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SCOLIONET: An Automated Scoliosis Cobb Angle Quantification Using Enhanced X-ray Images and Deep Learning Models

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Abstract

The advancement of medical prognoses hinges on the delivery of timely and reliable assessments. Conventional methods of assessments and diagnosis, often reliant on human expertise, lead to inconsistencies due to professionals' subjectivity, knowledge, and experience. To address these problems head-on, we harnessed artificial intelligence's power to introduce a transformative solution. We leveraged convolutional neural networks to engineer our SCOLIONET architecture, which can accurately identify Cobb angle measurements. Empirical testing on our pipeline demonstrated a mean segmentation accuracy of 97.50% (Sorensen–Dice coefficient) and 96.30% (Intersection over Union), indicating the model's proficiency in outlining vertebrae. The level of quantification accuracy was attributed to the state-of-the-art design of the atrous spatial pyramid pooling to better segment images. We also compared physician's manual evaluations against our machine driven measurements to validate our approach's practicality and reliability further. The results were remarkable, with a p-value (t-test) of 0.1713 and an average acceptable deviation of 2.86 degrees, suggesting insignificant difference between the two methods. Our work holds the premise of enabling medical practitioners to expedite scoliosis examination swiftly and consistently in improving and advancing the quality of patient care. © 2023 by the author.

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atrous spatial pyramid pooling; computer vision; image enhancement; image processing; machine learning; medical image analysis; segmentation; spatial Wiener filter

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