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Visualizing Future Breast Cancer Prognosis by Generative AI

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Abstract. In Sweden, 30 percent of breast cancer cases are detected between screenings, leading to later staged cancer diagnoses. Aileen Health is preventing later staged cancers by making a breast cancer prognosis with generative AI. This study investigates how breast radiologists perceive AI-generated images and their usability as cancer prognosis. Through literature review and formative usability testing, the research study emphasizes the challenges when integrating AI-generated medical images into clinical decision-making. Furthermore, our findings stress the importance of avoiding cognitive overload and following mental models. Future research should focus on radiologists' use of breast cancer prognosis at various urgency levels, as well as AI accuracy of generated images.

Keywords. AI, breast cancer, mammography screening, user interface, radiology

1. Introduction

In Sweden, about 30 percent of breast cancer cases are detected between regular biannual screenings. This frequently results in later-stage diagnoses and worse outcomes [1]. The AI solution under development by Aileen Health is generating medical images to make a breast cancer prognosis with generative AI. These generated images are visualizing when and where breast cancer occurs. The goal is to detect cancer earlier, more specifically to prevent cancers from being incurable. The AI model is based on previous research on Alzheimer's progression [2]. This study aims to investigate how AI-generated breast cancer prognosis is perceived by breast radiologists as a decision support. The research question revolved around design guidelines for an interface communicating AI-generated images.

2. Methods

A literature review was conducted to gather information and insights into the current knowledge on the topic. Then, several design iterations with formative usability testing [3] were conducted, including the five distinct phases: empathize, define, ideate,

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prototype, and test. Testing was conducted using the CSAW dataset [4], with AI visualizations of the breast cancer prognosis provided by Aileen Health. With breast radiologists as participants, semi-structured interviews gathered user insights on AI-generated information. At the same time, observations provided a firsthand understanding of user situations to identify needs and areas for improvement without influencing actions.

3. Results

Facilitating clinical decisions using information from AI systems necessitates a collaborative approach between humans and AI, with the AI serving as an assistant rather than a rival. To enhance radiologists' decision-making, the AI system must be capable of addressing radiologists' queries, offering comprehensive insights into their rationale, and utilized data. Moreover, the AI system should align with the mental models of radiologists and be presented clearly to prevent increasing cognitive burden.

4. Discussion

The next phase would be to conduct a more detailed study of how breast radiologists act when they are faced with various urgencies in breast cancer prognosis. From a usability perspective, additional requirements could probably be found when studying the breast cancer prognosis used during clinical practice. This also needs to include how accurate the AI solution is in predicting the breast cancer prognosis, for example, with the Fréchet inception distance [2].

5. Conclusions

When introducing AI-generated images in breast cancer screening, design guidelines avoiding cognitive overload are necessary. The rationale behind the AI-generated insights needs to align with the radiologists' mental models, in order for the AI to be integrated into clinical decision-making. By doing so, there is a potential for using generative AI for predicting disease progression, in cancer treatment and beyond.

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