

Article

A Comparative Analysis of Artificial Intelligence and Manual Methods for Three-Dimensional Anatomical Landmark Identification in Dentofacial Treatment Planning

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Abstract: With the growing demand for orthognathic surgery and other facial treatments, the accurate identification of anatomical landmarks has become crucial. Recent advancements have shifted towards using three-dimensional radiologic analysis instead of traditional two-dimensional methods, as it allows for more precise treatment planning, primarily relying on direct identification by clinicians. However, manual tracing can be time-consuming, mainly when dealing with a large number of patients. This study compared the accuracy and reliability of identifying anatomical landmarks using artificial intelligence (AI) and manual identification. Thirty patients over 19 years old who underwent pre-orthodontic and orthognathic surgery treatment and had pre-orthodontic three-dimensional radiologic scans were selected. Thirteen anatomical indicators were identified using both AI and manual methods. The landmarks were identified by AI and four experienced clinicians, and multiple ANOVA was performed to analyze the results. The study results revealed minimal significant differences between AI and manual tracing, with a maximum deviation of less than 2.83 mm. This indicates that utilizing AI to identify anatomical landmarks can be a reliable method in planning orthognathic surgery. Our findings suggest that using AI for anatomical landmark identification can enhance treatment accuracy and reliability, ultimately benefiting clinicians and patients.

Keywords: dentofacial deformity; anatomical landmarks; artificial intelligence; three-dimensional radiologic analysis; accuracy; reliability

1. Introduction

Since its introduction by Broadbent in 1931, cephalograms have become a standard method for analyzing the skull and facial bones, measuring the dimensions and contours of craniomaxillofacial structures, and assessing their growth and maturation [1]. Among these, lateral cephalogram is considered the most reliable tool for evaluating craniofacial development, diagnosing orthodontic problems, planning treatments, assessing treatment outcomes, and predicting further growth of the craniomaxillofacial region. Cephalograms

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Bergey's Manual of Determinative Bacteriology John G. Holt, 1994 Covers the nature of bacterial identification schemes the differentiation of procaryotic from eucaryotic microorganisms and major categories and groups of bacteria **Textbook of Diagnostic Microbiology - E-Book** Connie R. Mahon, Donald C. Lehman, 2022-11-02 Selected for Doody's Core Titles 2024 in Laboratory Technology Gain the knowledge and skills you need to succeed in the clinical lab Textbook of Diagnostic Microbiology 7th Edition uses a reader friendly building block approach to help you learn the essentials of diagnostic microbiology Featuring full color drawings and photos this text helps you learn to develop the critical thinking and problem solving skills necessary to the accurate diagnosis of infectious diseases and the identification of infectious agents Written by noted educators Connie R Mahon and Donald C Lehman this edition adds new content on SARS CoV 2 and COVID 19 along with the latest information on prevention treatment modalities and CDC guidelines Building block approach encourages you to use previously learned information in mastering new material Full color photographs and photomicrographs make it easier to understand and apply diagnostic microbiology concepts Case studies describe clinical and laboratory findings offering opportunities to correlate observations with possible etiologic agents and to build critical thinking and problem solving skills Hands on procedures in the appendices describe techniques used in the lab setting Issues to Consider boxes list important points to think about while reading the chapter Case Checks in each chapter highlight specific points in the text and show how they connect to case studies Bolded key terms with abbreviations are listed at the beginning of each chapter showing the most important and relevant terms in each chapter Learning Objectives at the beginning of each chapter supply you with a measurable learning outcome to achieve by completing the material Points to Remember sections at the end of each chapter provide a bulleted list of key concepts Learning Assessment Questions at the conclusion of each chapter help you to think critically and to evaluate how well you have mastered the material Agents of Bioterror and Forensic Microbiology chapter provides the most current information about these important topics Lab manual on the Evolve website reinforces concepts with real life scenarios and review questions Glossary at the end of the book supplies you with a quick reference for looking up definitions of key terms NEW Information about SARS CoV 2 and COVID 19 is added to this edition NEW Updated content is included throughout the book and several chapters are reorganized and refocused NEW Enterobacteriaceae chapter is updated Laboratory Manual in General Microbiology Michigan State University. Department of Bacteriology and Public Health, 1916 *Laboratory Manual in General Microbiology* Michigan State University. Dept. of Bacteriology and Public Health, 1926 West Balkans Regional Aquatic Animal Disease Diagnostic Manual Food and Agriculture Organization of the United Nations, 2018-11-16 A reference for official veterinarians veterinary inspectors and fish health experts to facilitate daily tasks at aquaculture farms in five Balkan countries and improve product compliance with common EU market standards Laboratory Manual in General Microbiology Ward Giltner, 1916 **Artificial Intelligence and Animal**

Ecology Lidia Ghosh,Amiyangshu De,2025-07-29 Artificial Intelligence and Animal Ecology A Review explores the transformative synergy between AI and animal ecology unveiling how cutting edge technology is revolutionizing ecological research and conservation This pioneering book bridges these dynamic fields demonstrating how AI techniques such as evolutionary algorithms and optimization methods both draw inspiration from and advance the study of animal behavior species interactions and environmental adaptation With a strong focus on innovation it examines groundbreaking AI applications from bio inspired algorithms and adaptive learning to breakthroughs in animal communication and behavioral analysis Readers will gain valuable insights into how AI deciphers complex ecological dynamics including navigation vocal communication and interspecies relationships The book also addresses ethical considerations ensuring responsible AI integration in ecological research More than just a review this book is a call to action It empowers researchers conservationists and ecologists to embrace AI driven solutions fostering interdisciplinary collaboration and expanding the frontiers of ecological knowledge As AI continues to evolve Artificial Intelligence and Animal Ecology A Review provides a vital roadmap for addressing environmental challenges with innovation and a deeper appreciation of the natural world

Manual of Clinical Microbiology Patrick R. Murray, Ellen Jo Baron, 2003 Includes information on infection detection and prevention and control diagnostic technologies bacteriology antibacterial antiviral antifungal and antiparasitic agents and susceptibility test methods virology mycology and parasitology **Microbial Identification and Their Prospective** Singh Raghvendra Pratap, Manchanda G, 2014-12-11 Microbes make up most of the biodiversity on Earth and several of the processes which microorganisms perform are of critical importance for decomposing organic matter and recycling plant materials They are important for biological cycling of nutrients maintenance of soil fertility and in crop protection and enzyme technology Therefore knowledge of the phenotypic genotypic and biological characters to identify a microorganism is essential for developing ecosystem services and to frame strategies for their efficient utilization in agriculture and allied sectors However Traditional methods of identification and characterization are not expose the real scientific need Now development of molecular methods has greatly improved the ability to rapidly detect identify and classify microorganisms and also establish the taxonomic relationship among closely related genera and species Identification using molecular methods relies on the comparison of the nucleic acid sequences DNA RNA or protein profiles of a microorganism with documented data on known organisms This book expose to cutting edge research acceptable scientific methodologies and techniques of microbiology **Cowan and Steel's Manual for the Identification of Medical Bacteria** Samuel Tertius Cowan, 1993 A practical manual of the key characteristics of the bacteria likely to be encountered in microbiology laboratories and in medical and veterinary practice *Benson's Microbiological Applications Complete Version* Alfred Brown, 2014-01-10 Benson s Microbiological Applications has been the gold standard of microbiology laboratory manuals for over 30 years The 77 self contained clearly illustrated exercises and four color format with a wealth of added photographs

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