Harnessing computer vision for automated measurements of Cobb's angles in adolescent idiopathic scoliosis

Favian Ding Jie Ng, Andrew Chia Chen Chou, PIN Pin Yu YU, Siaw Meng Chou[1], Andy Khye Soon Yew[2], Arjandas S Mahadev, Kenneth Wong[3]
[1]School of Mechanical and Aerospace Engineering, Nanyang Technological University, [2]Organization, [3]KK Women's and Children's Hospital

INTRODUCTION: The Cobb's angle is the gold standard metric for evaluating adolescent idiopathic scoliosis. Currently, measurement is done manually by a physician using scoliosis radiographs, which can be time consuming and subject to human error.

METHODS:

We developed an algorithm utilizing computer vision to automate the measurement of Cobb's angles, which was trained on a set of 500 scoliosis radiographs that were measured and labeled independently by two fellowship-trained paediatric orthopaedic surgeons, followed by a testing data set of 54 radiographs. The application is run locally with a model built on Tensorflow Keras using Python. The algorithm segments the spine, before providing automated measurement and labeling of the Cobb's angles.

RESULTS: The algorithm can correctly identify scoliosis in plain coronal scoliosis radiographs, correctly segment multiple curves within the same spine, and calculate a Cobb's angle with a mean angle difference of 4.50 ± 5.19° compared to the physician measurement. Time from uploading the image to angle measurement was 9.76s, versus an average of three minutes taken by a physician, representing a time savings of over 90%.

DISCUSSION AND CONCLUSION:

This technical study shows that the computer vision software algorithm is able to reliably and efficiently measure multiple Cobb's angles in a plain coronal scoliosis radiograph in less than 10s. The software algorithm can potentially be deployed to improve accuracy and significantly reduce manpower hours required for manual Cobb's angle measurements in orthopaedic and school health screening clinics and has other potential uses in pre-operative surgical planning and intra-operative alignment checks.

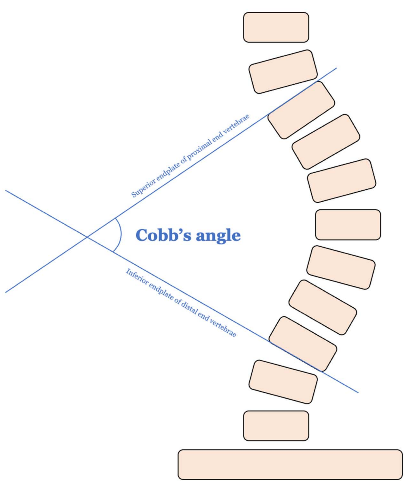

Figure 1. The Cobb's angle is the angle between the tangents between the superior endplate of the proximal end vertebrae and the inferior endplate distal end vertebrae.

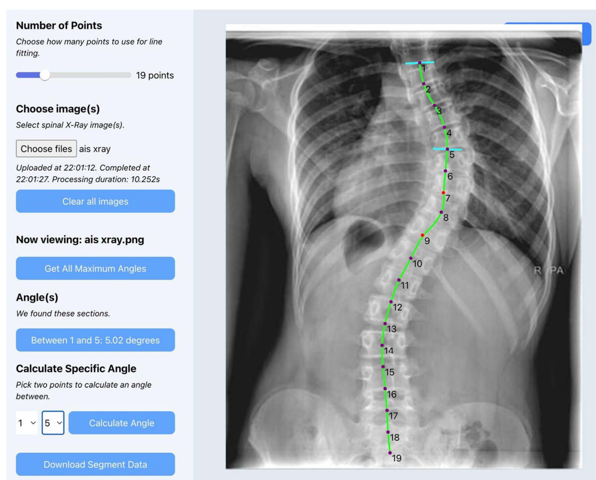

Figure 2. The AI algorithm is able to accurately detect multiple curves on a plain coronal scoliosis radiograph and generate Cobb's angles accordingly. Fine adjustments can still be made by the user based on clinical judgment.