

Computer-Based Cobb Angle Measurement using Deflection Points in Adolescence Idiopathic Scoliosis from Radiographic Images

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Abstract: Idiopathic scoliosis treatment depends on the accurate assessment of the Cobb angle, which is usually performed manually. Manual measurements, however, can lead to observer variations, which depend on the correct selection of the curvature superior and inferior vertebrae in order to draw the needed lines for Cobb angle measurements. In this paper, we are proposing an algorithm to measure the Cobb angle semi-automatically. The algorithm is based on two processing phases in which each column in the raw X-ray image is reduced to a two-points representing the end points of the spine and containing its general structure and outline. These points are then used to fit a 5th order polynomial. We hypothesize that the deflection points of the fitted curve represent the superior and inferior vertebrae of the scoliosis curvature. The deflection points were used to calculate the Cobb angle. The algorithm was tested on X-ray images from 28 subjects (14 females and 14 males, average age of 15.6 ± 1.3 years) diagnosed with adolescence idiopathic scoliosis. Three manual measurements were obtained, with manually measured Cobb angles ranging from 10° to 98°. The mean of the standard deviation of the manual readings and the algorithm results was 5.28° and 2.64°, respectively, with mean abs error of 6.6° and R value of 0.81. Excluding the cervical and rib cage touching scoliosis cases, the mean of the standard deviation of the manual readings and the algorithm results was 4.73° and 2.35°, respectively, with mean abs error of 3.78° and R value of 0.94. From the results, we can conclude that our proposed algorithm can minimize and simplify user intervention, thus allowing easier and more accurate Cobb angles measurements and resulting in a shorter diagnosis time and requiring no special skills from the user.