AI Health Innovation Cluster

- an initiative of the Innovation Campus Heidelberg Mannheim Health & Life Sciences

Postdoc position available

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AIH15: Increased knowledge on AI-based diagnostics: conducive to user acceptance?

Abstract: Deep learning image analysis algorithms have shown their potential to improve skin cancer screening in numerous studies. However, these studies have largely been conducted in artificial settings, and real clinical implementation of such algorithms in clinical practice is mostly lacking. One prerequisite for a successful translation into the clinic is user acceptance, which may be correlated with a better, if still basic, understanding of the way these algorithms work. In addition, the introduction of AI into medical diagnostics significantly increases the complexity of physician consultations. It is challenging for physicians to comprehensively address AI methods, statistical implications and individual consequences in conversation.

We therefore propose to generate modular information on the function, potential uses and pitfalls of deep learning-based image analysis algorithms in Dermatology in the form of short movie sequences. Different combinations of the information modules will then be shown to potential users (both dermatologists as direct users and skin cancer screening participants as indirect users).

Their impact on the users' willingness to employ/accept them as an integral part of skin cancer screening, as well as the direct and indirect users' psychobiological stress responses during their interaction will be assessed as outcomes.

	Coordinator	Partner 1
PI	Prof. Dr. B. Ditzen	Dr. T. Brinker
Institution	UKHD	DKFZ

Project description

1. Aims and expected impact of the project

The goal of the project here proposed is to investigate whether and how knowledge on the function, potential uses and pitfalls of deep learning image algorithms in Dermatology influences the attitudes of potential direct (e.g. dermatologists) and indirect users (skin cancer screening participants) with respect to their clinical implementation. With this aim we plan to develop short movie sequences on the function, potential uses and pitfalls of deep learning-based image analysis algorithms in Dermatology. Different combinations of the information modules will then be evaluated with the target groups/ potential users (both dermatologists as direct users and skin cancer screening participants as indirect users). Usability and acceptance as well as the direct and indirect users' psychobiological stress responses during physician-patient interaction will be assessed as outcomes.

The project was developed by the Ditzen and the Brinker group based on their joint interest in the requirements for successful translation of digital/ Artificial Intelligence-based diagnostic applications into clinical practice. Educational material (video clips) will be developed and evaluated with the aim to improve user experience and reduce stress responses both in physicians and patients during the diagnostic procedure. Thereby, the project will combine the expertise of the Institute of Medical Psychology at Heidelberg University Hospital (head: Ditzen) regarding social interactions, and doctor-patient interactions in particular, with the dermatologic and Artificial Intelligence (AI) expertise of Brinker's research group. The latter will be instrumental in defining the contents of the envisaged movie modules. The expertise of the Ditzen group regarding the design and the statistical evaluation of health-related surveys and real-time psychobiological stress measures will enable the required simplification of the complex information and the *lege artis* evaluation of their impact on the target groups of interest.

Requirements for the interdisciplinary PostDoc are: MD, PhD or equivalent, in a field related to the project. Experience in health communication, survey development, and statistical analysis. Interest in AI-based applications in medicine and/ or medical psychology as well as educational film creation are desirable.

The candidate will conduct a self-contained research project and broaden his or her expertise on AI-based applications in Clinical Medicine (with Dermatology as the starting point) and survey generation and evaluation.

2. Prior work related to the proposal

The Ditzen group has already successfully conducted a variety of projects dealing with the real or potential impact of several stressors on quality of life and psychobiological stress responses. In addition, the group has prior experience in evaluating explanatory videos used to explain AI-based diagnostics in medicine. The group is currently developing and evaluating short movies designed to explain the use of AI in gene diagnostics to ease physician-patient communication in subsequent consultations (GenKI). In addition, the group's VERIKOM project evaluates stress, user acceptance, and recall performance in individuals depending on the level of digitization they are exposed to in simulated doctor-patient conversations.

The research group of Dr. Brinker, who is a Dermatologist himself, has been working with AI-based image analysis algorithms to identify biomarkers on medical images for several years. One main focus of their work is the generation of diagnostic algorithms for skin cancer detection, both on the

level of clinical/ dermoscopic and histopathological images. In the process, they have already evaluated patient preferences with respect to such applications in routine clinical practice. Moreover, the group has established a communication platform for patient surveys in oncology in conjunction with the Cancer Information Service at DKFZ.

Relevant publications:

- Haggenmüller S, …, **Brinker TJ**. Digital Natives' Preferences on Mobile Artificial Intelligence Apps for Skin Cancer Diagnostics: Survey Study. JMIR Mhealth Uhealth. 2021 Aug 27;9(8):e22909. doi: 10.2196/22909.

- Hekler A, Utikal JS, …, **Brinker TJ**; Collaborators. Superior skin cancer classification by the combination of human and artificial intelligence. Eur J Cancer. 2019 Oct;120:114-121. doi: 10.1016/j.ejca.2019.07.019. Epub 2019 Sep 10.

- Jutzi TB, Krieghoff-Henning EI, …,, **Brinker TJ**. Artificial Intelligence in Skin Cancer Diagnostics: The Patients' Perspective. Front Med (Lausanne). 2020 Jun 2;7:233. doi: 10.3389/fmed.2020.00233. PMID: 32671078; PMCID: PMC7326111.

- Stoffel, M.,... **Ditzen, B.** (2021). Covariation of psychobiological stress regulation with valence and quantity of social interactions in everyday life: disentangling intra- and interindividual sources of variation. J Neural Transm (Vienna). doi:10.1007/s00702-021-02359-3

- Stoffel, M., Neubauer, A. B., & **Ditzen, B.** (2021). How to assess and interpret everyday life salivary cortisol measures: a tutorial on practical and statistical considerations. Psychoneuroendocrinology, 133(12), 105391. doi:https://doi.org/10.1016/j.psyneuen.2021.105391

- Wekenborg, M. K.,... & **Ditzen, B.** (under review). Digitalization-associated changes in stress-relevant working conditions in medicine and their psychobiological concomitants. Psychosomatic Medicine.

3. Expected impact in- and outside the consortium

User acceptance is one of the central requirements for the successful - and as yet very limited - implementation of AI-based diagnostics using medical images in oncological clinical practice. In our experience, physicians and patients are often reluctant to rely on AI for crucial medical decisions. In addition, it is challenging and time-consuming for the treating physicians to go through the AI-based methods themselves and explain them in detail to the patient. Nevertheless, patients have a right to this information and must be comprehensively informed in order to make their personal treatment decisions. To overcome these acceptance barriers, profound expertise in the fields of psychology, medicine and data science is urgently needed.

If the educational movie-based approach investigated here is successful, it is scalable and can be extended to other indications/ other kinds of medical images with minimal effort. All members of the consortium will be able to access the final version of the movie modules and re-use the ones that are not specific to dermatological images. Hence, all members of the consortium that intend to employ AI-based image analysis applications in healthcare and particularly in oncology may benefit from the project. Since we intend to publish the results in open access journals, other research groups and commercial companies developing similar assistance systems can build on our results. The movie modules can also be made available externally.

Overall, the involvement of potential users into the development of the educational material (user-driven research) can increase acceptance due to better insights into the potential and limits of AI-based diagnostic assistance tools. In this project may provide one important cornerstone for an easier and used-centered implementation of such systems in clinical practice.

4. Nature of the collaboration and management of the project

The two groups will collaborate closely on the generation of the contents of the movie modules. The background expertise on deep learning-based algorithms will be provided by the Brinker group. The Ditzen group will contribute their knowledge of psychosocial aspects of digitized medicine such as user acceptance when using AI-based communication formats, as well as their expertise from previous film and stress-measurement projects. Both groups will work together on the development of the required surveys and the evaluation of the results, building on their previous experience. The large network of Dermatology clinics that the Brinker group has established for their ongoing projects can be leveraged to recruit dermatologists for the surveys. The communication platform "fragdiepatienten.de" can be used to conduct an anonymous survey among patients/ putative screening participants.