old-female-with-burst-fracture-of-t6-vertebra/



Challenges in Fracture Detection

1. **Variability in Fracture Presentation:**
    - Fractures can be subtle and may not always be easily distinguishable from normal anatomical variations or degenerative changes.
    - Differences in fracture severity and morphology require careful assessment.
2. **Time Constraints:** Radiologists must review large volumes of medical images, increasing the risk of delayed diagnosis and treatment.
3. **Error Risks:** Fatigue, differences in radiologist experience levels, and the complexity of image interpretation contribute to diagnostic errors.
4. **Data Challenges:**
    - Variability in scan quality, patient demographics, and scanner parameters can affect detection performance.
    - Class imbalance between fractured and non-fractured cases can introduce biases in model training.
5. **Clinical Relevance:** Any automated solution must generalize well across different datasets and maintain clinical applicability by ensuring high sensitivity and specificity.

Problem Statement

Participants are tasked with developing a machine learning model capable of accurately detecting the presence or absence of acute vertebral body fractures in thoracic spine X-rays.

The main task is to generate the Spinal Vertebral Fracture Localization Bounding Box.

Participants should focus on achieving:

- **High sensitivity and specificity** to minimize false negatives and false positives.
- **Robust generalization** across diverse patient data and imaging conditions.

Data: UTMB 1000 Thoracic Spine X-Rays

The dataset consists of labeled X-ray scans, annotated by expert radiologists, and is divided into:

1. **Training Set:**
    - Includes X-ray scans with labelled vertebral fractures and normal cases.
    - Fractures are labelled using criteria of >= 20% height loss between the anterior (front), middle, or posterior (back) of the vertebral body. Typically, the >=20% loss in height affects the anterior/front of the vertebral body and the posterior part is used as a reference point.
2. **Validation Set:**
    - Used for model tuning and performance assessment.
3. **Test Set:**
    - Held out for final evaluation.
4. **Format:**
    - X-ray scans are provided in DICOM format.
    - Preprocessing includes voxel normalization and resolution standardization.
    - A data loading script and preprocessing guidelines will be provided.
5. **Exclusion Criteria:**
    - Patients with known spinal surgery evidenced by spinal fixation hardware.