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Artificial Intelligence Based Breast Cancer Detecting Device

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***Abstract*: Breast cancer is one of the main death causes for women worldwide 16% of the diagnosed malignant lesions worldwide are its consequence. Breast cancer is assessed and detected using imaging as a primary approach. Recent advances in artificial intelligence (AI) have resulted dramatic developments in a variety of fields including healthcare. Cancer is assessed and detected using imaging as a primary approach. Artificial Intelligent (AI) developments for breast cancer detection can lead to a proper treatment to affected patients as early as possible that eventually help reduce the women mortality rate. Current clinical detection techniques, such as Ultra-Sound, Mammography, and Magnetic Resonance Imaging (MRI) from screening images for precise elucidation. The capability to detect a tumor in early diagnosis, expensive, relatively long waiting time due to pandemic and painful procedure for a patient to perform.**

***Keywords*: breast cancer, AI techniques, breast cancer screening, mammography, ultrasound, magnetic resonance imaging, radar technique.**

1. Introduction

Breast cancer is the primary common cancer and the second leading cause of death among ladies around the world [1]. Breast cancer happens when the cell tissues of the breast become abnormal and furiously detached. These abnormal cells form large lump of tissues, which in this way gets to be a tumor.

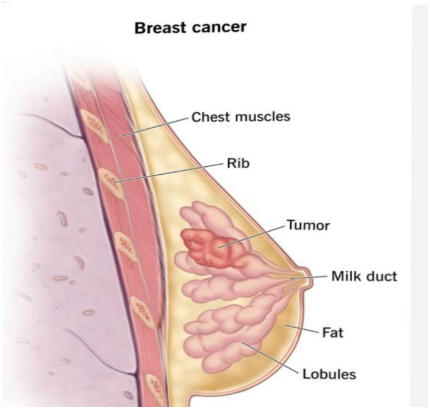

Fig. 1.

Breast cancer is one of the primary pressing issues women f the 21st century stand up to. It may be a success issue and the preeminent as often as possible as conceivable analyzed cancer among women around world. Numerous lives are lost due to breast cancer. It includes an extraordinary impact on the physical and mental wellbeing of women. Breast cancer is more effective to treat if diagnosed early. The effectiveness of treatment in later stages is poor. Therefore, early diagnosis and prevention can be helpful in recording more cases and reducing the number of deaths. The incorporation of artificial intelligence (AI) into screening methods may be new and developing field that's very promising within the early detection of breast cancer, hence coming about in better improved condition [2].

Breast cancer may be a condition that serious the lives of most women. The reduction of the mortality rate and the advancement of the chances of remedy are as it were Conceivable in the event that the tumor is overseen at the primary stages of its appearance. The mammary Organ is an organ in permanent evolution. The cells are still developing and separating, making it more suitable to cancerous changes. In case of breast Cancer, the cells can stay within the breast or disperse within the body through the blood or lymphatic vessels. The movement and/or scattering of breast cancer take, most of the time, a few months or indeed a number of Breast cancer as a rule creates within the milk ducts and lobules. The carcinogenesis handle has four stages: initiation, Promotion, progression and invasion. [3], [4] Population-based breast cancer screening programs utilizing mammography are respected as compelling in lessening breast cancer-related mortality [2]-[5], [6], [7].

Table 1
Risk factors of breast cancer

Modifiable factors	Non-modifiable factors
Hormonal replacement therapy	Female sex
Physical activity	Older age
Obesity	Family history
Alcohol intake	Genetic mutation
Smoking	Pregnancy and breast feeding
Exposure to chemicals	Menstrual period and menopause
Intake of proceed food	Radiation therapy

A. Breast Cancer Screening

The majority of health care systems that have been developed have implemented population screening for breast cancer (BC) based on evidence from randomized trials showing that mammography reduces BC mortality, along with observational evidence demonstrating the value of screening in the real world

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[8], [9]. Translation of advanced mammograms is part of the BC screening process to identify suspected abnormalities that need to be looked at further (recall to assessment) in order to rule out BC. Mammography interpretation is subjective. In addition to detecting BC, mammographic interpretation can yield false-positive results [10].

2. AI Based Techniques

A. Technologies Utilized to Identify Breast Cancer

One of the steps require to create a analyze framework is the representation of the breast tissue flow. In this sense, there are a few advances that are commonly utilized to speak to the tissue by means of pictures. This section presents the foremost utilized ones.

1) Mammography

Mammography may be a used to screen the breast tissue in arrange to distinguish variations from the norm that could demonstrate the prescience of cancer or other breast disease [11]. This procedure includes a sensibility of up to 85% within the suggested population. Basically, mammography employments measurements of X-ray to create a picture of the breast inner tissues [12]. To make the picture, the breasts are compressed by two plates with the point of relieving the scattering of the beams, permitting to get better picture without utilizing an X-ray high-dose, where the tissue changes might show up as white zones on a dim differentiate. On normal, the entire radiation measurements for a common place mammogram with 2 views for each breast is almost 0.4 [12].

2) Ultrasonography

Breast cancer is analyzed by means of ultrasonography, which could be an imaging method. In later a long time, it has progressed to the point that it can presently be utilized for breast imaging [13]. Ultrasound may be a utilized as a follow-up examination to clarify equivocal discoveries [14]. In essentially fatty breasts and dense breasts, ultrasonography can be utilized to survey the introduction and morphology [15]. A panoramic high-resolution picture of the breast is gotten utilizing amplified field of view imaging. Versatile sonography may be an approach for identifying breast injuries utilizing ultrasonic location. Ultrasound with differentiate is utilized to identify and screen the advance of neighborhood treatment. Intravenously infused gas microbubbles are utilized in this approach. The volume of an injury can be calculated utilizing 3D ultrasonography [16], [17].

3) Magnetic Resonance Imaging (MRI)

Magnetic resonance imaging (MRI) may be an imaging procedure that records changing strong magnetic areas and radio waves to deliver detailed images of the organ and delicate tissues of the human body [18]-[20]. MRI is the most viable imaging methodology that provides exact exactness and affectability in recognizing basic variations from the norm of the body compared to the other strategy [21].

Magnetic resonance imaging uses an attractive field (for the most part 1.0–1.5 T) and radio waves to alter the arrangement of hydrogen cores and, from this alter, makes a picture. A gadolinium-based differentiate operator is commonly utilized in breast imaging [22]. The subject lies inclined, whereas either one or both breasts, depending on the sort of coil, are imaged though. Mammography works best with fatty breasts, fat must be smothered in MRI, either through post preparing subtraction or other strategies some time recently differentiate specialist infusion, to protect the picture quality [23].

4) Microwave Tomography

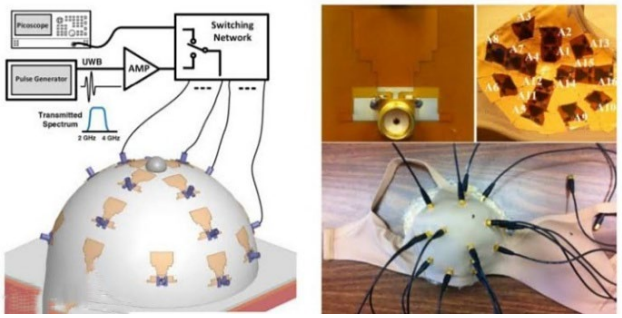

Fig. 2.

Microwave tomography (MT) is a progressed imaging procedure that employments microwave frequencies to make detailed cross section image of Breast. It takes advantage of the distinctive electrical properties of diverse sorts of tissues to precisely identify and visualize abnormalities, especially breast cancer. Different strategies are commonly utilized in MT to prepare the collected information and illuminate reverse issues. Gradient-based approaches (such as conjugate slope slightest squares and Arrive weber) and worldwide procedures (such as hereditary calculation and molecule swarm optimization) are utilized [24]-[27]. A few picture remaking calculations have been created and connected in MT for recognizing breast cancer, upgrading the precision and unwavering quality of the imaging technique [28]-[30].

5) Molecular Breast Imaging

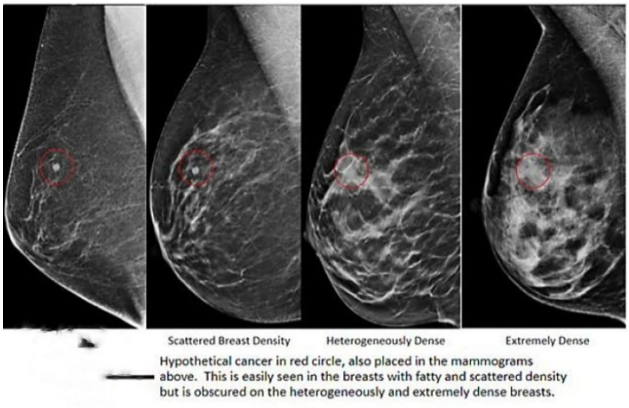

Fig. 3.

Atomic Breast Imaging (MBI) is an imaginative breast cancer screening approach that employments a radioactive tracer to highlight cancerous breast tissue, pictured with an atomic medication scanner. It is known by different names, counting the Miraluma test, the Sestamibi test, scintimammography, or particular gamma imaging [31]. MBI utilizes Tc-99m sestamibi, an endorsed tracer, with comparable affectability to MRI but higher specificity for identifying little

breast injuries [32]. Breast biopsy is the foundation of breast cancer determination, regularly employing a "triple test" combining clinical examination, imaging, and biopsy methods. Needle biopsy incorporates fine needle goal cytology (FNAC) and core needle biopsy (CNB). FNAC is less invasive and fast, including the extraction of cells from suspicious breast injuries for research facility investigation. CNB, more invasive, extra's little tissue centers, upgrading demonstrative exactness [33].

6) Radar Based Imaging Technology

Radar methods detect discontinuities within the dielectric constant within the medium. In specific, a division of the control lighted by the receiving wire framework is reflected by the irregularity back to the radio wire framework itself, and hence, the detection of the brokenness position is conceivable. This technique is additionally reasonable for breast cancer location; studies reported in examined the electrical characteristic of human tissues. In specific, it is clear that within the microwave region the of tumor tissue is around five times more noteworthy than that of fat. The gotten signals s weakened due to not as it were tissue proliferation misfortunes but too the restricted backscattering of a target with little dimensions [34].

7) Breast Cancer Diagnosis Advantage

When AI is utilized in mammography, it can identify cancer up to two a long time prior than a human oncologist. On the off chance that illnesses can be distinguished and treated sooner, more lives can be saved. Specialists can be more certain in their analyze with the help of AI, in this way expanding their proficiency. AI too diminishes the stress by radiologists. Rather than investing hours perusing mammogram pictures, AI is never tired. With AI, exactness and prior cancer detection are achieved. In expansion, with the assistance of AI, therapeutic care can be enhanced. The utilize of AI-based symptomatic instruments within the determination of breast cancer has made a difference increment the effectiveness of radiologists and produces comes about that are way better than those gotten by radiologists working alone.

3. Conclusion

In this review we pointed to summarize and update the current information almost breast Cancer with an accentuation on its innovations, chance components and accessible treatment methodologies. The AI system utilized in this study had great affectability and specificity compared with the radiologist and in this way may be utilized to move forward the determination and discovery of breast cancer. In mammography, AI points to enhance cancer detection accuracy and review rates. In conclusion, we have illustrated high sensitivity for the location of known cancers utilizing an abbreviated MRI protocol.

References

[1] Ferlay, J., Soerjomataram, I., Dikshit, R., Eser, S., Mathers, C., Rebelo, M., Parkin, D.M., Forman, D. and Bray, F. (2015), Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. Int. J. Cancer, 136: E359-E386.

[2] Mehdy MM, Ng PY, Shair EF, Saleh NIM, Gomes C. Artificial Neural Networks in Image Processing for Early Detection of Breast Cancer. Comput Math Methods Med. 2017;2017:2610628.

[3] Cotterchio M, Mirea L, Ozcelik H, Kreiger N. Active cigarette smoking, variants in carcinogen metabolism genes and breast cancer risk among pre and postmenopausal women in Ontario, Canada. Breast J.2014;20(5):468–480.

[4] Mombelli S. Cancers du sein immunology anti-tumorale [Ph.D. dissertation]. France: Univ. Reims Champagne-Ardenne; 2014

[5] Broeders M, Moss S, Nystroms L, et al., The impact of mammographic screening on breast cancer mortality in Europe: a review of observational studies. J Med Screen. 2012;19(suppl 1):14 QA–25.

[6] Lauby-Secretan B, Scoccianti C, Loomis D, et al., Breast cancer screening–viewpoint of the IARC Working Group. N Engl J Med. 2015;37224:2353–2358.

[7] Marmot MG, Altman DG, Cameron DDewar JA, Thompson SG, Wilcox M. The benefits and harms of breast cancer screening: an independent review. Br J Cancer. 2013;10811:2205–2240.

[8] Lauby-Secretan B, Scoccianti C, Loomis D, Benbrahim-Tallaa L, Bouvard V, Bianchini F, et al. Breast-cancer screening d viewpoint of the IARC working group. N Engl J Med 2015;372(24):2353e8.

[9] Independent UK Panel on Breast Cancer Screening. The benefits and harms of Breast cancer screening: an independent review. The Lancet 2012;380(9855):1778e86.

[10] Nelson HD, Pappas M, Cantor A, Griffin J, Daeges M, Humphrey L. Harms of Breast cancer screening: systematic review to update the 2009 U.S. Preventive services task force recommendation. Ann Intern Med 2016;164(4):256e67.

[11] Jochelson, M. Advanced Imaging Techniques for the Detection of Breast Cancer; American Society of Clinical Oncology Educational Book: Alexandria, VA, USA, 2012; pp. 65–69.

[12] Yaffe, M.J. AAPM tutorial. Physics of mammography: Image recording process. Radio Graphics 1990, 10, 341–363.

[13] Andreea GI, Pegza R, Lascu L, Bondari S, Stoica Z, Bondari A. The role of imaging techniques in diagnosis of breast cancer. Curr Health Sci J. 2011;37:241–248.

[14] Albert US, Altland H, Duda V, Engel J, Geraedts M, Heywang-Köbrunner S, Hölzel D, Kalbheim E, Koller M, König K. 2008 update of the guideline: early detection of breast cancer in Germany. J Cancer Res Cling Uncoil. 2009;135:339–354.

[15] Guo R, Lu G, Qin B, Fei B. Ultrasound imaging technologies for breast cancer detection and management: a review. Ultrasound Med Biol., 2018;44:37–70.

[16] M Gharekhanloo F, Haseli MM, Torabian S. Value of ultrasound in the detection of benign and malignant breast diseases: a diagnostic accuracy study. Oman Med J. 2018;33:380.

[17] K. Planche and S. Vinnicombe, "Breast imaging in the new era," Cancer Imaging, vol. 4, no. 2, pp. 39–50, 2004.

[18] Zeng, J.; Liu, Z.; Shen, G.; Zhang, Y.; Li, L.; Wu, Z. MRI evaluation of pulmonary lesions and lung tissue changes induced by tuberculosis. Int. J. Infect. Dis. 2019, 82, 138–146.

[19] Zhang, L.; Ren, Z. Comparison of CT and MRI images for the prediction of soft-tissue sarcoma grading and lung metastasis via a convolutional neural networks model. Clin. Radiol. 2020, 75, 64–69.

[20] Arteaga-Marrero, N.; Villa, E.; González-Fernandez, J.; Martín, Y.; Ruiz-Alzola, J. Polyvinyl alcohol cryogel phantoms of biological tissues for wideband operation at microwave frequencies. PLoS ONE 2019, 14, e0219997.

[21] Mann, R.M.; Cho, N.; Moy, L. Breast MRI: State of the Art. Radiology 2019, 292, 520–536.

[22] K. Planche and S. Vinnicombe, "Breast imaging in the new era," Cancer Imaging, vol. 4, no. 2, pp. 39–50, 2004.

[23] S. G. Orel and M. D. Schnall, "MR imaging of the breast for the detection, diagnosis, and staging of breast cancer," Radiology, vol. 220, no. 1, pp. 13–30, 2001.

[24] Grayaa, K. Microwave imaging of dielectric cylinders using level set method and conjugate gradient algorithm. Prog. Electromagn. Res. M 2012, 23, 195–205.

[25] Salerno, E. Using a nonlinear Landweber algorithm to reconstruct 1D permittivity range profiles from coherent microwave backscattering data. Sensors 2005, 5, 493–506.

[26] Xiao, F.C.; Yabe, H. Microwave imaging of perfectly conducting cylinders from real data by micro genetic algorithm coupled with deterministic method. IEICE Trans. Electron. 1998, 81, 1784–1792.

[27] Noghanian, S.; Sabouni, A.; Pistorius, S. A numerical approach to microwave imaging based on genetic algorithm optimization. In Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems V, Proceedings of the Proceedings Volume 6177, San

Diego, CA, USA, 26 February–2 March 2006; SPIE: Bellingham, WA, USA, 2006; p. 61771B.

[28] Lulu Wang, Microwave imaging and sensing techniques for Breast cancer Detection, Biomedical Device Innovation Center, Shenzhen Technology University, Shenzhen 518118, China Micromachines 2023, 14(7), 1462.

[29] Nounou, M.I.; ElAmrawy, F.; Ahmed, N.; Abdelraouf, K.; Goda, S.; Syed-Sha-Qhattal, H. Breast Cancer: Conventional Diagnosis and Treatment Modalities and Recent Patents and Technologies. Breast Cancer Basic Clin. Res. 2015, 9, BCBCR-S29420.

[30] Elmore, J.G.; Armstrong, K.; Lehman, C.D.; Fletcher, S.W. Screening for Breast Cancer. JAMA 2005, 293, 1245–1256.

[31] Bevers, T.B.; Anderson, B.O.; Bonaccio, E.; Buys, S.; Daly, M.B.; Dempsey, P.J.; Farrar, W.B.; Fleming, I.; Garber, J.E.; Harris, R.E.; et al. Breast Cancer Screening and Diagnosis: Clinical Practice Guidelines in Oncology. J. Natl. Compr. Cancer Netw. JNCCN 2009, 7, 1060–1096.

[32] Stefano Moscato, Giulia Matrone, Marco Pasian, Andrea Mazzanti, Maurizio Bozzi, Luca Perregrini, Francesco Svelto, Giovanni Magenes, Paolo Arcioni, Paul Summers, "A mm-Wave 2D Ultra-Wideband Imaging Radar for Breast Cancer Detection", International Journal of Antennas and Propagation, vol. 2013, Article ID 475375, 8 pages, 2013.

[33] Mendes J, Domingues J, Aidos H, Garcia N, Matela N. AI in Breast Cancer Imaging: A Survey of Different Applications. J Imaging. 2022;8(9):228.

[34] Ozsahin I., Uzun Ozsahin D. Applied Machine Learning and Multi-criteria Decision-making in healthcare. Bentham Science Publishers; Sharjah, United Arab Emirates: 2021.