

MACHINE LEARNING MODELS FOR ROOT CANAL LENGTH DETERMINATION

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ABSTRACT

The exact determination of working length in root canal treatment forms a critical aspect of endodontic treatment, as lapses in working length estimation can leave the root canals inadequately cleaned, shaped, and obturated. Traditional methods of working length determination have been used and still remain in use. These methods by their inherent nature are limited by anatomical variations, and operator dependency and, in the case of radiographs, are prone to imaging inaccuracy. AI and ML techniques have, recently, brought data-driven models to ensure a greater degree of precision in measuring root canal lengths. The models employ CNNs, deep learning algorithms, and image processing techniques to analyze periapical radiographs and CBCT scans to offer measurements that are automated and reproducible. This review elucidates the ML-based techniques currently employed in endodontics with a focus on their application in determining root canal length, how they compare with traditional methods in terms of performance, and the possibility of integrating these into clinical workflows. It also highlights the trends emerging in the field, the challenges pertaining to model generalization, and future directions concerning AI-assisted endodontic diagnosis and treatment planning.

KEYWORDS: *Machine Learning; Root Canal Length; Endodontics; Artificial Intelligence; Cone-Beam Computed Tomography; Deep Learning; Apex Locators; Dental Imaging.*

Article History

Received: 25 Jun 2022 | Revised: 27 Jun 2022 | Accepted: 29 Jun 2022
