Introduction

The Applied AI in Oral Health Summer Institute, held from July 23-26, 2024, at the Mike Petryk School of Dentistry, University of Alberta, was a collaborative and educational event organized with the support of the Network for Canadian Oral Health Research (NCOHR). This event gathered 25 participants, including faculty members, students, and clinicians from the University of Alberta and other institutions across Canada, bringing together a wide range of expertise in artificial intelligence (AI) and oral health.

Program Overview and Structure

The four-day event was carefully designed to integrate theoretical knowledge with practical applications, providing participants with the opportunity to explore the transformative role of AI in dental research and practice. The program was structured into daily sessions, each focusing on a distinct area of AI applications relevant to oral health. The curriculum emphasized a balance between presentations and hands-on activities to ensure participants could effectively translate knowledge into practice.

1) Day 1 and Day 2: Tabular and text data analysis
   - The first two days introduced participants to the foundations of data processing, focusing on tabular and text-based datasets. Dental records, which are often stored as structured tables or unstructured clinical notes, were explored to demonstrate how AI can extract meaningful insights from these formats. Participants learned how trends and patterns within patient data can inform clinical decisions, research insights, and operational improvements in dental practices.
   - Lab activities were conducted on Google Colab, a cloud-based coding environment, where attendees practiced knowledge structuring, information retrieval, and text mining tasks. These activities provided essential skills for working with clinical notes, dental charts, and other textual data sources. The labs were carefully designed to progress participants from understanding basic AI concepts to practical applications, concluding in assignments centered on data classification and predictive modeling tasks, preparing them to apply these tools in their own contexts.

2) Day 3 and Day 4: Image processing and feature detection
   - The focus shifted to image processing on the third and fourth days, addressing more advanced topics such as image classification, augmentation, annotation, and feature detection. Participants were introduced to the potential of AI in analyzing dental radiographs and other imaging data, essential for identifying patterns that aid in diagnostics and treatment planning.

- The hands-on labs equipped participants with practical skills in image annotation, with a particular focus on object detection techniques using the renowned YOLO (You Only Look Once) models. These models, known for their efficiency and accuracy in real-time object detection, were applied to dental imaging tasks. Participants practiced detecting key features on periapical radiographs, such as anatomical structures, gaining critical competencies necessary for modern dental diagnostics.

Each day followed a structured format, beginning with morning presentations that laid the theoretical foundation for the day's topic. The afternoon sessions were dedicated to interactive lab work, where participants applied what they had learned in a practical setting. To encourage networking and knowledge exchange, breaks were incorporated throughout the day, allowing participants to engage in meaningful discussions and explore opportunities for collaboration.

The program's structure ensured that participants not only developed a solid understanding of AI tools and techniques but also experienced how these technologies could be applied to real-world dental research and clinical settings. The blend of theory and practice empowered participants to confidently integrate AI solutions into their own professional environments, driving innovation and progress in oral health research.

Learning Objectives and Competencies
The institute aimed to achieve several learning objectives:
1) AI awareness and knowledge transfer: Participants, ranging from beginners to experienced researchers, were introduced to AI concepts applicable to dentistry.
2) Practical implementation skills: Hands-on labs were designed to equip attendees with the tools needed to apply AI to real-world dental research. The labs progressed through three competency levels: running and applying models, modifying models to fit specific needs, and customizing models to optimize outcomes.
3) Collaborative learning environment: Round-table discussions and group activities promoted knowledge exchange, enabling participants to gain insights from each other's research backgrounds and professional experiences.

The curriculum was crafted to cater to both newcomers and seasoned researchers, ensuring that all participants gained valuable insights and takeaways to implement AI in their own research contexts.

Outcome and Impact

The institute was a resounding success, achieving its goal of advancing knowledge and collaboration in AI-driven oral health research. Participants expressed positive feedback regarding the comprehensive curriculum and the balance between theoretical and practical learning. The following outcomes highlight the event's impact:

1) Skill development: Participants acquired new skills in text mining, data analysis, and image processing, preparing them to apply these technologies in their clinical and research activities.

2) Networking and collaboration: The institute facilitated meaningful interactions among researchers, students, and clinicians from different institutions, fostering opportunities for future collaborative projects.

3) Knowledge dissemination: Discussions during the event helped participants exchange ideas on the latest developments in AI applications, promoting the integration of AI tools into oral health research.

Future Plans

The University of Alberta is looking forward to offering the summer program again this year (2025) with a shortened curriculum to attract more participants from across the country.

Participant Feedback

The Applied AI in Oral Health Summer Institute was highly praised for its engaging content and knowledgeable presenters. After the workshop was done, Google Forms were distributed among participants to collect their feedback. Participants highlighted the quality of instruction: "Awesome! The presenters were great. Great course and lots of new info." The graduate student presenters stood out: "Their expertise made AI seem easy, and they patiently answered our questions, helping us appreciate the depth of the field."

The hands-on labs were particularly well-received: "The computer lab helped visualize AI concepts and reinforced what we learned in the lectures." Participants also appreciated the discussions: "The group discussions after presentations enhanced understanding and retention." Many called it a transformative experience: "One of the best learning experiences I've had since graduate school."

While some participants felt certain sessions could have been more intensive, they still valued the overall experience. Suggestions for improvement included covering basic AI terminology early on and slightly slowing the pace of presentations for better comprehension.