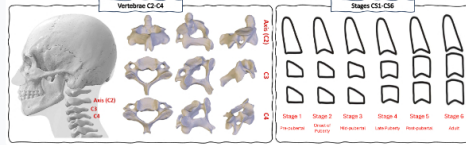


CVM Assessment using an Innovative AI-Based Imaging Analysis System

Cervical Vertebral Maturation (CVM) Assessment using an Innovative Artificial Intelligence (AI)-Based Imaging Analysis System

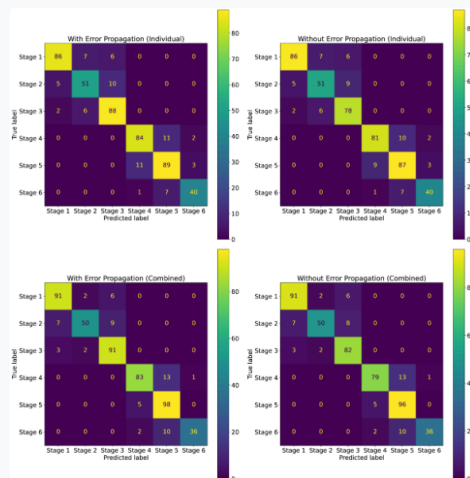
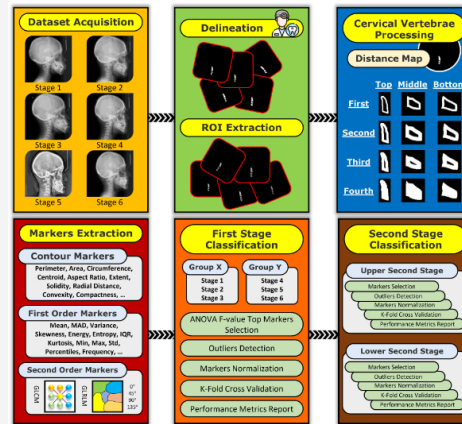


Introduction

The Cervical Vertebral Maturation (CVM) assessment plays a pivotal role in orthodontic diagnosis and treatment planning by providing insights into skeletal growth and enabling timely interventions. This study introduces an innovative approach to predict CVM stages based on novel imaging markers extracted from X-ray images, which are then correlated with CVM stages.

Proposed System

The proposed system comprises the following main steps: (i) initiating with manually delineated cervical vertebrae (i.e., C2, C3, and C4) from the X-ray images; (ii) parcellating the cervical vertebrae based on the Marching level-sets approach to generate five iso-contours for each segmented cervical vertebra; the primary objective of vertebrae segmentation is to extract both local and global imaging markers to accurately grade and classify CVM stages; (iii) extracting first and second-order appearance and morphology imaging markers that describe the shape and appearance of each extracted cervical vertebra; and (iv) employing two-stage classifiers to grade and classify CVM for each patient.



Experimental Results

The system without data augmentation demonstrated promising results, achieving an accuracy of 95.85%, sensitivity of 88.03%, specificity of 97.20%, and precision of 88.70%. After applying data augmentation techniques, the accuracy improved to 98.89%, with a mean score of 97.20%. To the best of our knowledge, this is the first system to assess the six stages of CVM with such high accuracy. The proposed AI-based system will enhance orthodontic patient care in the USA and worldwide by providing a new non-invasive tool for early CVM assessment.

Our Team

Dedicated to quality and your success



Hossam Magdy Balaha
Email: hmbala01@louisville.edu



Ahmed Alksas



Amine Fattal



Amir A. Sewelam



Wael Aboelmaaty



Khaled Abdel-Ghaffar



Toru Deguchi



Ayman El-Baz
Email: aselba01@louisville.edu