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Automating Cephalometric Analysis in Orthodontics Using Artificial Neural Network

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Dissertation submitted to the Faculty of Information Technology, University of Moratuwa, Sri Lanka for the partial fulfillment of the requirements of the Degree of MSc in Artificial Intelligence

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Declaration

I declare that this dissertation does not incorporate, without acknowledgment, any material previously submitted for a Degree or a Diploma in any University and to the best of my knowledge and belief, it does not contain any material previously published or written by another person or myself except where due reference is made in the text. I also hereby give consent for my dissertation, if accepted, to be made available for photocopying and for interlibrary loans, and for the title and summary to be made available to outside organization.

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Dedication

Pay homage to the Lord Buddha

For

Paving the way to the

Wisdom

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Also the authors of the references I have used throughout this project are highly appreciated.

Abstract

This study presented an Artificial Neural Network approach to promote Automate Cephelamatric Analysis in Orthodontics. Analysis and interpretation of standardized radiographs of the facial bones have become an important clinical task in Orthodontics. Conventional method of locating Landmarks depends on manual tracing of the radiographs. Since this is time consuming and error proven, demand for completely automate analysis and diagnostic tasks have increased. This study has critically reviewed four major problems in Cephelamatric Analysis; Precision of Landmark identification, Enormous time consumption, Subject to human errors and Need of continues support from experts. We argue that, issue of lack of autonomous solutions for Cephelamatric Analysis has been claimed to be the main problem with conventional approaches. There have been previous endeavors to Automate Cephalometric Analysis using Hand Crafted Algorithms, Mathematical or Statistical Models and Artificial Intelligence techniques. In any case accuracy was the same or worse than the one of manual identification. Therefore the aim of this investigation was to propose an Artificial Neural Network approach to computerize the Cephalometric Analysis. It is evident from the literature that, Neural Networks can introduce very high level of autonomy and accuracy in modeling real world problems. Therefore we hypothesized; Cephalometric Analysis can be automating by using self organizing feature of ANN. The proposed system automates Cephalometric Analysis along four dimensions. I.e. Image Acquisition using a Cephelostast and a scanner in order to capture the images and scan the images. Image Processing and Computer Vision to perform diffusion on gray scaled images and to detect possible edges using Canny. Two Landmarks, point-Me by finding the first existent edge of the image from RHS to LHS and edge starting from 'Me' is ended suddenly from the point -UIT along to the downward, have identified and localized during this module. Coordinate values of remaining extracted edges used as input to the ANN to detect other landmarks which cannot be identified directly during Computer Vision. Classify landmarks according to their geometrical specifications using a Competitive Neural Network. Pinpoint the land marks according to the mean value of each cluster obtained during ANN training. Users of the system are Orthodontists who will be benefitted from high level of accuracy and relatively fast outputs.

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