Artificial Intelligence in Mammography v. 2

David Mezzoprete
Global Business Development
Volpara Health

David.mezzoprete@volparahealth.com
585 737 0587

Conflicts of Interest – Of course, I'm the Volpara & Lunit Guy!

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Why AI in Mammography?

Problem

- Hard to detect cancers resulting in 10-30% being overlooked
- Increase volume of images via tomography
- Increased need for proficient breast specialists
- Traditional C-CAD shows too many false positive marks causing radiologist to acknowledge or ignore

Solution

- Must improve radiologists' performance
- Must increase early cancer detection rate
- Must fit into existing workflow of mammography facility and/or enable increase in workflow

1 Kim HE, Kim HH, Han BK, et al. Changes in cancer detection and false-positive recall in mammography using artificial intelligence: a retrospective, multireader study. Lancet Digit Health. 2020
2. Fenton JJ, Taplin SH, Carney PA, et al. Influence of computer-aided detection on performance of screening mammography. N Engl J Med 2007;356:1399-1409
3. Gur D, Sumkin JH, Rockette HE, et al. Changes in breast cancer detection and mammography recall rates after the introduction of a computer-aided detection system. J Natl Cancer Inst 2004;96:185-190
4. Hall FM. Breast imaging and computer-aided detection. N Engl J Med 2007;356:1464-1466

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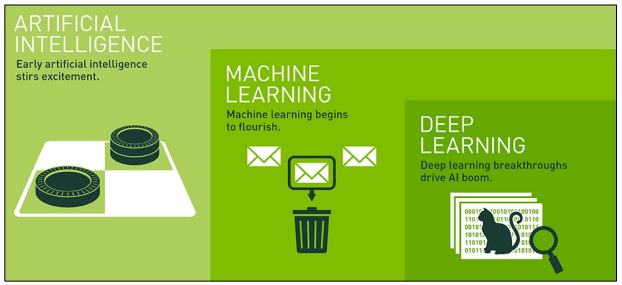
CAD v. Deep Learning AI



Late 1990's | CAD Early 2010's | AI Early 2020's

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CAD v. Deep Learning AI

- Machine Learning CAD: Hand-crafted
- Deep Learning: Adjusted & Fine-tuned by Machine (AI)

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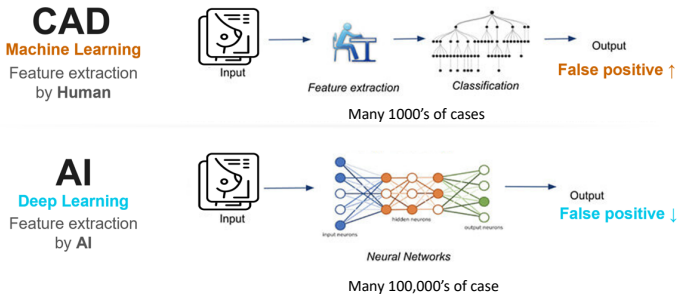
CAD v. Deep Learning AI



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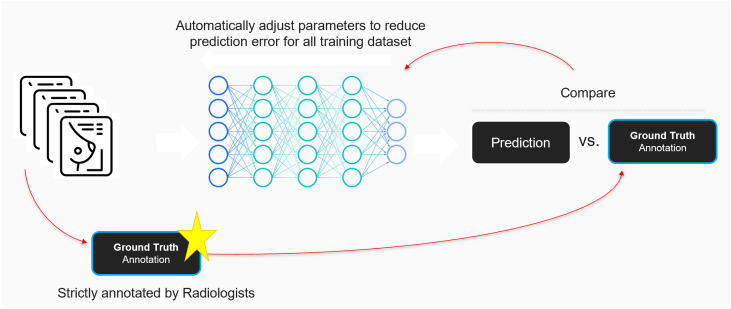
CAD v. Deep Learning AI



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Pixel Level Evaluation

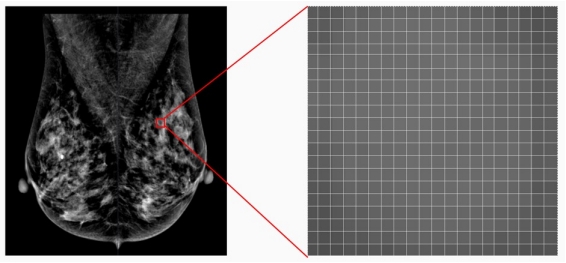

Image Evaluation @ Pixel Level – Impossible for Human Reader

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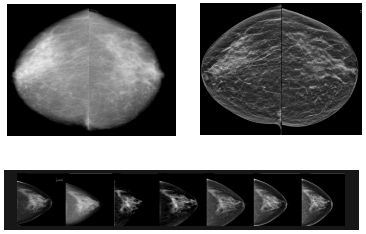
Must Train on Many Variables

- Breast size and tissue composition
- X-ray machine types and settings
- Technologist factors, e.g., compression, positioning, artifacts
- Image processing
- Need for data is important to train model – the more the merrier!



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Why Does This Matter?

Problem

- Hard to detect cancers resulting in 10-30% being overlooked
- Increase volume of images via tomography
- Increased need for proficient breast specialists
- Traditional C-CAD shows too many false positive marks causing radiologist to acknowledge or ignore

Solution

- Must improve radiologists' performance
- Must increase early cancer detection rate
- Must fit into existing workflow of mammography facility and/or enable increase in workflow
- Data from millions of mammograms used for training of algorithms

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2. Fenton JJ, Taplin SH, Carney PA, et al. Influence of computer-aided detection on performance of screening mammography. N Engl J Med 2007;356:1399-1409
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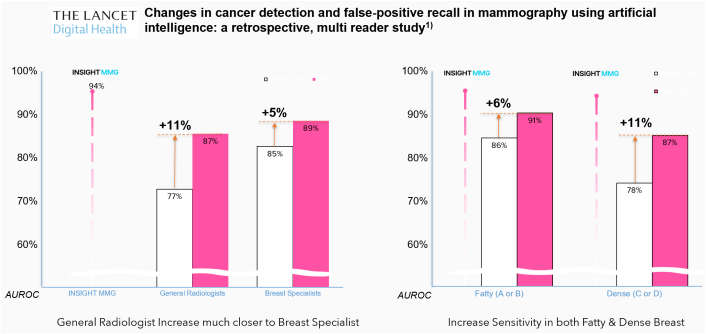
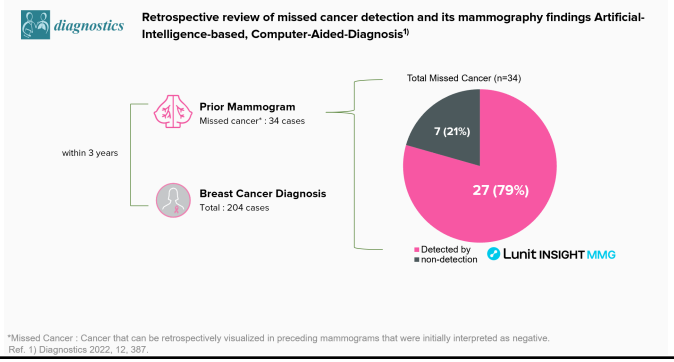
Improved Cancer Detection



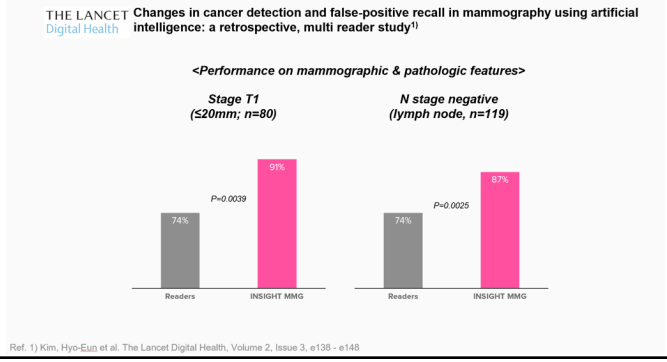
Ref. 1) Kim, Hyo-Eun et al. The Lancet Digital Health, Volume 2, Issue 3, e138 - e148

Increased Detection of Breast Cancer



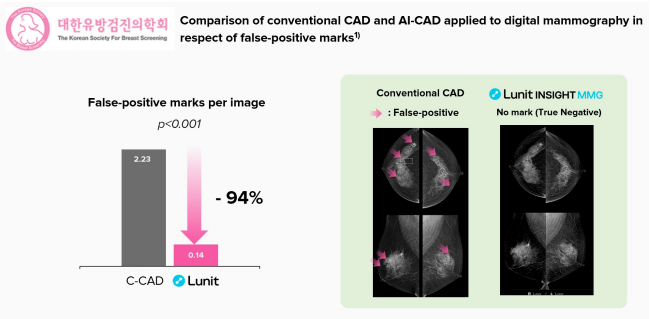
*Missed Cancer : Cancer that can be retrospectively visualized in preceding mammograms that were initially interpreted as negative.
Ref. 1) Diagnostics 2022, 12, 387.

Improved Early Stage Detection



Ref. 1) Kim, Hyo-Eun et al. The Lancet Digital Health, Volume 2, Issue 3, e138 - e148

Reduction in False Marks



Ref. 1) J.G. NAM ET AL. Eur Respir J 2021; 57: 2003061

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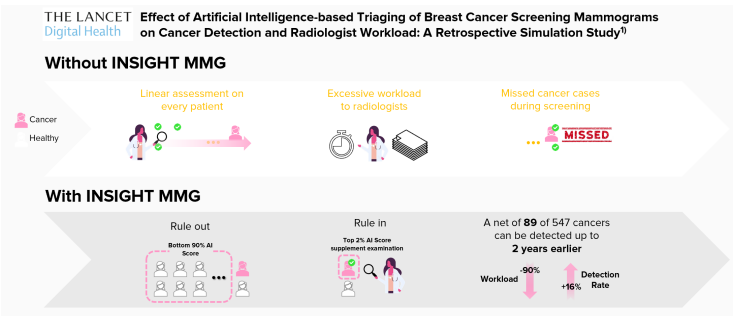
Less Workload & Increased Detection



Ref. 1) Dembrower, Karin et al. The Lancet Digital Health, Volume 2, Issue 9, e468 - e474

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Potential Second Reader Replacement

- AI algorithm combined with radiologist(s) compared to standard-of-care being two radiologists assessing screening mammograms in a true screening population
- Lunit INSIGHT MMG, when combined with a single human reader, can detect more cancers at a lower recall rate, compared to two human readers

Per 1000 exams	+	+ Lunit	Lunit INSIGHT MMG only
RR (recall rate)	29.3 >	**28.0**	15.5
CDR (cancer detection rate)	4.1 <	**4.3**	4.1

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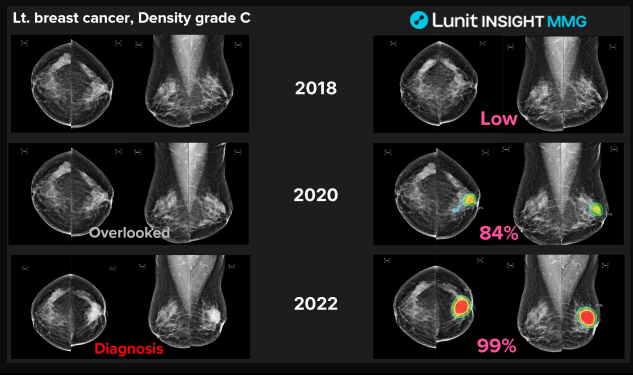
Clinical Case



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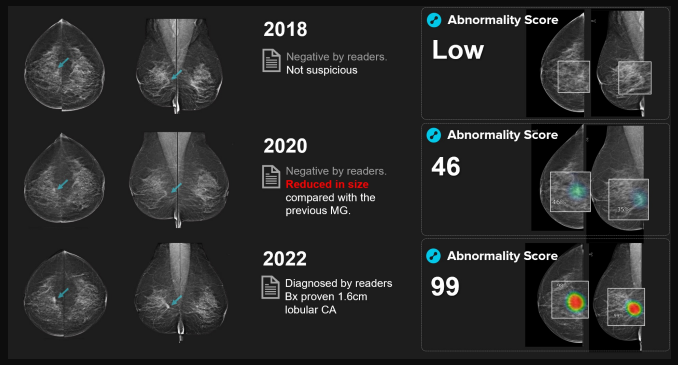
Clinical Case



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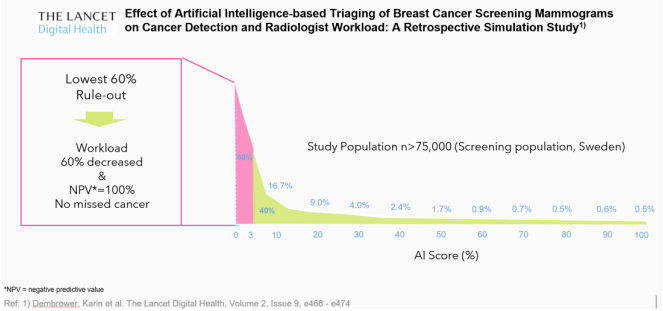
Pre-screen “Normal”

Karolinska Institutet



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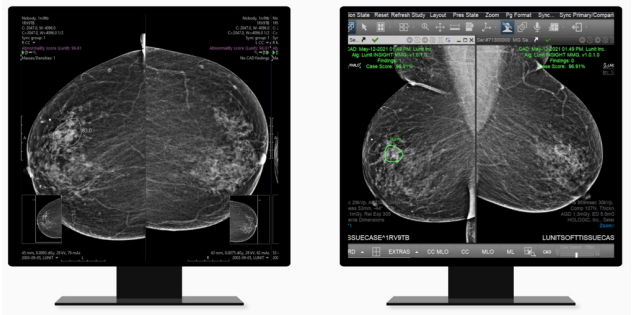
Fit Into / Improve Workflow



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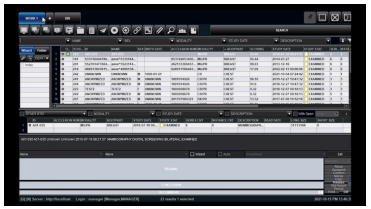

- Use PACS DICOM worklist on PACS to improve workflow for Radiologist
- Potential to establish a screening only protocol using data to exclude those patients that are at low risk

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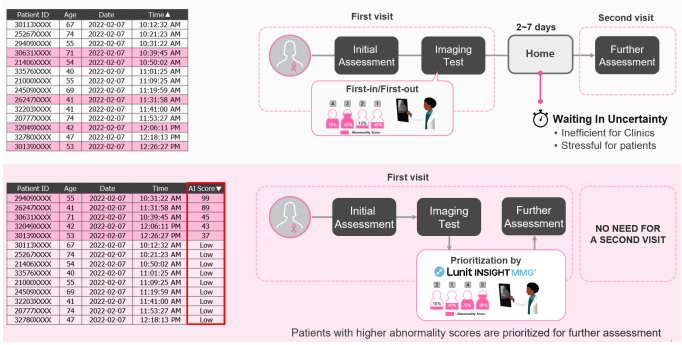
Fit Into / Improve Workflow



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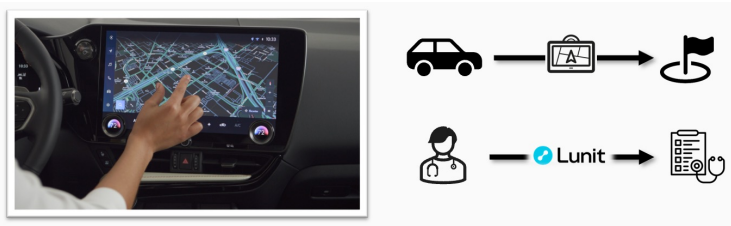
Fit Into / Improve Workflow



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Take-aways

- AI, Machine Learning, Deep Learning are not going away
- AI is not evil
- 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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