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BONE AGE ESTIMATION FROM LEFT-HAND RADIOGRAPH WITH DEEP LEARNING METHODS

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out by the regulations of Universiti Teknologi MARA. It is original and is the result of my work unless otherwise indicated or acknowledged as referenced work.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

To overcome the shortcomings of conventional manual techniques like the Greulich-Pyle (GP) and Tanner-Whitehouse 3 (TW3) approaches, this work investigates the application of deep learning techniques for age estimates using left-hand radiographs. An X-ray picture dataset that was divided into three age groups (Low, Middle, and High) for teenagers between the ages of nine and eighteen was used to train and assess the suggested models, Extreme Inception (Xception), Squeeze-and-Excitation Residual Network (SE-ResNet), and InceptionV3. To improve the dataset's quality and variability, the X-ray was preprocessed and augmented. Based on test accuracy and generalization across male and female datasets, the results show that the Xception and InceptionV3 models perform better than SE-ResNet in terms of accuracy and resilience. The work demonstrates the process of deep learning used to automate the assessment of bone age, providing notable gains in speed, objectivity, and accuracy over manual methods. Careful hyperparameter adjustment and data augmentation were used to solve issues like dataset size, class imbalances, and model generalization. This research provides a foundational step toward integrating deep learning-based systems into clinical workflows for pediatric diagnosis, sports medicine, and forensic science, emphasizing the need for continued development and validation of diverse datasets. This study highlights the necessity of ongoing development and validation on a variety of datasets and offers a first step toward incorporating deep learning-based systems into clinical workflows for pediatric diagnostics, sports medicine, and forensic science. The experimental findings demonstrate that Xception achieves an accuracy of 76% for the male dataset and 66% for the female dataset, InceptionV3 achieves 77% for the male dataset and 66% for the female dataset, and SE-ResNet achieves 54% for the male dataset and 28% for the female dataset, making Xception and InceptionV3 superior choices for robust and accurate bone age estimation.

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