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Superior performance of a center-point AI model over VFLDNet in automated cobb angle estimation for scoliosis assessment

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Assessing the Utility and Challenges of Machine Learning in Spinal Deformity Management: A Systematic Review

Khan, J.A., Houdane, A., Hajja, A.
(2025) *Spine*

A deep learning model for radiological measurement of adolescent idiopathic scoliosis using biplanar radiographs

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Purpose: Aims to establish the superiority of our proposed model over the state-of-the-art vertebra-focused landmark detection network (VFLDNet) in automating Cobb angle estimation from spinal radiographs. Methods: Utilizing a private dataset for external validation, we compared the performance of our center-point detection-based vertebra localization and tilt estimation network (VLTENet) with the key-point detection-based VFLDNet. Both models' Cobb angle predictions were rigorously evaluated against manual consensus score using metrics such as mean absolute error (MAE), correlation coefficient, intraclass correlation coefficient (ICC), Fleiss' kappa, Bland-Altman analysis, and classification metrics [sensitivity (SN), specificity, accuracy] focusing on major curve estimation and scoliosis severity classification. Results: A retrospective analysis of 118 cases with 342 Cobb angle measurements revealed that our model achieved a MAE of 2.15° for total Cobb angles and 1.89° for the major curve, significantly outperforming VFLDNet's MAE of 2.80° and 2.57°, respectively. Both models demonstrated robust correlation and ICC, but our model excelled in classification consistency, particularly in predicting major curve magnitude (ours: kappa = 0.83; VFLDNet: kappa = 0.67). In subgroup analyses by scoliosis severity, our model consistently surpassed VFLDNet, displaying superior mean (SD) differences, narrower limits of agreement, and higher SN, specificity, and accuracy, most notably in moderate (ours: SN = 86.84%; VFLDNet: SN = 83.16%) to severe (ours: SN = 92.86%; VFLDNet: SN = 85.71%) scoliosis. Conclusion: Our model emerges as the superior choice for automated Cobb angle estimation, particularly in assessing major curve and moderate to severe scoliosis, underscoring its potential to revolutionize clinical workflows and enhance patient care. © The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2024.

Author keywords

Adolescent idiopathic scoliosis; Artificial intelligence; Cobb angle; X-ray

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