

Orthodontic Faculty Development Fellowship Award

Dr. Jonas Bianchi, *University of the Pacific*

Project title. Can Artificial Intelligence Approaches Predict the Need for Orthognathic Surgery?

Award Recipient. Dr. Jonas Bianchi, Assistant Professor of Orthodontics— University of the Pacific, Arthur A. Dugoni School of Dentistry.

Biography. Dr. Bianchi is a full-time Assistant Professor of Orthodontics at the University of the Pacific in San Francisco, CA. He holds a master's degree from the State of Sao Paulo University in Brazil and completed his Ph.D. in collaboration with the University of Michigan. During his Ph.D. studies, he also undertook a post-doctoral fellowship in Michigan, under the guidance of Dr. Cevidanes. Dr. Bianchi's research focuses on utilizing data science approaches and artificial intelligence to develop decision support systems in dentistry. In addition to his academic role, Dr. Bianchi collaborates with Dr. Heesoo Oh at the Craniofacial Research Instrumentation Laboratory (CRIL) and engages with orthodontic residents from the University of the Pacific in research endeavors. He actively participates in collaborative projects with the University of Michigan, supported by an R01-funded grant led by Dr. Cevidanes. Furthermore, Dr. Bianchi engages in fruitful collaborations with the State of Sao Paulo University and the University of North Carolina (USA). These collaborative efforts involve utilizing CBCT images, digital dental models, and patient clinical data to enhance clinical decision-making processes through data science approaches. Dr. Bianchi adheres to an evidence-based approach in his orthodontic practice, employing diverse protocols and personalized treatment strategies. He utilizes segmented mechanics, straight-wire techniques, temporary anchorage devices (TADs), and orthopedic appliances to tailor his patients' orthodontic care.



Brief description of the project. This research project aims to enhance treatment planning in orthodontics by integrating artificial intelligence (AI) methods with traditional cephalometric analysis. Orthodontists typically rely on 2D cephalometric analysis for assessing patient characteristics and treatment planning due to its accessibility and lower radiation exposure. However, the decision-making process in orthodontic treatment, particularly in orthognathic surgery cases, is complex and dependent on multiple quantitative and qualitative factors. This project seeks to address the gap between small-scale studies and the potential of AI in orthodontic decision-making by leveraging a large dataset of 920 lateral radiographs from patients who have undergone conventional orthodontics or orthognathic surgery. The primary objective is to evaluate the efficacy of ten different machine learning models in predicting the necessity of orthognathic surgery based on 32 cephalometric measurements derived from the radiographs. By comparing the predictions of the AI models with the actual treatment performed, the project aims to assess the accuracy and reliability of the AI approaches. Furthermore, the research seeks to examine the performance of the AI models by segregating the patient groups into skeletal class II and skeletal class III categories, thus considering the variability in orthodontic diagnoses. The agreement between the diagnoses provided by two orthodontists and two oral maxillofacial surgeons will also be assessed to determine the concordance between human expert judgment and AI-based predictions. The project's ultimate objective is to develop a robust AI model that can effectively diagnose and recommend the most suitable treatment for orthodontic patients. By elucidating the variables utilized by the AI model for classification, the

research aims to provide valuable insights into the decision-making process, thereby improving orthodontic treatment planning and enhancing patient care.

Statement of how orthodontic education will benefit from your award. Embracing technological advancements is crucial in orthodontic education. As the field continues to evolve rapidly, students need to understand the potential of emerging technologies. Incorporating AI methods into the curriculum allows students to learn how to integrate these advanced tools with traditional diagnostic techniques, preparing them to navigate and adapt to the evolving landscape of orthodontic practice. Orthodontic education stands to benefit greatly from the above-mentioned project in several ways. Integrating artificial intelligence (AI) methods with traditional cephalometric analysis can advance treatment planning techniques. This exposure to cutting-edge technologies will better equip future orthodontists to provide optimal patient care. Additionally, the project aims to provide evidence-based decision-making support in orthodontics. By conducting a comprehensive analysis using a large dataset and comparing the performance of machine learning models with clinicians' diagnoses, the project can contribute valuable evidence on the efficacy and reliability of AI algorithms. Integrating this evidence-based approach into orthodontic education will guide students and practitioners toward data-driven decision-making.

Why the Foundation is important to your project. The Foundation holds great importance for my project due to its crucial role in supporting and advancing research endeavors. Firstly, the Foundation's financial assistance ensures the project's feasibility and success. By providing essential funding, the Foundation enables the acquisition of necessary resources, access to cutting-edge technologies, and the implementation of innovative research methodologies. This financial support allows me to conduct comprehensive studies, analyze large datasets, and explore new avenues in data science and artificial intelligence within the field of dentistry. The Foundation's involvement strengthens the project's credibility, attracts valuable partnerships, and contributes to advancing the field of dentistry.

How Foundation funding is expected to or has benefitted your career. The AAOF significantly impacts my career enrichment as a professor in orthodontics, and I have the privilege of mentoring and guiding students in their educational and research journeys. With the AAOF assistance, I can provide a stimulating learning environment by offering hands-on research experience, exposure to state-of-the-art technologies, and access to interdisciplinary collaborations. This support fosters the growth of students as future practitioners and researchers, equipping them with valuable skills and knowledge that will shape their careers in orthodontics. The AAOF's assistance goes beyond financial support and enriches students' educational experiences. Through the AAOF's resources and network, I can expose students to many opportunities contributing to their professional growth. By providing access to cutting-edge technologies, facilitating collaborations with experts in various disciplines, and promoting research activities, the AAOF allow me to empower students to expand their horizons and explore the frontiers of orthodontics.