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| **ITU-T Focus Group on AI for Health** |
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| **Abstract:** | This document contains the Call for Participation in the Topic Group “Dental Diagnostics and Digital Dentistry” (TG-Dental). The purpose of the Call for Participation is to call on members of the medical and artificial intelligence communities with a vested interest in the topic to become engaged in the TG-Dental. |

**ITU/WHO Focus Group on artificial intelligence for health (FG-AI4H)**

**Call for Topic Group Participation: Dental Diagnostics and Digital Dentistry**

The International Telecommunication Union (ITU)/World Health Organization (WHO) Focus Group on “Artificial Intelligence for Health” (FG-AI4H; <https://itu.int/go/fgai4h>) seeks engagement from members of the medical and artificial intelligence (AI) communities (including clinicians, technologists, entrepreneurs, potential benchmarking data providers, machine learning experts, software developers, researchers, regulators, policy-makers, companies/institutions, and field experts) with a vested interest in shaping the benchmarking process of dental diagnostics and digital dentistry.

1. **About FG-AI4H**

Over the past decade, considerable resources have been allocated to exploring the use of AI for health, which has revealed an immense potential. Yet, due to the complexity of AI models, it is difficult to understand their strengths, weaknesses, and limitations. If the technology is poorly designed or the underlying training data are biased or incomplete, errors or problematic results can occur. AI technology can only be used with complete confidence if it has been quality controlled through a rigorous evaluation in a standardized way. Towards developing this standard assessment framework of AI for health, the ITU has established FG-AI4H in partnership with the WHO.

Thus far, FG-AI4H has established several topic groups, including AI and cardiovascular disease risk prediction, child growth monitoring, dermatology, falls among the elderly, histopathology, neuro-cognitive diseases, ophthalmology (retinal imaging diagnostics), psychiatry, radiotherapy, snakebite and snake identification, symptom assessment, tuberculosis, volumetric chest computed tomography, and dental diagnostics and digital dentistry.

Each topic group agrees upon representative benchmarking tasks in a pragmatic, best-practice approach, which can later be scaled and expanded to similar tasks. Every benchmarking task should address a health problem of relevance (e.g. impacting a large and diverse part of the global population or challenging to treat) and for which AI technology would provide a tangible improvement relative to the current practice (e.g. better care, results, and/or cost/time effectiveness).

For a rigorous and sound evaluation, undisclosed test data sets must be available (or have to be collected) for each task. All data must be of high quality and compliant with ethical and legal standards. In addition, the data must originate from a variety of sources so that it can be determined whether an AI algorithm can generalize across different conditions, locations, or settings (e.g. across different people, hospitals, and/or measurement devices). The format/properties of the data serving as input to the AI and of the output expected from the AI, as well as the benchmarking metrics are agreed upon and specified by the topic group.

Finally, the AI-to-be-evaluated will be benchmarked with the undisclosed test data on FG-AI4H computing infrastructure. Here, the AI will process single samples of the undisclosed test data set and predict output variables, which will be compared with the "ground truth." The results of the benchmarking will be provided to the AI developers and will appear on a (potentially anonymized) leaderboard.

1. **Topic group: Dental Diagnostics and Digital Dentistry**

A topic group is a community of stakeholders from the medical and AI communities with a shared interest in a topic. The objectives of the topic groups are manifold:

1. to provide a forum for open communication among various stakeholders,
2. to agree upon the benchmarking tasks of this topic and scoring metrics,
3. to facilitate the collection of high-quality labelled test data from different sources,
4. to clarify the input and output format of the test data,
5. to define and set-up the technical benchmarking infrastructure, and
6. to coordinate the benchmarking process in collaboration with the Focus Group management and working groups.

The primary output of a topic group is one document that describes all aspects of how to perform the benchmarking for this topic. (The document will be developed in a cooperative way by suggesting changes as input documents for the next FG-AI4H meeting that will then be discussed and integrated into an official output document of this meeting. The process will continue over several meetings until the topic description document is ready for performing the first benchmarking.)

This topic group is dedicated to dental diagnostics and digital dentistry. Dental conditions, like caries or periodontitis or tooth loss, are among the most prevalent diseases of humankind, affecting up to 98% of a population. Direct treatment costs due to dental diseases globally were estimated at US $298 billion annually, corresponding to an average of 4.6% of global health expenditure. The burden emanating from oral diseases is comparable to that from diabetes or cardiovascular diseases. The majority of the world's 1.6 million dentists are based in Europe and the Americas, such that 69% of the world's dentists serve 27% of the global population. Africa has only 1% of the global workforce. The overall workforce in dentistry exceeds 10 million worldwide. Diagnostics in dentistry largely relies on dentists diagnosing diseases via a combination of dental history taking, clinical investigation and imaging as well, if required, further physical or (bio)chemical or microbiologic assessments. AI will help to (1) improve the accuracy of each of these individual tasks, (2) allow the integration of different data with higher effectiveness than the individual can do this, (3) without ease also longitudinally assess these data, compare them over time, and hence allow predictions, (4) reduce the reliance of diagnosis making from the dentist, expanding the scope of dental auxiliary staff, thereby increasing the access and efficiency of dental services, and (5) enable patients and healthy individuals to better participate into their dental health experience and management. AI will pave the way to a more personalized, precise, preventive and participatory dentistry for more people worldwide. It has the potential to aid in overcoming current ineffective, expensive care models. Benchmarking is expected to yield more robust models and algorithms, with initially lower accuracy compared with current validation strategies (largely in-sample). Benchmarking is further expected to allow transparent comparisons of different models and algorithms.

More details about the activities of the topic group can be found in the (forthcoming) topic description document, which can be accessed with a free ITU account (cf. “Get involved”).

Current members of the topic group on Dental Diagnostics and Digital Dentistry:

*Charité – Universitätsmedizin Berlin (Department of Oral Diagnostics & Digital Health & Health Services Research)*

Prof. Dr. Falk Schwendicke is Professor and Head of Department, Oral Diagnostics, Digital Health and Health Services Research. Demonstrable track record of clinical and scientific excellence in the field of diagnostics, operative, preventive and data-driven dentistry.
Falk’s research is aimed at answering questions of high clinical relevance. His research focus is on cariology and restorative dentistry, preventive and public health dentistry, dental diagnostics and AI as well as health economics and health services research. He has authored over 300 articles, edited various books and provided over 20 book chapters on a range of issues, from caries management to health economics. Falk was awarded a range of prestigious awards, among them the Basil Bibby and Lion Award of the IADR, numerous awards of the German Society of Conservative Dentistry as well as the David Sackett Award of the German Network for Evidence-based Medicine. He reviews for over 40 peer-reviewed journals, among them the Lancet, as well as various national funding agencies. He serves as Associate Editor of the Journal of Dental Research and has been on the editorial board of various dental journals before.

Dr. Joachim Krois is Lead Data Scientist at ODDH2, Charité - Universitätsmedizin Berlin. He predominantly works in the fields of statistics, predictive modeling, machine learning, computer vision, epidemiology and public health. One of his core interests is the development of tangible solutions to improve dental diagnostics by applying machine learning and deep learning techniques. He is an advocate of the paradigm of data driven dentistry. Thereby, he is embracing the complexity of decision-making in the medical domain and is critically reviewing costs, benefits and trustworthiness.

M.Sc. Lisa Schneider is a Data Scientist at ODDH2, Charité - Universitätsmedizin Berlin.

She has a strong passion for building meaningful, transformative software solutions that positively affect the lives of patients and practitioners. Her proficiencies cover the fields of computer vision and machine learning with a strong focus on deep learning techniques.

One of Lisa’s core research areas is the field of Federated Learning, which enables a collaborative learning process of deep learning models between multiple institutes without the need to share highly-sensitive data.

Dr. Lubaina T. Arsiwala is an Associate Researcher at the Department of Oral Diagnostics, Digital Health and Health Services Research, Charité - Universitätsmedizin Berlin. She is also a dentist and a clinical scientist with a keen interest in dental public health research, particularly the epidemiology of dental conditions. She holds a degree in dentistry from DY Patil University, India and has 4 years of clinical experience. She also completed a master’s degree in epidemiology at Johns Hopkins University, USA and has 3 years of experience as the lead biostatistician on several clinical research projects. Currently, Lubaina contributes her dental and analytic expertise to several ongoing projects in her department at Charité - Universitätsmedizin Berlin.

*deepkapha.ai*

deepkapha.ai was founded with the sole goal of solving problems with Artificial Intelligence and Deep Learning. Deepkapha.ai develops niche algorithms that outperform leading state-of-the algorithms. The company focuses on solving extremely hard and complex problems within healthcare with the use of AI. deepkapha.ai is as key startup inception program members at Nvidia. Tarry Singh, the CEO of deepkapha.ai, is a visiting faculty lecturer at University of Dallas, Texas and at University of Utrecht and he is a startup mentor at Hult Prize Foundation, which is sponsored by President Bill Clinton.

*Wonkwang University College of Dentistry, Daejeon, Korea*

Prof. Dr. Jae-Hong Lee is currently an Associate Professor at the College of Dentistry, Wonkwang University, Daejeon, Korea. He predominantly works in the fields of periodontology and implantology, and his research interests include the application of epidemiology, big data, and oral health. He has authored over 50 articles and book chapters, which have been published in national and international journals and conferences. Recently, he has become interested in the application of deep learning for AI-based dental diagnostics and digital dentistry, and has received several national research grants to conduct research in this area of study.

*King George Medical University, Lucknow, India*

Dr. Akhilanand Chaurasia is Associate professor and clinical consultant at King George’s Medical University, Lucknow, India. He has remarkable credit of contributing to academics by publishing research papers in peer reviewed national and international journals, peer reviewer of many national and international journals.He has contributed 5 books and 2 book chapters in oral medicine and Head, Neck radiology.He is editorial board member, Academic editor, associate editor of many national and international journals including Oral Diseases and OOO (Oral radiology section), member of several national and international organization related to field of Oral Medicine, Oral biology and Dento-maxillofacial radiology. Dr. Chaurasia’s research is focused on AI application in maxillofacial Radiology, Diagnostics and Digital Dental Health.

*Riga Stradins University, Riga, Latvia and Universidad Austral de Chile, Valdivia, Chile*

Dr. Sergio Uribe is Associate Professor at the Riga Stradins University (RSU), Riga, Latvia, Universidad Austral de Chile (UACh), Valdivia, Chile and Leading Researcher of the Bioinformatics Unit of the RSU. He is a Dental Surgeon, Specialist in Dental and Maxillofacial Radiology and PhD in Medical Sciences. His area of research is preventive dentistry and the evaluation of the impact of new imaging technologies in diagnostic and treatment decision making for oral diseases. He participates in the editorial board of the Journal of Dental Research, BMC Oral Health and Dental Traumatology. Prof Uribe is a strong advocate for the use of open science and FAIR standards in medical research.

*Computer Engineering Department, Sharif University of Technology, Tehran, Iran*

Dr. Hossein Mohammad-Rahimi graduated from Shahid Beheshti University of Medical Sciences (SBMU) as a general dentist. He is currently a Research Assistant in the Medical Imaging lab under supervision of Dr Mohammad Hossein Rohban at the Computer Engineering Department at Sharif University of Technology (SUT). He founded a research group in AI in the Dentistry field based on collaboration of the SBMU and SUT. In the research groups, they defined various major projects which have their defined roadmaps consisting of step-wise tasks to provide a meaningful solution in practice.

*Universität Regensburg, Germany*

Janet Brinz is a final year dentistry student.

*Private dental practice, Perth, Australia*

Anahita Haiat is a dentist. Her research interest is applications of artificial intelligence and bioengineering in dentistry.

*Medical University of Vienna, Vienna, Austria*

Prof. Ulrike Kuchler is an associate professor at the Department of Oral Surgery. Dr. Balazs Feher is a junior scientist and lecturer at the Department of Oral Surgery as well as a Ph.D. candidate in Endocrinology. Together, Prof. Kuchler and Dr. Feher research the application of contemporary methods of data science in oral surgery. Their recent work includes individualized preoperative risk prediction in wisdom teeth extraction based on tooth anatomy, volumetric modeling of postoperative bone regeneration after jaw cyst surgery, as well as automated diagnosis of cysts and tumors.

*Radboud University, Nijmegen, the Netherlands*

Shankeeth Vinayahalingam completed his medical studies at Westfälische Wilhelms-Universität in Münster. He is currently a third year PhD student in oral and maxillofacial surgery. Furthermore, he is a Master Artificial Intelligence and Dentistry student at Radboud University. His area of research is applications of artificial intelligence in dentistry and oral and maxillofacial surgery.

*IDISBA (Fundació Institut d'Investigació Sanitària Illes Balears)*

Dr. Francesc Perez Pastor is member of the research group *e-Health & Telemedicine Multidisciplinar mediante Sistemas Inteligentes Ciberfísicos*. Graduated & PhD in Medicine. Former assistant clinical professor at the Facultat d’Odontologia, UB. Currently Prof. at the Master in Orthodontics, Faculty of Odontology UB, Spain. Researching in Artificial Intelligence, since October 2020.

*Oral-Maxillofacial Imaging Unit, Department of Oral Medicine, Sedation and Maxillofacial Imaging, Hadassah Medical Center, Faculty of Dental Medicine, Hebrew University of Jerusalem, Israel*

Dr. Nadler Chen, DMD PhD, is a senior lecturer, currently the head of the oral-maxillofacial imaging unit. Currently engaged in education of under-graduate and post-graduate students, service and research. Service includes bone and salivary gland imaging (plain radiographs, CBCT and ultrasonography). Her main research fields include education, diagnostic and artificial intelligence in oral maxillofacial and salivary gland imaging.

*Dentofacial Deformities Research Center, Research Institute of Dental Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran*

Sahel Hassanzadeh-Samani is a final year dentistry student at Shahid Beheshti University of Medical Sciences (SBMU). She is currently working on her thesis in the fields of orthodontics and artificial intelligence.

*Medical University - Plovdiv, Bulgaria*

Dr Tedy Karteva is a Chief Assisting Professor at the Department of Operative Dentistry and Endodontics, Medical of University of Plovdiv, Bulgaria. Her lifestyle fuses clinical practice, academic tutoring and research zeal. As an endodontist she spends her time finding her way in the root canals of her patients, as a science communicator she strives to tell stories in the world of science and as a researcher she is excited to introduce herself to you.

*Centre for Dental Education and Research, All India Institute of Medical Sciences, New Delhi, India*

Dr. Kunaal Dhingra, MDS, MFDS RCPS (Glasg), MFDS RCS (Eng), MDTFEd, MAMS, is Additional Professor at Division of Periodontics, Centre for Dental Education and Research, All India Institute of Medical Sciences (AIIMS), New Delhi, India. His research interests include clinical trials, systematic reviews, and epidemiological studies in Periodontology, including developing artificial intelligence-based periodontal clinical studies. Dr. Dhingra is Academic Editor of *PLOS ONE*, Associate Editor of *BMC Oral Health*, *BMC Biotechnology*, and *Frontiers in Dental Medicine* journals. Dr. Dhingra is committed to research to explore the applications of artificial intelligence and digital technology in Dentistry along with training the future generations of clinicians in these areas through education and research.

Dr. Prabhat Kumar Chaudhari is Additional Professor (full time) at Division of Orthodontics and Dentofacial Deformities, Centre for Dental Education and Research, All India Institute of Medical Sciences (AIIMS), New Delhi, India. His research interests include development of non-compliant orthodontic appliances/devices for orthodontic care of children with and without Cleft Lip and Palate, the application of digital technologies (3-D printing & non-ionizing 3D surface imaging in Oral Health Science) and artificial intelligence for Dentistry in general and Orthodontics in particular. Dr. Chaudhari is Associate Editor of BMC Oral Health-Digital Dentistry Section, Section Editor (Orthodontics) of J of Oral Biology and Craniofacial Research, and Guest Editor of Frontiers in Dental Medicine Journal. Dr. Chaudhari is committed to conduct research to explore the applications of artificial intelligence and digital technology in Orthodontics and Craniofacial Deformity and to train the future generations of clinicians in these areas through research and education.

*University of Belgrade, School of Dental medicine, Belgrade, Serbia*

Jelena Roganović is Associate professor and Head of the Department of Pharmacology in Dentistry. Her scientific work is recognizable by employment of epigenetic biomarkers, especially microRNAs, as diagnostic and prognostic tools in periodontology and oral complications of type 2 diabetes mellitus. Another scope of interest is Bioethics, and she is involved in the master studies in Bioethics at the University of Belgrade with focus on ethical issues associated with recent developments in dental practice. She feels eager to support work that favours the development of ethical AI, with an emphasis on applied precision medicine-driven research and education.

 *Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran*

Fatemeh Sohrabniya is a general dentist graduated from the Shiraz University of Medical Sciences. She is a member of the research committee. Now she is working on her programming skills to apply AI knowledge into different fields of dentistry.

 *Dental Materials Research centre, Azad University of Tehran, Tehran, Iran*

Rata Rokhshad is a general dentist recently graduated from the Azad Tehran University. Her area of research is applications of digital dentistry especially in the prosthodontics.

*Department of Orthodontics, School of Dentistry, Zanjan University of Medical Sciences, Zanjan, Iran.*

Zeynab Pirayesh is a final year dentistry student at Zanjan University of Medical Sciences (ZUMS). She is currently working on her thesis in the fields of orthodontics and artificial intelligence.

The topic group would benefit from further expertise of the medical and AI communities and from additional data. In particular we want to invite groups that are working with dental imagery, such as X-rays, CBCT, scans and photographs, among others.

1. **Get involved**

To join this topic group, please send an e-mail to the focus group secretariat (tsbfgai4h@itu.int) and the topic driver (falk.schwendicke@charite.de). Please use a descriptive e-mail subject (e.g. “Participation topic group AI for Dental Diagnostics and Digital Dentistry”), briefly introduce yourself and your organization, concisely describe your relevant experience and expertise, and explain your interest in the topic group.

Participation in FG-AI4H is free of charge and open to all. To attend the workshops and meetings, please visit the Focus Group website (<https://itu.int/go/fgai4h>), where you can also find the whitepaper, get access to the documentation, and sign up to the mailing list.

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