


Artificial Intelligence in Mammography

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Conflicts of interest - Of course, I'm the Volpara Guy!




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Artificial Intelligence as Promised


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Artificial Intelligence as Delivered

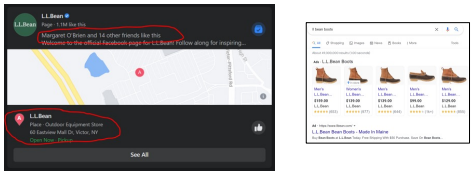
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Raise your hand if you use AI



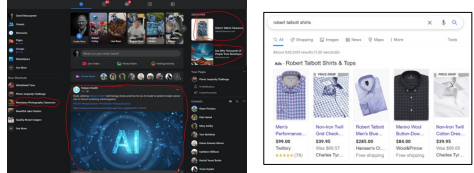
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Search on L.L. Bean Boots



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Search on Robert Talbott Shirts



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Search on Volpara – We'll Find You ☺

PREVENT
ADVANCED-STAGE
BREAST CANCER

Volpara Health

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History & types of artificial intelligence

Artificial intelligence
Programming of machines to simulate human intelligence. A computer also trying to replicate human vision by understanding it.

Machine learning
Ability to learn without being explicitly programmed.

Deep learning
Learning based on deep neural networks.

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AI must work with a wide range of variables:

- Breast size and tissue composition
- X-ray machine types and settings
- Technologist factors, e.g., compression, positioning, artifacts
- Image processing (if not using raw x-ray images)

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Challenge 1: each patient is unique

• > 13M women attend a Volpara breast clinic annually.

• Volpara has collected 60M raw images, securely stored in the cloud.

• Volpara® Analytics™ enables analysis of that data to provide site-wide analytics and nationwide benchmarking.

Low breast volume
High breast density

High breast volume
Low breast density

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Challenge 2: vendor unit variability

Machine brand (US)

Brand	Percentage
GE	54.54%
Other	1.8%
Hologic	43.6%

Screening modalities

Modality	USA (%)	Rest of world (%)
3D	~45%	~35%
Combo	~45%	~30%
2D	~15%	~35%

Each machine has different versions and settings. This presents a challenge for most AI to work across all of them.

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Challenge 3: variation from paddles

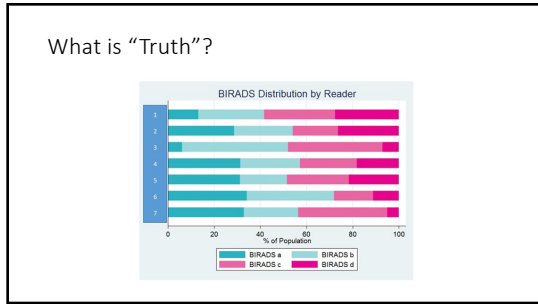
Paddles used

Paddle Type	Percentage
Standard	~70%
Flexible	~10%
Other	~10%
Diagnostic	~5%
Curved	~5%
Procedure	~5%

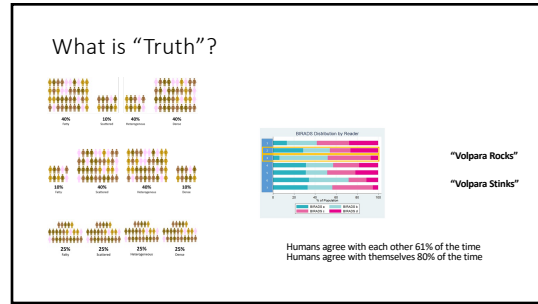
Paddles can create significant artifacts the AI must deal with—either slant across an image or other issues, such as this from a curved paddle.

Knowing the physics allows the user to correct for most issues prior to AI processing—that is computer vision.

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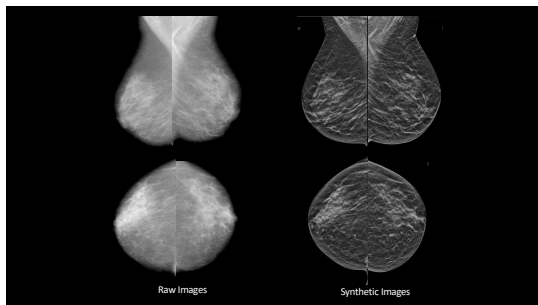


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What is Truth?

- Use of DICOM Raw data avoids bias introduced by using processed data
- Different manufacturers' images are processed with proprietary algorithms
- The same manufacturer will change processing algorithms

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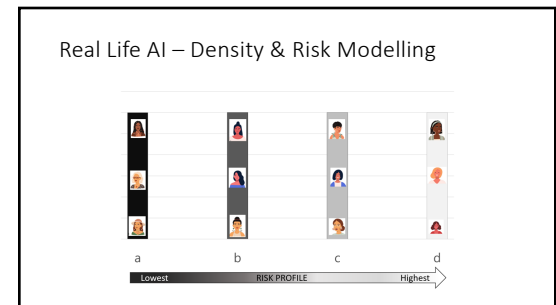


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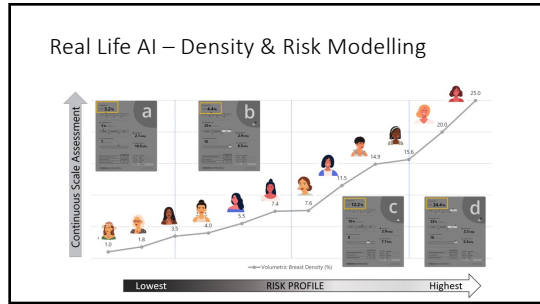
What is "Truth"?

- MRI has long been established as the "truth" regarding breast density
- Algorithm developed based on physics avoids bias introduced by human interpretation
- Volumetric density based on physics provides a 3D textured "map" of breast tissue

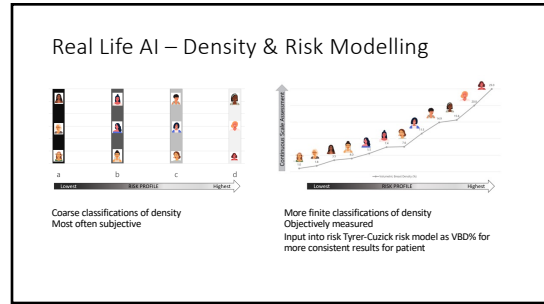
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What is "Truth"?

Bassett 1993	Huppe 2018	Volpara 2021
6 Technologists	5 Technologists	3,600 Technologists
6 Technologists	5 Technologists	3,600 Technologists
1,000 Mammograms	340 Mammograms	50,000,000 Mammograms

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Real Life AI - Measurement

Volpara's Analytics AI, (Deep Learning), assesses breast geometry in the CC view:

- Nipple Central without Exaggeration
- No Cut-off
- Nipple in Profile
- PNL Length

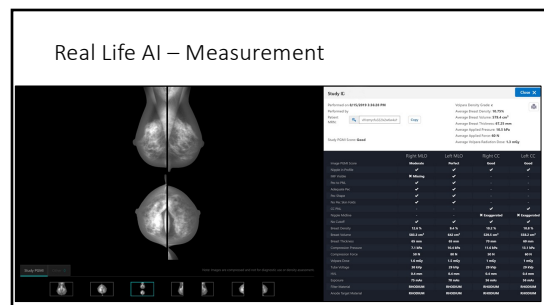
Volpara's Analytics AI, (Deep Learning), assesses breast geometry in the MLO view:

- Pectoral Muscle Length
- Pectoral Muscle Shape
- Nipple in Profile
- IMF Visible
- PNL Length

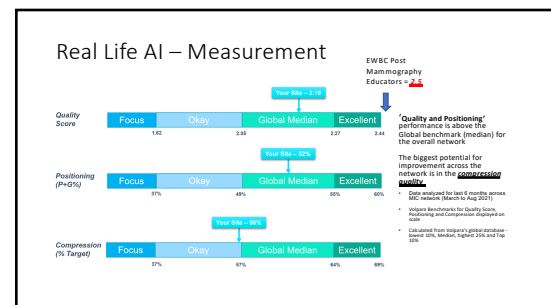
Comprehensive assessment of adequate pectoral including the extension and width of the muscle on the image

- Pectoral skin fold
- Detection of tissue cut-off

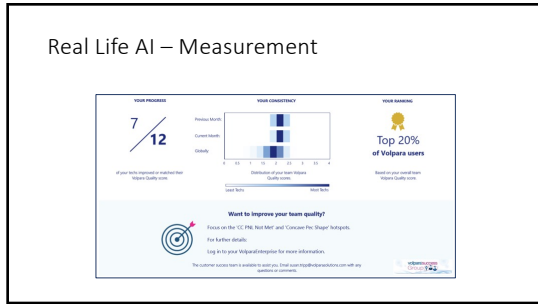
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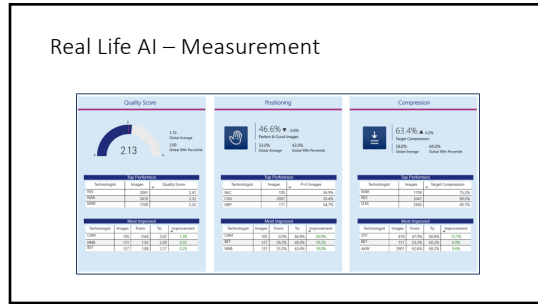
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Real Life AI – Rejected Images

Patient has mammogram taken and then get called back for additional views.

- Volpara determines compression is 3.7kPa of pressure which is ~40% of the ideal pressure based on force from the mammo unit and breast contact area with the compression paddle
- Feedback to RT is based on SQMMI images in the Volpara Database

Patient return for mammogram and this time is compressed properly and everything is normal.

- Patient was worried that their might be a problem
- Patient has to take off of work, find child care, etc.
- Radiologist put in position to determine if the image needs to be rejected
- Patient receives additional radiation
- Facility has to use room that may have been used to accommodate another patient for a mammogram
- Patient gets billed for additional procedure

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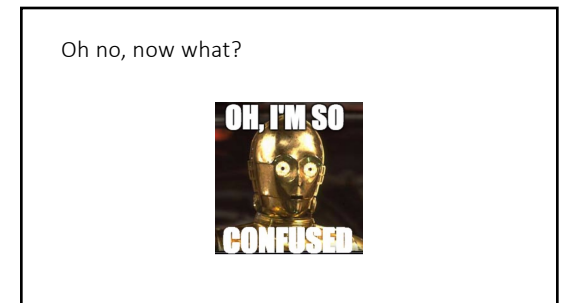
Identified and Addressed!

Analytics
The Analytics in Action program helps breast imaging centers create a culture of learning and continuous quality improvement.

Mammography Initial Training Programs

- 50K Technologists Trained
- 97K Breast Pnc Data
- 19 Countries Served

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Oh no, now what?

ChatGPT for health care providers: Can the AI chatbot make the professionals' jobs easier?

Introducing ChatGPT
We've trained a model called ChatGPT which interacts in a conversational way. The dialogue format makes it possible for ChatGPT to answer follow-up questions, admit to mistakes, challenge incorrect premises, and reject inappropriate requests.

Elon Musk and others urge AI pause, citing 'risks to society'

Misinformation machines? Common sense the best guard against AI chatbot 'hallucinations', experts say

Use technology as a tool not a crutch, AI experts advise

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Oh no, now what?

Ask Wang, PhD
Here is my test result from MedgenAI

Input the image of USG - A.

Q: What is this image about?
A: The image shows a mammogram, which is an X-ray image of the breast. The mammogram is used to detect breast cancer and other breast abnormalities. The image shows the breast tissue in cross-section, with the dark areas indicating the areas of the breast that are dense. The image is used to detect breast cancer and other breast abnormalities.

Q: What is the BRADIS of this image, and what's the density percent?
A: The BRADIS of this image is 6, and the density percent is 50%.

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Oh no, now what?

Input the image with IBC?

Q: Any unusual features in this image? such as focal density or breast arterial calcification?
A: Yes, there are no unusual features in this image such as focal density or breast arterial calcification. The breast tissue appears to be well-defined and without any areas of density or calcification.

Clearly, the model understands mammograms, but it lacks the ability to analyze it. 38, it's not bad at all.

Image source:
University breast density evaluation using fully automated techniques: its comparison with clinical density scale and correlation with the risk of coronary artery disease and cardiovascular and metabolic risk factors | Full text (springer.com)

Special collaboration between Technology Advances Against Foundation.org

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Take-aways

- AI, Machine Learning, Deep Learning are not going away
- AI is not evil but not yet ready for prime-time
- Computers don't come into a situation and ever leave so embrace the technology – you won't win the fight
- Just because a product or service uses AI does not mean something is automatically good or even better than it used to be
- Well sorted data and "truth" is key to the use of AI in medical imaging

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Questions?, Muffins?, Chihuahua?

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