Editorial

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Artificial Intelligence in Senology - Where Do We Stand and What Are the Future Horizons?

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ABSTRACT

Artificial Intelligence (AI) is defined as the simulation of human intelligence by a digital computer or robotic system and has become a hype in current conversations. A subcategory of AI is deep learning, which is based on complex artificial neural networks that mimic the principles of human synaptic plasticity and layered brain architectures, and uses large-scale data processing. AI-based image analysis in breast screening programmes has shown non-inferior sensitivity, reduces workload by up to 70% by pre-selecting normal cases, and reduces recall by 25% compared to human double reading. Natural language programs such as ChatGPT (OpenAI) achieve 80% and higher accuracy in advising and decision making compared to the gold standard: human judgement. This does not yet meet the necessary requirements for medical products in terms of patient safety. The main advantage of AI is that it can perform routine but complex tasks much faster and with fewer errors than humans. The main concerns in healthcare are the stability of AI systems, cybersecurity, liability and transparency. More widespread use of AI could affect human jobs in healthcare and increase technological dependency. AI in senology is just beginning to evolve towards better forms with improved properties. Responsible training of AI systems with meaningful raw data and scientific studies to analyse their performance in the real world are necessary to keep AI on track. To mitigate significant risks, it will be necessary to balance active promotion and development of quality-assured AI systems with careful regulation. AI regulation has only recently included in transnational legal frameworks, as the European Union's AI Act was the first comprehensive legal framework to be published, in December 2023. Unacceptable AI systems will be banned if they are deemed to pose a clear threat to people's fundamental rights. Using AI and combining it with human wisdom, empathy and affection will be the method of choice for further, fruitful development of tomorrow's senology.

Keywords: Artificial Intelligence; breast cancer; breast cancer screening; breast disease; breast imaging; MRI; senology; ultrasound

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Key Points

- Artificial Intelligence (AI) is defined as the simulation of human intelligence by a digital computer or robotic system and has become a hype in current conversations.
- A subcategory of AI is deep learning, which is based on complex artificial neural networks that mimic the principles of human synaptic plasticity and layered brain architectures, and uses large-scale data processing.
- AI-based image analysis in breast screening programmes has shown non-inferior sensitivity, reduces workload by up to 70% by pre-selecting normal cases, and reduces recall by 25% compared to human double reading.

Introduction

Artificial Intelligence (AI) has recently come to the fore in news reports, daily newspapers, periodical magazines and even scientific journals (1, 2). Touching the surface of this topic and ending up with humanised views and expectations is the usual mode of operation. This is more than understandable. One of the pioneers of AI, Turing (3), said that only computers can understand computers. Inputs, embeddings, vectors, matrices, weighted scores, probability distributions, and outputs are pure mathematics. Emotions and feelings are reserved for humans and are the product of a long evolutionary process. Using AI and combining it with human wisdom, empathy and affection will be the recommendation of this editorial, which will focus on AI in senology and its future horizons.

Definition

AI is defined as the simulation of human intelligence by a digital computer or robot system. The term is often used for developed

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systems that are designed to be equipped with the intellectual process characteristic of humans, such as the ability to reason, discover meaning or learn from past experiences (4).

However, the science fiction concept of an AI singularity refers to a super AI singularity that has evolved to a level of intelligence far beyond human performance (5, 6). The implications of such a super AI for the continued existence of mankind are being debated, and you may be familiar with fictional negative outcomes ending in a dictatorship of singularity AI from films, such as the Terminator series or the Matrix trilogy.

Today AI is an umbrella term, and several subfields of AI can be used - although none of them are the super-AI described in Science Fiction. Weak AI can perform certain limited tasks, such as speech recognition. Strong AI may be able to perform any intellectual task that a human brain can perform, if it is strong enough.

Groundhog Day - Fundamentals of AI Training

Maybe some readers are familiar with the American comedy film “Groundhog Day” starring Bill Murray (7). He is playing a raw, narcissistic and cynical television weatherman who falls in love with his co-star Andie MacDowell on a particular February 2nd. He becomes trapped in a time loop and re-lives February 2nd repeatedly. However, each day is different, and he is testing multiple new behaviours ranging from auto-destruction to philanthropy without aging. Further, he acquires new abilities and properties, and gradually changes into a positive, altruistic, and caring person who meets the needs of his beloved co-star that he has courted every day. Finally, she also falls in love with him, and both escape the time loop.

The makers of the film have unknowingly created a simplified and humanised model of AI for us. Bill Murray must re-live this specific date and with each new repetition, explore different actions and find the optimal policy until the desired result (in Bill Murray’s case: break out of the time loop with his beloved) is achieved. This corresponds to how AI is trained by humans.

Like Murray does with his February 2nd, artificial neuronal networks repeat several training cycles until all parameters and connectors, like synapses, are finetuned to meet the required output results that human developers define (8, 9), although the scale of AI learning is very different from the film as AI training cycles can consist of millions of repetitions.

Parallel and Sequential Training

Murray is trained in a sequential time loop, one day after another. In comparison, AI training loops can run parallel and sequentially, forward and backwards, at high speed. The rapid improvement of calculating abilities of computers thus allows training of AI and development of solutions with AI in short time frames. Murray took years to solve his problem. A modern AI probably would have taken not even a day - but the process definitely would have seemed less heart-warming and inspiring to us than Murray’s story.

The question arises, at what phase of the “Groundhog Day” time loop would “AI in senology” be located today? Is AI in senology still in its beginnings or already advanced along its way, developing into a better form with improved properties? Does AI already change the live trajectories of breast cancer patients, or their caring health professionals? The answers to these questions are complex and full of ambivalence. AI supporters have high hopes and ambitions when it comes to predicting the possible transformation of all areas of society, including medicine and, more specifically, senology, through AI (10, 11).

Bionic Design: How the Structure of AI is Inspired by the Human Brain

AI systems are not only able to mimic the functions of the human brain, but their structure is also heavily influenced by the design of the human brain. Artificial neural networks simulate the principles of human synaptic plasticity and layered brain architecture.

How the Brain Works

Synaptic plasticity refers to the ability of synapses (connections between neurons) to change and adapt in strength and structure over time. Thus, our brain constantly changes structurally with use. A fundamental principle of synaptic plasticity is that “what fires together, wires together”. This means that when neurons repeatedly fire at the same time, the synapses between them strengthen, forming a more robust connection and thus reinforce the neural circuitry associated with that particular firing pattern. Conversely, transmission can be weakened by desynchronization of neuronal activity or inhibitory neurons (12).

The cerebral multilayer architecture allows processing of input patterns that improve economy and speed of cerebral function. For example, the visual information of the retina (input) up streams through the neurons of the brain and is perceived at different levels as edges, lines, colours, (intermediate layers) and finally as a complex object. As a result, the brain recognizes the faces or body of, for example, Albert Einstein (output) (13).

How AI Works

The transformation of visual input from simple features to increasingly complex features and then to object recognition in AI is represented by the mathematical approach of convolutional neural networks (14). Between the input layer (corresponding to the retina) and the output layer (corresponding to the object-recognising cortical layer of the brain), intermediate layers, called hidden layers, learn from the raw data and error-correction algorithms. However, what precisely happens in the hidden layers between the input and the output? Each attempt by the network to achieve the output goal is registered and corrected by the network itself. Failed attempts lead to the weakening of unsuccessful data in intermediate layers, analogous to the process of synaptic weighting in the human brain. Due to the high complexity of this process, human observers are ultimately unable to understand how exactly an output is generated from an input in a self-learning network. This is called the “black box” problem, because we humans do not know what the black box of an algorithm looks like and how it works inside (15).

Types of AI

The umbrella term AI covers various methods, such as machine learning (ML), deep learning (DL) or natural language processing (NLP). ML is still the preferred technology in medical systems because of its stable performance, for example in image analysis, diagnosis classification or survival prediction. ML is based on algorithms that learn from data and improve their performance over time (16).

A subcategory of ML is DL, which relies on complex neural networks, that mimic the workings of the human brain and the processing of large amounts of data.

NLP is an artificial neural system of generative intelligence that enables computers to understand, interpret and generate human language. Modern NLPs, such as ChatGPT (OpenAI), Bard (Google) or Galactica (Meta, formerly Facebook) can summarise and simplify documents, answer questions in conversations, translate or autocorrect, or recognize the sentiment of text (17, 18). However, the result of generative AI can sometimes be wrong; the system "hallucinates" and offers information that seems believable but is incorrect (19). A notorious case of this is ChatGPT's generation of confabulated references or wrong biographies for real people, which ChatGPT embellished with various false information, such as fake university degrees or awards.

A similar example of incorrect content creation by AI can be seen in text-image generators, which create artificial images. Midjourney, Dall-E 2 or Stable Diffusion are the world's leading AI-based image generators. While AI-generated images are becoming more advanced and produce impressive results from written prompts, they struggle with highly specific content or small details. For example, when trying to generate images that include people, the number or position of fingers is often incorrect. This is because the models are trained on sometimes blurry and small internet images. Further training of generative AI systems with better and more focused reference images is likely to make such obvious mistakes a thing of the past and compensate for the lack of understanding of human anatomy (20).

More problematic are AI biases based on real, human biases regarding religion, gender, race, or other factors that are represented in the training data. For this reason, the latest version of ChatGPT, as a result of rigorous training, suppresses most responses that do not represent currently accepted ethical, socio-political or legal standards.

Basic Applications of AI With a Focus on Medicine and Senology

The main applications of AI worldwide are in the fields of business/finance and war/defence. In medicine, the following main applications have developed (1, 10, 17, 21, 22).

(a) Medical imaging, aiming at shorter examination times, less contrast media, updated AI-assisted detection and diagnosis, and improved diagnostic accuracy.

(b) Drug discovery to predict molecular interactions and potential new drugs.

(c) Genomics to analyse large genomic datasets for new insights into genetic diseases.

(d) Electronic health records to extract insights and trends for decision making.

(e) Precision medicine to tailor individual treatment plans.

ChatGPT in Senology

Current applications of NLP, such as ChatGPT, in medicine and senology include text generation (e.g., responses, manuscripts, coding), content summarisation (e.g., abstract paraphrasing, meeting notes summarisation), translation (e.g., between languages, text-to-code), classification (e.g., diagnostic classification, patient sentiment analysis), and chatbots (e.g., question and answer, virtual assistants) (18).

Have These Possibilities Already Touched the Field of Breast Healthcare?

A recent PubMed search by the authors in December 2023, focusing on the query "ChatGPT and Senology", yielded only a single result. An alternative search with the prompts "ChatGPT and breast cancer" or "ChatGPT and breast health care" yielded 16 results after removing duplicates. The publications were of low scientific quality and included feasibility or proof of concept studies, case series and expert opinions (LoE 4, 5, GRADE D). Nevertheless, these early publications provide interesting insights. For example, ChatGPT's treatment recommendations were 80% or more in line with human judgement for several tasks, such as providing radiology screening or tumour board recommendations, breast augmentation advice, or top breast cancer-related search queries. In addition, ChatGPT performed significantly better than most human candidates on board exams in radiology, paediatrics and other areas (23-27).

Interestingly, ChatGPT 4 provided 10% to 20% more correct results than ChatGPT 3.5 for well-trained topics such as "screening", but was less successful for "breast pain" or complex clinical cases. Chatbots, particularly context-aware chatbots, resulted in significant time and cost savings compared to radiologists' imaging recommendations.

One may conclude that the future of medical writing will rely heavily on AI and chatbots. However, a major concern was that ChatGPT created non-existent references, cited the wrong journal and date, and lacked depth. These drawbacks provide a significant caveat to the use of ChatGPT and similar large language programs in academia without critical review. Obviously, supervision by professionals is mandatory to ensure accuracy (25, 28-30).

AI in Breast Cancer Screening

Older approaches to screening using computer-aided detection (CAD) systems have been disappointing. While CAD did not improve the diagnostic accuracy of mammography, the insurers paid unnecessary costs for CAD in ultrasound (US) with no proven benefit for women. Today, the application of AI to breast cancer screening seems ready to change old strategies (31-36). Current applications of AI in screening focus on differentiating between benign and malignant tissue and localising of suspicious lesions within breast tissue (37). The newest methods used allow for transfer learning and the use of bilateral and prior images to detect subtle asymmetries and lesion growth. Recently, the authors of the first prospective randomised screening study comparing AI-assisted reading of digital mammography screens with conventional double reading (MASAI study) concluded that AI-assisted reading was safe (38). AI-assisted reading detected more invasive cancers (184 *vs.* 165 invasive cancers) and more *in situ* cancers (60 *vs.* 38 *in situ* cancers) than state-of-the-art double reading. AI also reduced the screen reading workload by 44.3% (38).

Four different applications of AI are currently being studied (39-45):

(a) AI-assisted reading of digital mammography;

(b) AI as a stand-alone decision support system;

(c) AI pre-selection of normal cases;

(d) AI-assisted prediction of breast cancer risk.

The current results for these applications in digital mammography are encouraging.

AI will become a useful tool in the near future and, most importantly, it will help reduce costs and may compensate the initial shortage of specialised radiologists by up to 50% (46). Rule-out and rule-in triage workflows can improve and refine the efficiency and effectiveness of mammography breast cancer screening (47, 48). Complicated cases are sent to two human readers, less suspicious cases to one human reader. Normal cases are directed to one human reader or are analysed only by the stand-alone AI. Thus, the AI can either exclude low-risk cases from double reading, replace the second reader or replace all human readers. Scores are used to express the AI-based stratification of lesion risk assessment.

In addition, the classification of breast density and matrix heterogeneity opens up the possibility of predicting the current and tailored predictive overall risk of breast cancer for each individual woman (49). Recent publications suggest that this type of prediction outperforms clinical risk scores. In addition, the combined assessment of an AI-based lesion detection system and breast density measurements enabled the identification of a greater proportion of women who would develop interval cancer compared than either method alone (50, 51).

AI in Other Breast Imaging Modalities

Digital Breast Tomosynthesis

The lessons learned from digital mammography can also be applied to digital tomosynthesis, as shown by several publications focusing on digital breast tomosynthesis (DBT). The sensitivity of stand-alone AI systems in DBT shows a non-inferior sensitivity, reduces workload by up to 70% due to pre-selection of normal cases, and reduces recall by 25% (52, 53). In contrast, another retrospective analysis of stand-alone AI performance in DBT found a 2% increase in recall rate (54). An AI support system could make advanced and more reliable imaging techniques more accessible and enable more cost-effective breast screening programmes with DBT (55).

Ultrasound

With regard to US, a large multi-vendor, multi-centre study from China found that a DL model could help novice readers in particular, to improve their US reading in terms of accuracy and interobserver agreement for breast cancer diagnosis (56). Adding an AI system to breast US was able to reduce unnecessary lesional biopsies (57). AI support also helped radiologists reduce false-positive findings in breast US interpretation by 37.3%, while maintaining the same level of sensitivity (58). A very recent study by Guldogan et al. (59) evaluated the performance of a commercial AI system for the retrospective BI-RADS category assessment in 715 breast masses detected on breast US. The accuracy of AI was inferior to that of experienced radiologists. However, all lesions categorized as BI-RADS 2 by AI proved subsequently to be benign. The authors stated that considering AI-assigned BI-RADS 2 as safe, this would have avoided 11% (18 out of 163) of benign lesion biopsies and 46.2% (110 out of 238) of follow-up examinations (59).

Breast Magnetic Resonance Imaging

Breast magnetic resonance imaging (MRI) can benefit from AI-assisted k-space sampling, resulting in denoising, improved resolution, reduced artefacts, and up to a 10% reduction in gadolinium dose (60, 61). In addition to clinical indications such as preoperative staging or follow-up under neoadjuvant therapy, this is particularly interesting for the field of personalized breast cancer screening, as these benefits could alleviate concerns about gadolinium uptake, which may deter some patients from undergoing regular MRI in high-risk women or those with dense breast. The DENSE trial has already shown a significant reduction of the interval cancer rate in the supplemental MRI screening group compared with the digital mammography-alone screening group from 5.0% to 2.5% (62). Further simulation models suggested that even an MRI-only screening strategy with a 4-year interval would be cost-effective (63). In addition, Comstock et al. (64) reported a significant difference (7%) of abbreviated MRI in the cancer detection rates between MRI- and DBT-based screening groups.

Contrast-Enhanced Mammography

In terms of contrast-enhanced mammography, DL algorithms for the detection of single mass lesions on CEM outperformed radiologists in terms of classification efficiency in a recent prospective Chinese multicentre study (61).

Nuclear Medicine

AI-assisted positron emission tomography or single photon emission computed tomography studies also promise the same big major benefits: (a) shorter examination times; (b) less radioactivity; and (c) better diagnostic accuracy compared to the old-school approach (65, 66).

Impact of AI on Early Diagnosis and Further Clinical Pathway

At the time of breast cancer diagnosis, the most successful AI systems in recent mammography trials have shown non-inferior sensitivity to expert double reading and a tendency to reduce recalls, avoiding unnecessary anxiety for women and biopsies (39-41, 45, 46, 53).

The average size and stage of breast cancers detected by screening are similar, whether or not AI is added. In the future, AI would only be of significant benefit to patients if it could detect significantly smaller breast cancers at an earlier stage, leading to improved patient survival.

Discussion and Conclusion

In the future, robust studies will be needed to address unresolved issues including: the direct comparison of different AI systems; the effect of different mammography systems on the accuracy of AI systems; the effect of different screening programmes on AI cancer detection or on how the AI system might work within specific breast screening IT systems; and the effect of providing additional breast density and composition information to AI systems for decision making (63). In addition, from a global perspective, AI algorithms trained on image analysis of Western breast composition need to be adapted to the predominantly dense breasts of women in Asia, Africa or Latin America (67). The onset of breast cancer in these women occurs earlier than in Western Europe, Scandinavian countries and the USA. On the positive side, there is evidence that AI systems predicting the presence of breast cancer can be generalized across data from Western countries, although the data are representative of different screening populations and practices (68).

The question remains: can AI in screening bring benefits to breast cancer patients further along the clinical pathway? This pathway includes diagnostic procedures, such as biopsy, imaging for pre-operative staging, treatment and follow-up after screening or clinical detection of breast cancer. In their recent systematic review of AI image analysis, Freeman et al. (69) concluded that there is insufficient evidence to support the introduction of AI into the screening pathway for clinical impact. This is easy to understand. AI implementation and outcomes must meet the gold standard of human expertise. Currently, many AI tools for these later stages of the clinical pathway do not meet the quality requirements for medical devices that some applications in other fields, such as neuroradiology, cardiology or robotics, do. Eighty percent or more correct AI-generated answers in a tumour conference on the most appropriate therapy are not sufficient, nor are chatbot recommendations on medical procedures in a similar range. Nevertheless, AI tools such as ChatGPT or other NLP's can assist professionals and are particularly valuable for beginners and less trained professionals (17). However, we must remain realistic. The *status quo* can change quickly. A game changer in senology would be the development of new multimodal AI systems that not only detect and characterise cancer better and earlier than humans, but also have global medical knowledge at their disposal. In addition, it would be constantly on the lookout for complex patterns that were previously hidden from humans. Humans would relinquish the gold standard of their expert judgement to AI, and would likely lose the ability to make responsible decisions.

Promises

AI in senology and general AI share an intersection of advantages and disadvantages (70). Undoubtedly, as mentioned above, the main advantage of AI is that it can perform routine and complex tasks much faster and with fewer errors than humans. AI will be able to work cost-effectively 365 days a year, 24 hours a day, without a break. Therefore, future economic decisions will also favour AI in the long term (71). Genomics and research into new breast cancer drugs are likely to benefit most from the speed and efficiency of AI algorithms in processing large data sets (16).

AI's ability to identify subtle and complex patterns that human readers or clinicians might miss will improve data-driven optimisation of diagnosis, patient care, administration, public health and cost-effectiveness, and thereby provide the opportunity to transform breast healthcare. In particular, NLP systems can already provide significant support for academic publishing, translation, medical report summarisation and administrative billing of patient care (18, 30). AI chat bots can help raise awareness and educate women about breast cancer symptoms and lifestyle changes. Emotional support for patients is no longer the privilege of human doctors and nurses. AI can analyse a patient's basic feelings and emotions and respond appropriately (72).

Most importantly, the range of support provided by AI has the potential to evolve into new roles in the future. In just a decade, Western countries will have passed the golden age of the baby boomers and will face a shortage of well-trained breast specialists. AI promises to alleviate such future problems in senology.

Risks

The seven main risks of AI in healthcare have been identified by a recent EU study. These comprise: patient harm due to AI errors; misuse of medical AI tools; bias in AI and the perpetuation of existing inequities; lack of transparency; privacy and security issues; gaps in accountability; and barriers to implementation (22). However, among future general AI applications, the persistent theme of AI misuse could dramatically change our future lives. The sources of misuse are either man-made, such as misuse by authoritarian political systems or corporations, or arise from a super-intelligent AI singularity itself. Elon Musk recently estimated that there is an 80% chance that AI will be a blessing and a 20% chance of a hard landing. (73). Earlier, in May 2023, other prominent leaders from OpenAI, Google DeepMind, Anthropic and other AI labs had also warned that future AI systems could be as deadly as pandemics and nuclear weapons (74, 75).

But what about the present? Our biggest personal concerns relate to the long-term instability of AI models and poor cybersecurity. Most modern NLP training involves continuous learning by scraping information of all kinds from the internet. However, as online information becomes more and more content generated by AIs themselves, one consequence will be the "model collapse" of NLPs. Within a few generations, an AI model will begin to forget improbable events, leading to a degenerated model that no longer reflects the real world (76). This could resemble a schizophrenic human worldview. In addition, the AI model forgets previous examples when learning new information, a "catastrophic forgetting" that resembles human amnesia. Furthermore, contaminated websites can infiltrate AI models with malicious data that is inserted during training to degrade the model's performance (77). This so-called "data poisoning" calls for strong protection by cybersecurity systems.

Implications and Future Impact on Socio-Economic Healthcare System

There are several important conclusions regarding the future impact of AI on the socio-economic health care system (71, 78, 79). The main advantage of AI is probably the potential workflow optimisation by eliminating non-suspicious cases from double reading. Therefore, radiologists with high workloads will initially love these AI systems, as long as they are easy to use. This initial enthusiasm could be reversed if radiologists become increasingly exhausted by having to read more complicated cases per hour than before.

In terms of cost-effectiveness, the system will save significant time and money by reducing the number of cases that need to be double-read. It is expected that between 50–70% of cases will not require further double reading (54). The transition to AI could also negatively affect human jobs in the field of healthcare. Professionals who know how to make use of AI will displace those who do not.

Technological dependency will inevitably increase, especially the role of the human programmer in controlling the AI to prevent the stable system from falling prey to entropy. The examples given of model degeneration and data poisoning underline the need for a strict human interaction and control of AI.

Human neurons and muscles degenerate when they are no longer used. The younger generation in an AI era may become lazy, forget previous skills, and run the risk of trusting AI too much. The transition to AI will also take a lot of time and money. Some developing societies will not be able to afford these costs. As a result, global inequalities are likely to increase.

AI intuition, including its generative approaches, is different from human creativity and lacks the human touch, and has problems thinking outside the box. Combining both human creativity and AI will open new horizons.

Ethics demand transparency, accountability and informed consent in every medical decision. Legal laws and regulations clarify the medical liability. Accordingly, individuals and organisations will be held accountable for the future actions of AI systems, especially if medical AI systems make mistakes or contribute to incorrect diagnoses or treatments.

Progress Under Regulation

According to Sam Altmann, CEO of Open AI, the risks of advanced AI systems were serious enough to warrant government intervention and regulation of AI due to the potential risk of mankind's extinction (75). Released in December 2023, the European Union's AI Act was the first ever, comprehensive legal framework for AI in healthcare worldwide that had been agreed on in order to advance the European approach to trustworthy AI. AI systems identified as high-risk must meet strict requirements, including risk-mitigation systems, high quality datasets, logging of activities, detailed documentation, clear user information, human oversight, and high levels of robustness, accuracy and cybersecurity. Examples of such high-risk AI systems include certain critical infrastructure, medical devices and biometric identification, and categorisation and emotion recognition systems. Unacceptable AI systems will be banned when considered a clear threat to the fundamental rights of people. Companies not complying with the rules will be fined. Fines for breaching the banned AI applications will be €35 million or 7% of global annual turnover, whichever is higher (80).

Future Horizons, Recommendations

Today, modern AI is still in its infancy. Nevertheless, AI will boost digital medicine in all fields, including senology. However, there is still a long way to go before the majority of patients will benefit.

The transition to AI will be disruptive. The authors recommend that healthcare decision-makers and stakeholders in senology will be prepared and open to new AI developments and the necessary regulatory framework.

We suggest that physicians should invest in new AI systems mainly with optimism, with an added dash of caution, and call for strict quality control of the double-edged sword of AI. In the real world, this corresponds to a qualified curriculum of AI training, meaningful systemic controlled randomised trials, but also individual checks of logical plausibility in decision making, for example in AI-assisted tumour board recommendations.

We would like to mention that there is no room for false modesty. Human intellectual abilities have achieved marvellous results in medicine and elsewhere. Most importantly, if mistakes are made in the management of AI, humans can correct them, regulate and manage the risks involved.

We propose that the use of AI, combined with human wisdom, empathy and affection, will be the method of choice for the further fruitful development of tomorrow's senology.

Authorship Contributions

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Dedication

Dedicated to the 30th anniversary of the Osnabrueck Breast Centre at Franziskus-Hospital Harderberg.

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