C2 AI IN WOMEN'S IMAGING

Objectives:

Identify and define	Identify and define Women's Imaging
Identify and define	Identify and define AI
Explain	Explain the benefits of the use of AI in the healthcare field
Provide	Provide reasoning as to why computers are used in Women's Imaging
Provide	Provide examples for AI applications in Women's Imaging and the future possibilities of AI
Explain	Explain the potential risk/reward of AI

WHAT IS 'WOMEN'S IMAGING'?

Women's Imaging covers several different diagnostic imaging procedures that specifically apply to women.

Digital Mammography

Breast Tomosynthesis (DBT)

Ultrasound

Breast Biopsies (MRI, Stereotactic, Ultrasound, Needle, X-ray, etc.)

WHAT CAN THESE IMAGING PROCEDURES DO?

There are many notable benefits of diagnostic imaging for women:

❀ Diagnostic tests like digital screening exams can provide patients with immediate results.

❀ Some tests, like Mammograms, can detect early signs of cancer up to **years** in advance.

❀ For recovering cancer patients, women's imaging tests can monitor the after-effects of treatment and alert them of any reoccurrence.

❀ Imaging tests can help increase a patient's chances of survival and recovery by catching diseases early.

SO…WHAT IS AI?

ARTIFICIAL INTELLIGENCE IS THE SIMULATION OF HUMAN INTELLIGENCE PROCESSES BY MACHINES, ESPECIALLY COMPUTER SYSTEMS.
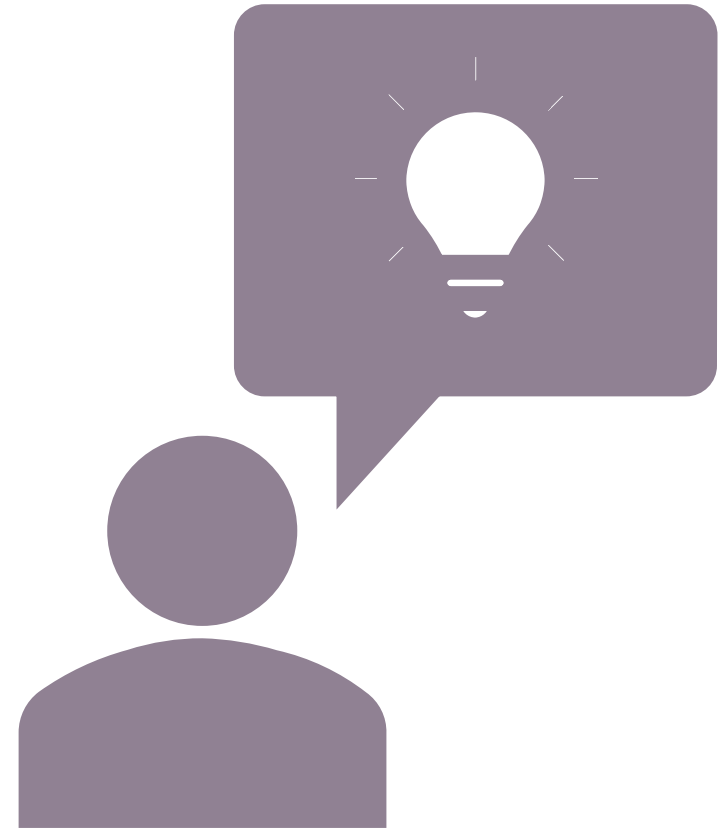
AI programming focuses on cognitive skills that include the following:

❀ Learning: This aspect of AI programming focuses on acquiring data and creating rules to turn it into usable information. The rules, which are called **algorithms**, provide computing devices with step-by-step instructions for how to complete a specific task.

❀ Reasoning: This aspect of AI programming focuses on choosing the right algorithm to reach a desired outcome.

❀ Self-Correction: This aspect of AI programming is designed to continually fine-tune algorithms and ensure they provide the most accurate results possible.

❀ Creativity: This aspect of AI uses techniques to generate new images, new text, new music, and new ideas.

Why is AI important in today's society?

AI is important for its potential to change how we live, work, and play.

In several areas, AI can perform tasks much better than humans.

Particularly when it comes to repetitive, detail-oriented tasks, such as analyzing large numbers of documents to ensure things are filled in properly, AI often completes jobs quickly and with relatively few errors.
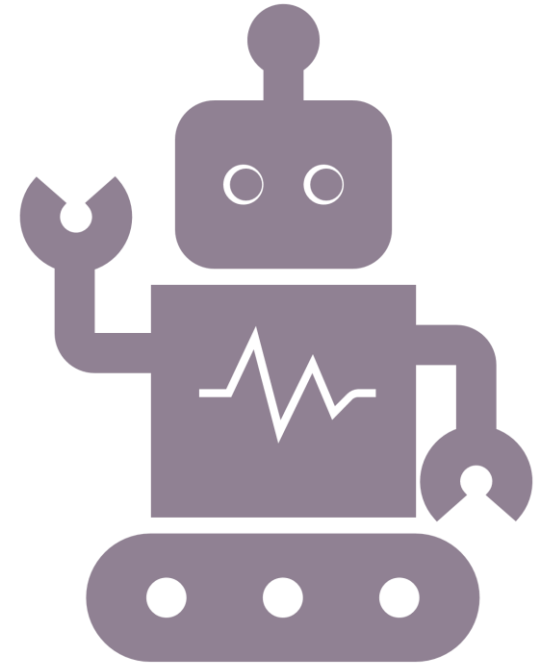
LET'S TAKE A CLOSER
LOOK AT DBT & AI

(DIGITAL BREAST
TOMOSYNTHESIS)

◆

Why would a woman need special diagnostic imaging?

———◇———

❊ Breast cancer is the most common cancer in women in the United States, excluding skin cancers, and represents nearly 1 in 3 new female cancers each year.

❊ "According to the American Cancer Society, there will be nearly 300,000 new cases of invasive breast cancer and over 50,000 cases of ductal carcinoma in situ diagnosed in 2023, with over 43,000 deaths attributable to breast cancer in the United States alone." (Taylor, Monga, Johnson, 2023).

❊ The purpose of any breast cancer screening program is to reduce the morbidity and mortality of breast cancer by identifying early, small breast cancers to ensure accurate diagnosis and optimal treatment.

WHY
COMPUTERS?
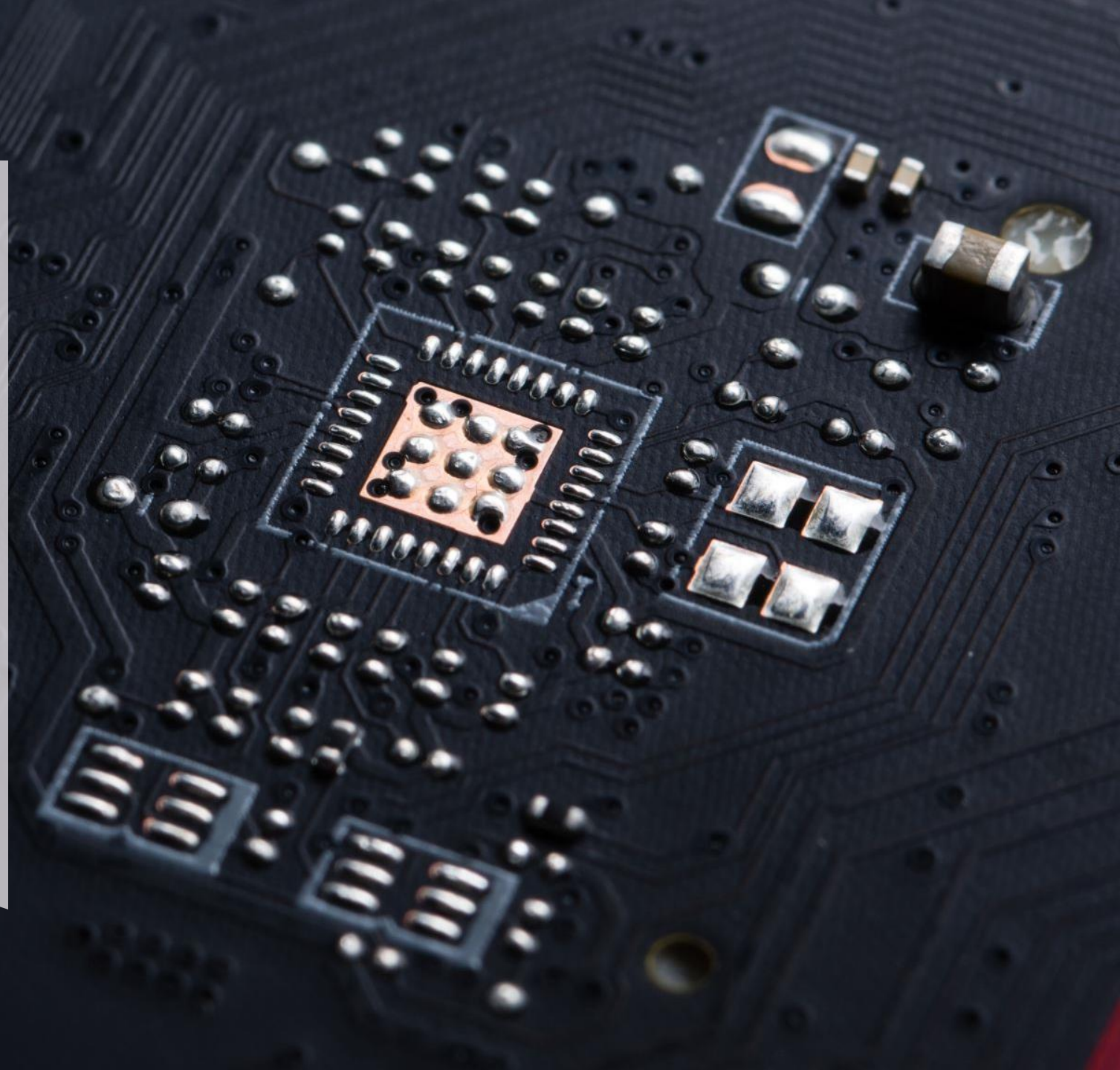
C.A.D

- Using computers to improve performance is not new in diagnostic imaging and has a long history in breast imaging in the form of computer-aided detection (CAD).

- Despite the program being helpful for many radiologists reading mammograms, a study published in July 2011 found that CAD use reduced specificity by increasing recall rates, with no increase in sensitivity or invasive tumor characteristics (stage, size, or lymph node status).

- Other studies find that CAD use reduced overall radiologist reading accuracy.

- The failure of CAD to fill the need for improving mammography performance creates an opportunity for artificial intelligence (AI) in breast imaging.

AI in Breast Imaging: Good or Bad?

Breast Imaging Opportunities:

- Standardized positioning and technique
- Large available data sets for training
- Familiarity with and acceptance of computer-aided detection (CAD)
- utilizing a predefined methodology and framework from the radiologist's interpretation of breast imaging studies and the mapping of results

Breast Imaging Challenges:

- Recent widespread adoption of digital breast tomosynthesis (DBT)
- File sizes are extremely large
- Clinical information obtained from patients, referring providers, and technologists is key for accurate interpretation
- Breast imaging interpretation can rely on concurrently performed mixed-modality (mammography, ultrasound, MRI) studies

Applications for AI in Breast Imaging:

❀ Cancer detection

❀ Decision support in diagnosis or treatment

❀ Cancer risk assessment

❀ Image enhancement

❀ Workflow Triage

❀ Image quality assessment

❀ Density quantification

Future possibilities for AI in women's imaging:

❀ As of now, there are at least 20 available FDA-approved AI-based applications available today for breast imaging

❀ Beyond these applications, there are many more areas for AI in breast imaging that are being investigated and developed.

❀ Things like breast density and cancer detection are at the forefront of the future of AI in breast imaging.

❀ Other areas like how it affects the workflow triage and applying it to chemo treatments are more investigational and not as easily accepted yet.

There is a real future for AI in women's diagnostic imaging.

Are there risks with AI?

There are significant barriers to the implementation of AI applications in breast imaging, including inconsistent performance, cost, and IT requirements, along with the lack of radiologists, patients, and referring provider familiarity and trust.

Additional obstacles to the successful use of AI in breast imaging include a lack of understanding of how radiologists interact with AI applications. This includes concerns about how biases may lead inexperienced radiologists to over-rely on AI applications, resulting in diminished clinical performance.

Will AI make Radiologists in women's imaging obsolete?

❀ With the growing use of AI in breast imaging, it will be necessary in the future to determine the roles of radiologists and AI in the clinical setting to maximize the clinical benefit.

❀ These roles may change over time, but the near future may include tasks that are best served by AI alone, radiologists alone, or AI and radiologists together.

❀ It will be essential to build trust and help form the perceptions of patients and referring providers towards AI in breast imaging.

❀ Patient attitudes and perceptions towards AI in radiology are complicated and include feelings of distrust and accountability, concerns about procedural knowledge, a preference for preserving personal interaction, efficiency, and remaining informed about use.

❀ Data suggests that there will be future work towards educating patients on how AI can be implemented in breast imaging and how to keep patients aware of the benefits and limitations of its use.
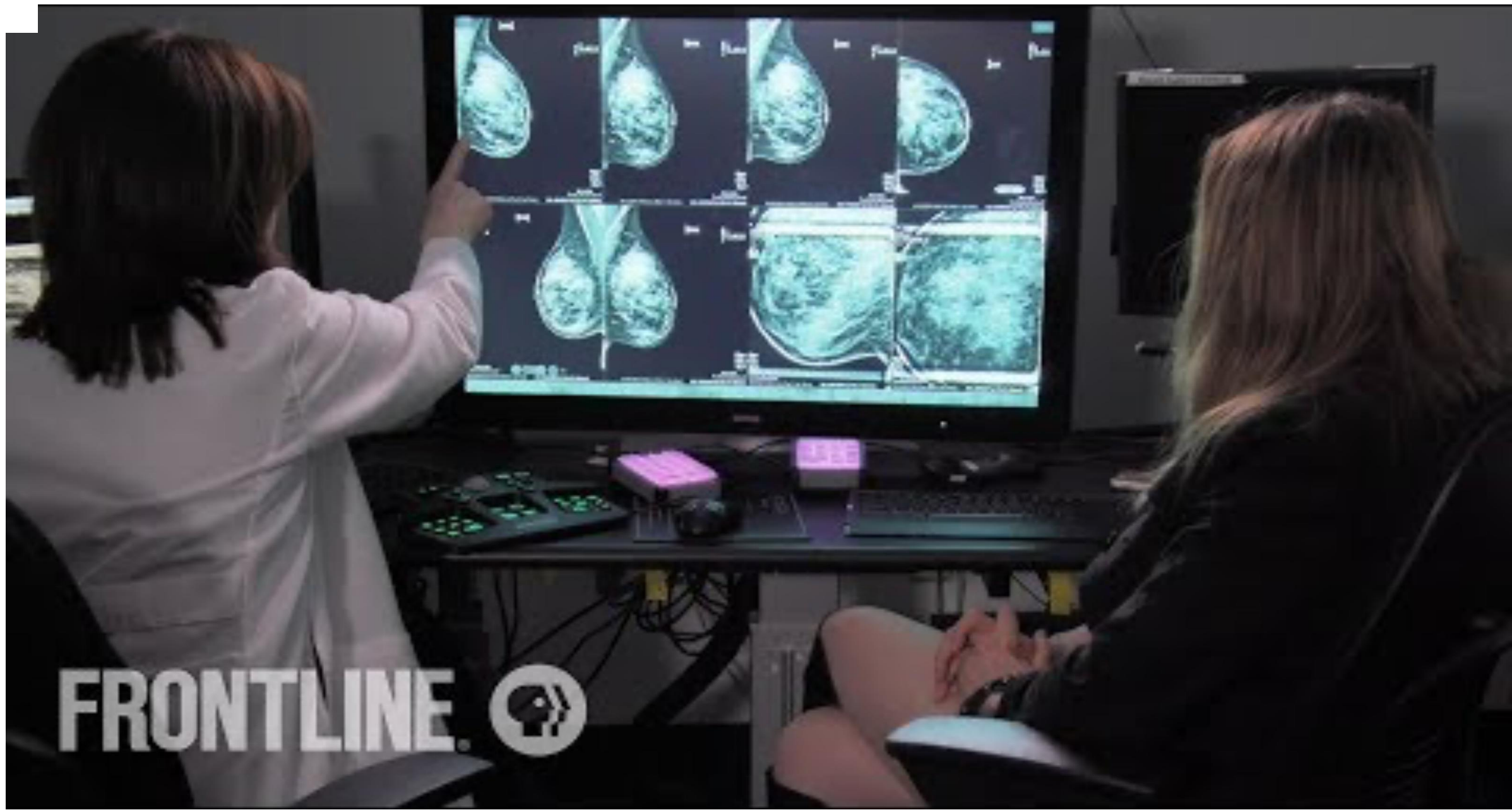
FRONTLINE

Conclusion

Women's Imaging covers several different diagnostic imaging procedures that specifically apply to women. (Digital Mammography, Breast Tomosynthesis, Ultrasound, etc.)

There are many notable benefits of diagnostic imaging for women: Imaging tests can help increase a patient's chances of survival and recovery by catching diseases early.

AI programming focuses on cognitive skills: Learning, Reasoning, Self-Correction, and Creativity. In several areas, AI can perform tasks much better than humans.

Using computers to improve performance is not new in diagnostic imaging and has a long history in breast imaging in the form of computer-aided detection (CAD).

Applications for AI in Breast Imaging: Cancer detection, cancer risk assessment, image enhancement, workflow triage, density quantification

As of now, there are at least 20 available FDA-approved AI-based applications available today for breast imaging. Beyond these applications, there are many more areas for AI in breast imaging that are being investigated and developed

It will be essential to build trust and help form the perceptions of patients and referring providers towards AI in breast imaging.

References:

Davenport, T., & Kalakota, R. (2019, June). *The potential for artificial intelligence in Healthcare*. Future healthcare journal. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/

Developer. (2022, July 11). *What is Women's Imaging?* Envision Radiology. https://www.envrad.com/what-is-womens-imaging/#:~:text=Women's%20imaging%20covers%20several%20diagnostic,gynecological%20complications%20or%20breast%20cancer.

Laskowski, N., & Tucci, L. (2023, November 13). *What is artificial intelligence and how does ai work?: Definition from TechTarget*. Enterprise AI. https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence

Pablos, T. (2020, November 12). *3 topics shaping the future of Women's imaging*. AuntMinnie. https://www.auntminnie.com/resources/conference/rsna/article/15627183/3-topics-shaping-the-future-of-womens-imaging

Women's services - diagnostic imaging & interventional radiology. Grossmont Imaging - Xray Medical Group . (n.d.). https://www.xraymedicalgroup.com/services-womens-imaging.html