CED/NOF-IADR
2024 Oral Health
Research Congress
12 — 14 Sept 2024
Geneva, Switzerland

0127

Deep Learning Utilization in Forensic Identification From Children's Orthopantomograms

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Objectives The first objective of this research was to develop and test deep learning(DL) models that can detect and properly identify and number teeth from orthopantomograms(OPGs) in humans with mixed dentition. The second objective was to compare various available models and evaluate the potential directions for further development in image recognition DL models.
Methods The research used 598 OPG images of subjects between 6 and 16 years. Some images were excluded due to low contrast, poor visibility of anatomical structures and artefacts. Teeth were marked in the form of a square that framed each individual tooth. The marked portions were divided into a training group and a test group. The training group was presented to the convolutional neural networks with the exact type of the tooth according to FDI notation. 2 models were developed and compared in order to explore the potentials of different available DL models.
The first model ran it through a 44 channel ResNet18 neural network.
The second model ran them through a 5 layer Yolov8 neural network. Additionally, we investigated the feasibility of categorizing teeth without considering left and right properties. Given the symmetric nature of teeth in these quadrants, we augmented the number of images to determine if a larger dataset would yield improved results. Deciduous incisors were excluded due to insufficient number of present teeth.
Results The first neural network had a precision rate of 90,44%
The second neural network model accurately identified the teeth in images with an average precision of 90,75%, while in the additional experiment with the second network, the accuracy increased to 91,53%.
Conclusions Both models effectively distinguished between deciduous and permanent teeth and correctly labelled them with high precision. The model based on Yolov8 architecture had slightly better precision. Based on prior studies, and received results it is inferred that a larger dataset would yield even more favourable results. Both architectures are applicable and there is no preference in further network development. The significance of this approach lies in its ability to analyse a large volume of OPGs within seconds, enabling the quick narrowing down of potential matches and expediting the forensic identification process, particularly in mass disaster scenarios.