

Republic of Iraq Ministry of Higher Education And Scientific Research University of Baghdad College of Dentistry



## NOVEL ARTIFICIAL NEURAL NETWORKS FOR PREDICTION OF SKELETAL AND DENTAL ORTHODONTIC MEASUREMENTS VIA PHOTOGRAPHS (A PROSPECTIVE STUDY)

A thesis

Submitted to the council of the College of Dentistry at University of Baghdad in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Orthodontics

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## ABSTRACT

**Background:** Digital technology is becoming increasingly crucial in most therapeutic tasks. Many multiple-factor analyses approaches are currently accessible for medical usage, with the artificial neural network (ANN) model being one of them. The aim of this study was to design artificial models for the evaluation of skeletal and dental factors via photographs using neural networks models in different malocclusions.

**Subjects and Methods:** A total of ninety-four patients were recruited for this prospective study, with an age range of 15-20 years, (41 males and 53 females) seeking orthodontic treatment. According to their sagittal skeletal relationship, they were allocated into three groups. Thirty with skeletal class I (14 males and 16 females), 34 patients with skeletal class II (14 males and 20 females) and 30 patients with skeletal class III malocclusion (13 males and 17 females). The study includes; (1) Finding the correlation of the skeletal measurements between lateral profile photographs and cephalometric radiographs for the recruited patients; (2) Designing a specific ANNs for prediction of skeletal factors via lateral photographs by training these networks on 70% of the sample and testing the efficiency of them on the remaining 30% of 94 standard lateral cephalograms; (3) Finding out the correlation of the lower incisors dimensions between intraoral photographs and dental casts followed by designing ANNs for prediction the size of un-erupted premolars and canines.

**Results:** These networks provided regression models for predicting cephalometric variables using analogous photographic measurements with strong predictive power (R=0.99) and can predict the size of un-erupted premolars and canines with a low estimate error (R=0.91) in different malocclusions.

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**Conclusion:** It can be concluded that ANNs models are useful as reliable and suitable method in orthodontics for predicting cephalometric measurements and the size of un-erupted teeth using photographs and its performance was achieved by components such as proper selection of the input data, preferable generalization and appropriate organization.



## الشبكات العصبية الاصطناعية المستحدثة للتنبؤ بقياسات تقويم الأسنان والفكين باستحدام الصور الفوتغرافية (دراسة مستقبلية)

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