

# The Spine Project Dataset

## **I. Introduction**

The Spinal cord injured patients who have suffered injuries due to some kind of trauma need urgent attention from a medical expert. They must be congregated early in the spinal units to receive better facilities and adequate attention, ultimately improving the outcome of the treatment and rehabilitation. Research indicates that early surgery and comprehensive rehabilitation markedly reduces the overall morbidity of spinal cord injured patients by enabling the patient to lead an independent life<sup>1-3</sup> Moreover, a higher incidence of neurological deficit if the diagnosis of thoracolumbar spine fracture is delayed<sup>4</sup>. Therefore, to advance our studies in enabling accurate and quick identification of a person's state of damage of the vertebral column, we have collected this dataset.

### ***(A) The Dataset***

Our dataset consists of radiological images, X rays, from over 1000 thousand patients who visited the Indian Spinal Injuries Centre seeking for their treatment. The precise reason behind choosing X rays as part of our dataset is that they are low cost as compared to other radiological imaging techniques like the MRI, CT Scan etc. The X-ray images of the patients that we've collected focus or highlight the thoracic and lumbar regions of the vertebral column. For each patient in the dataset, we have two X-Ray images highlighting two different views namely AP and Lateral, that help in identifying the underlying abnormality vividly. This gives us a total of 2000 X-ray images, equally divided among the two views.



Fig1: (a) AP view of the X-Ray  
(b) Lateral view of the X-Ray

### ***(B) Labels***

The fundamental labels for our dataset are ‘Normal’ and ‘Damaged’ reflecting upon the normal and damaged or diseased state of the vertebral column. The X rays from these 1000 patients are equally divided into these labels, giving us 500 cases of each kind.

### ***(C) Segmentation Classes***

The entire dataset has been annotated under the consultation of a medical expert. The segmentation classes of our dataset are specific to each view. For the AP view, we have 3 classes namely, Vertebra, Spinous Process, and Pedicle.

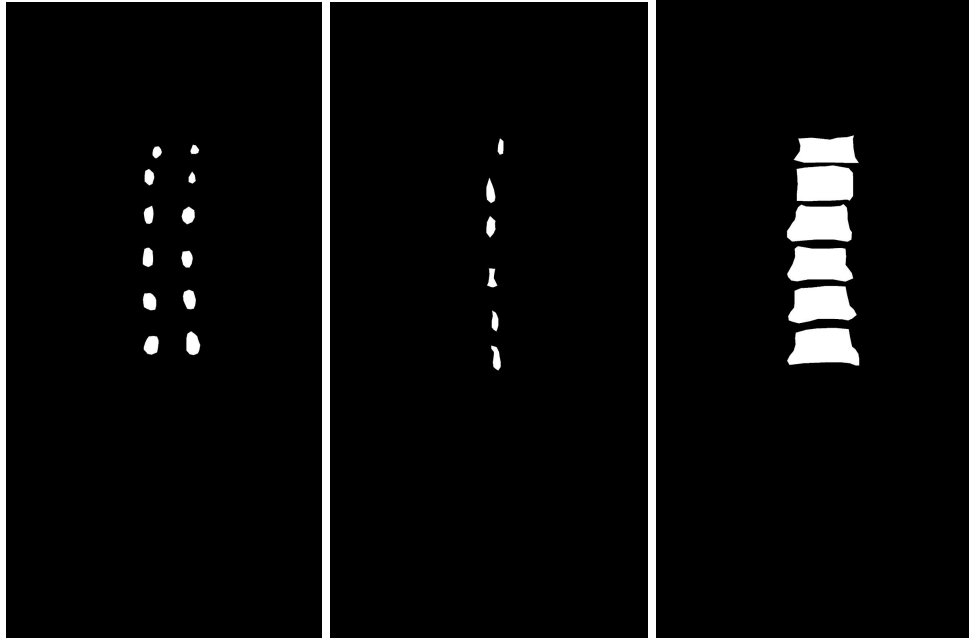


Fig 2: L-R (a) Binary Masks of Pedicle  
(b) Binary Masks of Spinous Process  
(c) Binary masks of Vertebra

Similarly, for the lateral view, we have 5 classes that include Vertebra, Spinous Process, Disk Height, Anterior Vertebral Line, and Posterior Vertebral Line.

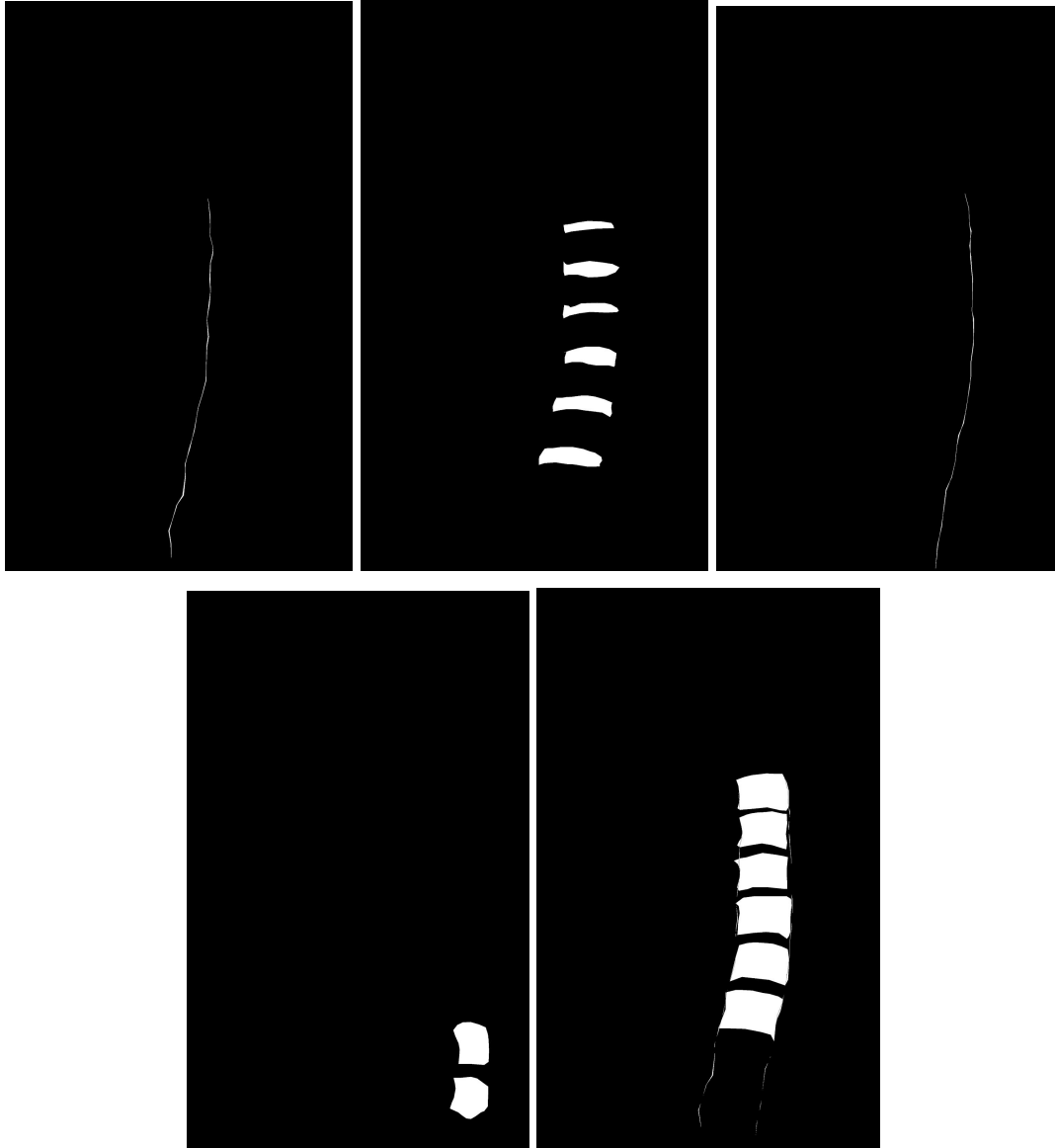


Fig 3 Binary Masks:L-R: (a) Anterior Vertebral Line  
 (b) Disk Height  
 (c) Posterior Vertebral Line  
 (d)Spinous Process  
 (e) Vertebra

***(D) Nature of the Annotations***

- The vertebra refers to the vertebral body. The area enclosed by the vertebra directly gives the distinction between a healthy and damaged one.
- The pedicles are found in pairs. They are the segment between the transverse process and the vertebral body. The pair of pedicles maintain a constant distance among each other in a normal state.

- The spinous process is a bony projection off the posterior (back) of each vertebra. All spinous processes in a single vertebral column must align in a single line in a healthy state.
- The anterior vertebral line is the line tracing the curvature of the anterior portion of the vertebra. This gives an insight into the deviation from the healthy strictly-straight spine.
- The posterior vertebral line is the line tracing the curvature of the posterior portion of the vertebra. This gives an insight into the deviation from the healthy strictly-straight spine.
- The disk height is the height between two vertebral bodies. It gives an insight into the healthy consistent height difference between two vertebral bodies.

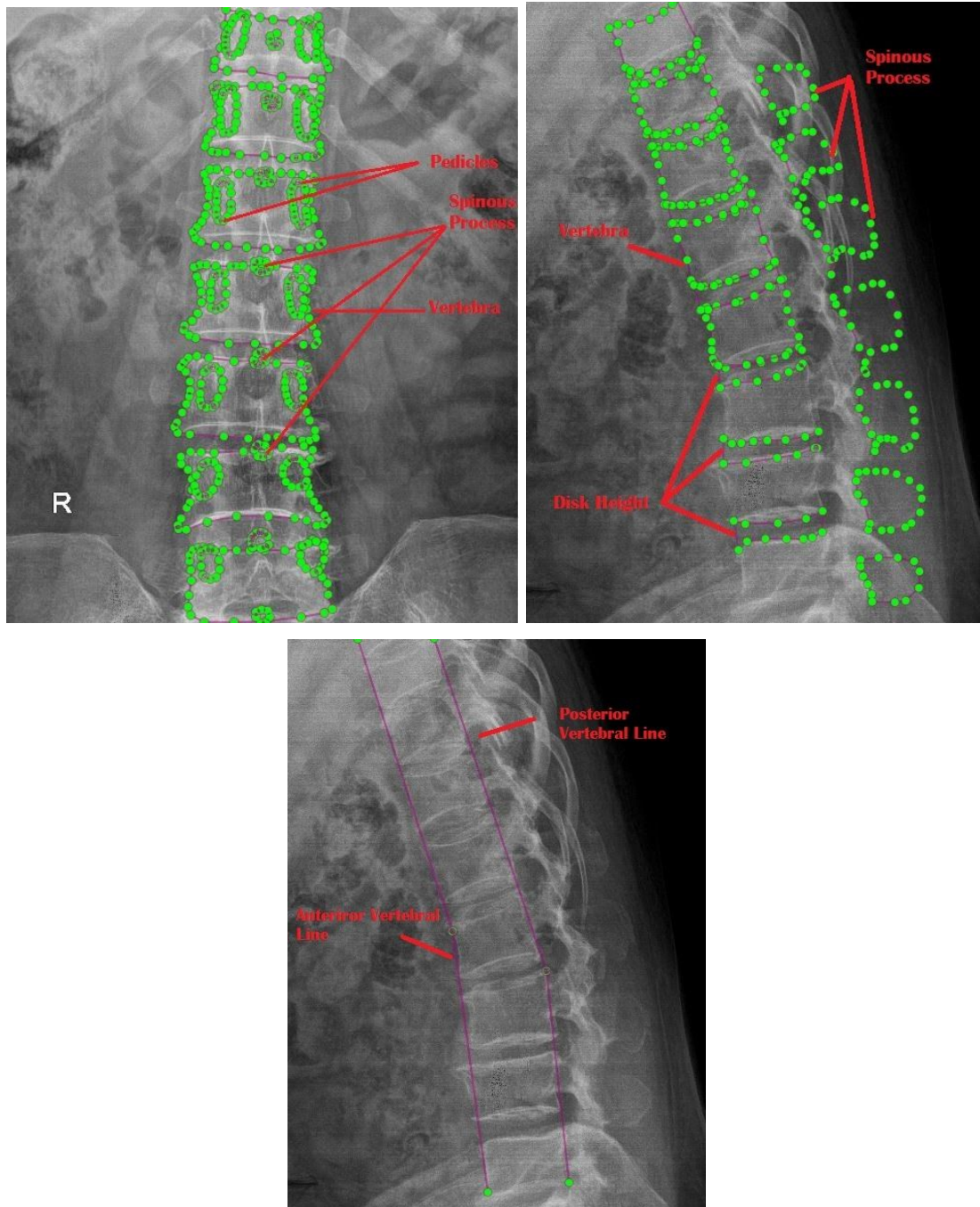


Fig 4:L-R: (a)Annotations in AP View, (b)Annotations in Lateral View, (c) Annotations in Lateral View

On average, an X-ray of the AP view has 7 vertebrae and spinous process, and 7 pair of pedicles. The Lateral image, on the other hand, has 8 vertebrae and disk heights. However, since the identification of the spinous process is a challenge in lateral images and dependent on the quality of the X-ray image, their annotations are fewer in number.

***References:***

1. Scivoletto G, Morganti B, Molinari M. Early versus delayed inpatient spinal cord injury rehabilitation: An Italian study. *Arch Phys Med Rehabil.* 2005;86:512–6.
2. Amin A, Bernard J, Nadarajah R, Davies N, Gow F, Tucker S. Spinal injuries admitted to a specialist hospital centre over a 5- year period: A study to evaluate delayed admission. *Spinal Cord.* 2005;43:434–7.
3. Kishan S, Vives MJ, Reiter MF. Timing of surgery following spinal cord injury. *J Spinal Cord Med.* 2005;28:11–9.
4. Reid DC, Henderson R, Saboe L, Miller JD. Etiology and clinical course of missed spine fractures. *J Trauma.* 1987;27:980 –986.