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# Deep learning prediction of curve severity from rasterstereographic back images in adolescent idiopathic scoliosis

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## Abstract

**Purpose:** Radiation-free systems based on dorsal surface topography can potentially represent an alternative to radiographic examination for early screening of scoliosis, based on the ability of recognizing the presence of deformity or classifying its severity. This study aims to assess the effectiveness of a deep learning model based on convolutional neural networks in directly predicting the Cobb angle from rasterstereographic images of the back surface in subjects with adolescent idiopathic scoliosis.

**Methods:** Two datasets, comprising a total of 900 individuals, were utilized for model training (720 samples) and testing (180). Rasterstereographic scans were performed using the Formetric4D device. The true Cobb angle was obtained from radiographic examination. The best model configuration was identified by comparing different network architectures and hyperparameters through cross-validation in the training set. The performance of the developed model in predicting the Cobb angle was assessed on the test set. The accuracy in classifying scoliosis severity (non-scoliotic, mild, and moderate category) based on Cobb angle was evaluated as well.

**Results:** The mean absolute error in predicting the Cobb angle was 6.1° ± 5.0°. Moderate correlation (r = 0.68) and a root-mean-square error of 8° between the predicted and true values was reported. The overall accuracy in classifying scoliosis severity was 59%.

**Conclusion:** Despite some improvement over previous approaches that relied on spine shape reconstruction, the performance of the present fully automatic application is below that of radiographic evaluation performed by human operators. The study confirms that rasterstereography cannot be considered a valid non-invasive alternative to radiographic examination for clinical purposes.

**Keywords:** Adolescents; Artificial intelligence; Deep learning; Rasterstereography; Scoliosis.



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