



# ONWARD

Enabling Better Outcomes

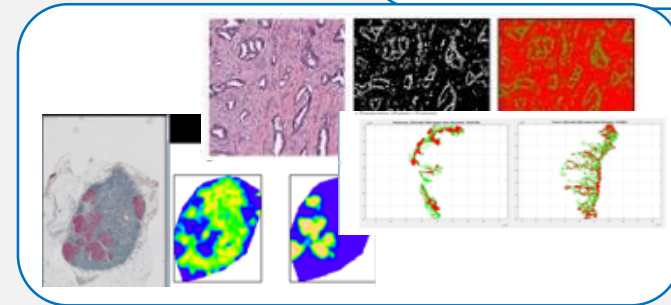
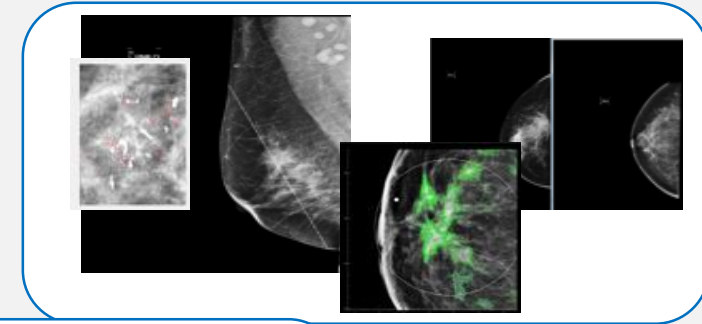
## Mammography AI

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# ONWARD ASSIST

## PLATFORM

**State-of-the-art AI platform to help clinicians make better medical decisions**

## BUILDING BLOCKS

*Focused on Patient risk scoring, automated diagnosis on large patient datasets, Multi-modal data pipeline*

## RESULTS

- Helping clinicians with
- ❖ Decision assistant in diagnostics
  - ❖ Treatment Effectiveness
  - ❖ Imaging based Insights



# TEAM

## Key Members



- Dinesh Koka** PGDM (IIML) | Anna Univ.
- 15+ years in Healthcare | GE, Startups
  - Work across Providers, Promoters, Govt
  - GE Region Director leading ~\$60M Rev

CEO, CoFounder



- Vikas Ramachandra** Ph.D (UCSD) | BITS Pilani
- 12+ years Industry + Research – Stanford
  - 5 Patents | Imaging, Sensors @ Qualcomm
  - ML-based Cancer Detection

Data Science, CoFounder



- Harish Prabhala** MPH (Yale) | MS (GWU)
- 5+ years Industry + Research
  - Healthcare EMR Consulting, Research
  - Data Science

Data Scientist



- Vineet Sharma** B.Tech (VJTI Mumbai) | IITB
- 6+ years Research, IOT, Data Science
  - Medtech, Embedded systems
  - Machine Learning

Data Scientist



Yale



QUALCOMM

Epic



# WHY MAMMOGRAPHY AI TOOL:

- Detect cancers early
- Reduce the false positives rates
- Reduce the recall rate
- Reduce unnecessary biopsies



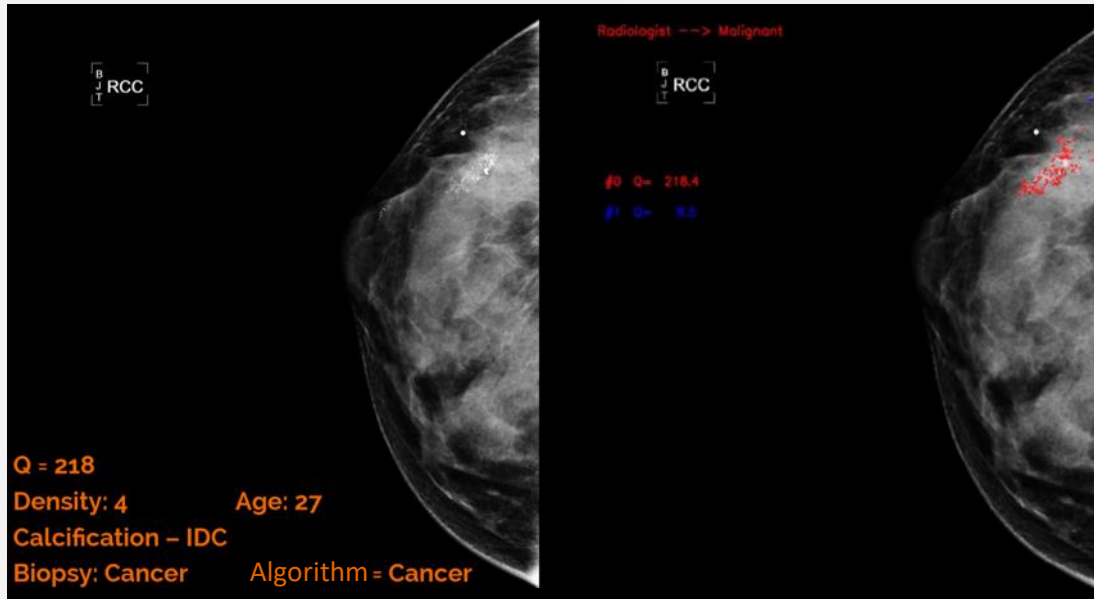
# MAMMOGRAPHY: CAPABILITIES INCLUDE

1. Identify as Benign and Malignant, separate cancer from normal
2. Detect contours and nestedness
3. Performs well on dense breast
4. Advanced Features include
  - Image registration (between CC and MLO views, between time separated scans of same patient over years)
  - Muscle finder (subtracts pectoral muscle)
  - Device finder (image the tumor even in the presence of needle biopsy, or implants)

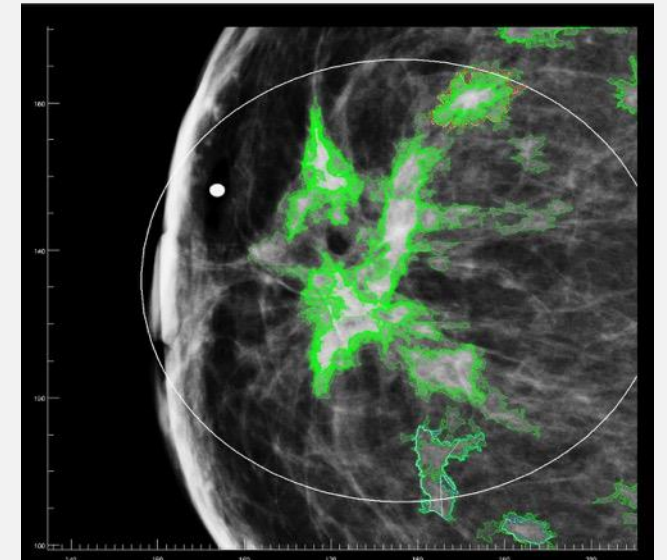
\*\* The tool was entirely built on MATLAB \*\*



# TOOL DEMO - CANCER DETECTION (1) -



<--Calcs  
Mass-->

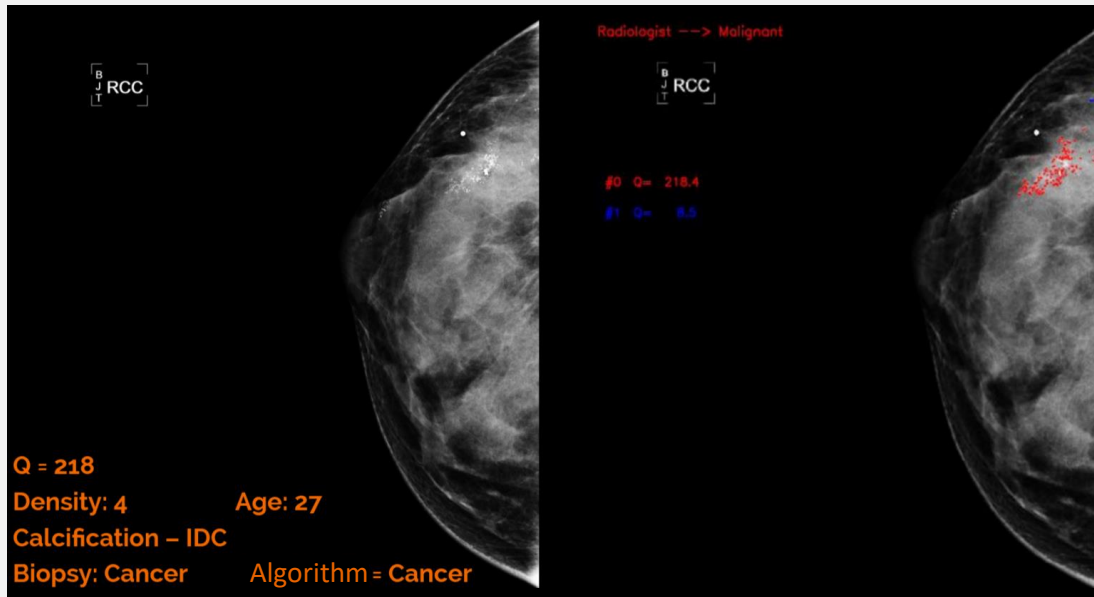


- Microcalcifications can be an early sign of breast cancer
- Spiculated Mass are the diagnostic feature of malignancy
- The white circle is annotated by the radiologist. We pinpoint it much further.

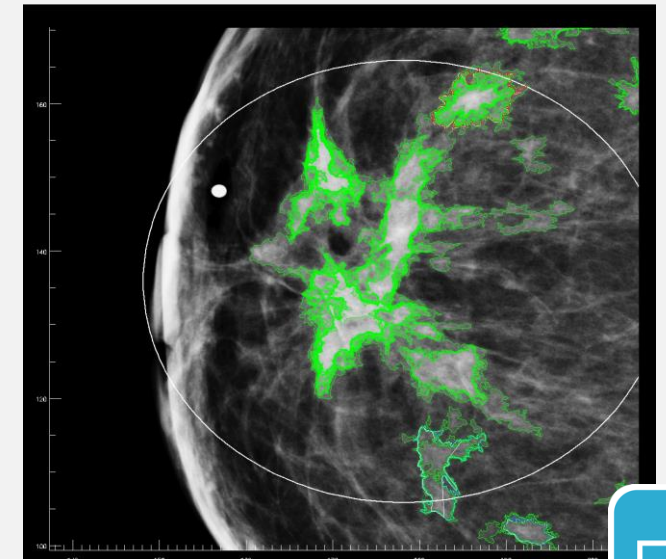


# CANCER DETECTION (I)

- Threshold the image into different levels based on the intensities
- Microcalcs can be seen as small hills with different slopes and intensities, when viewed from top
- Detect the slope of these hills
- Detect contours, nestedness, intensity, contrast, area, etc. clustering coefficient, texture and shape parameters.



<--Calcs  
Mass-->

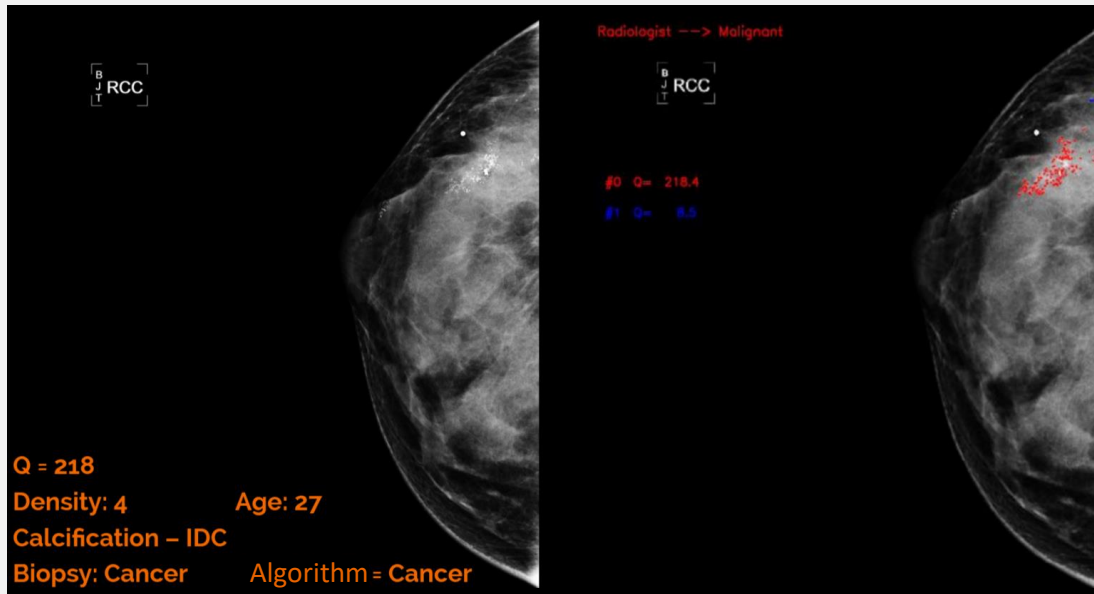


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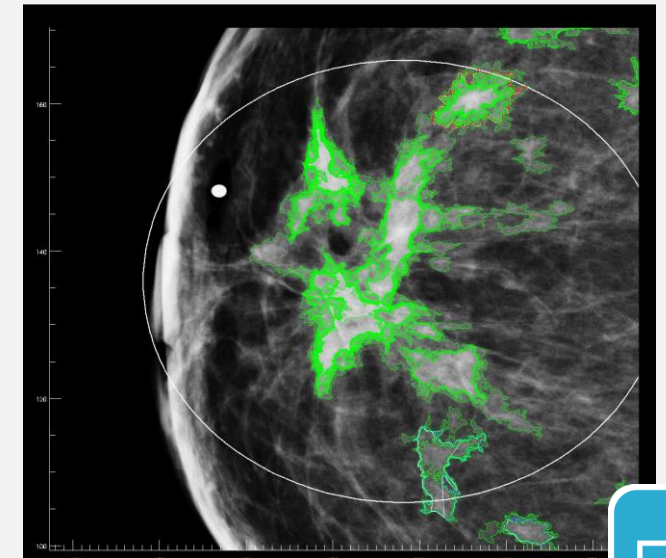


# CANCER DETECTION (I)

- Based on these features - peak of the slopes, roughness, distance, clusterness - we calculate a risk score
- Look at microcalcs cluster - doctors are interested - if not too many microcalcs cluster, then not probably cancer.
- Extracting all these features - we can train ML to train between true microcalcs and false positives
- Used Supervised learning - hand built features and also unsupervised learning (DL)



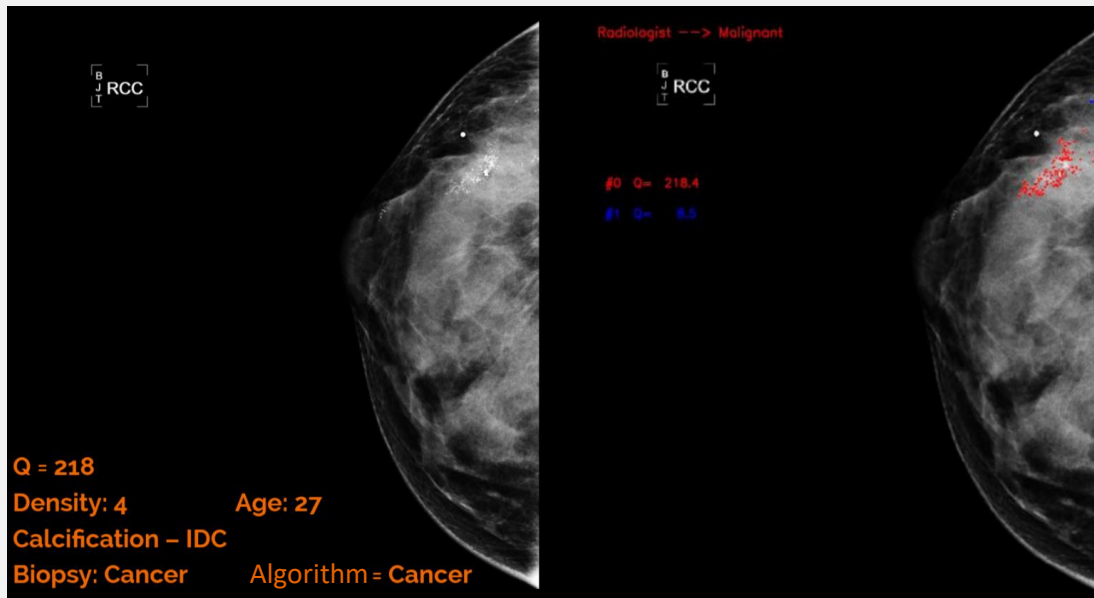
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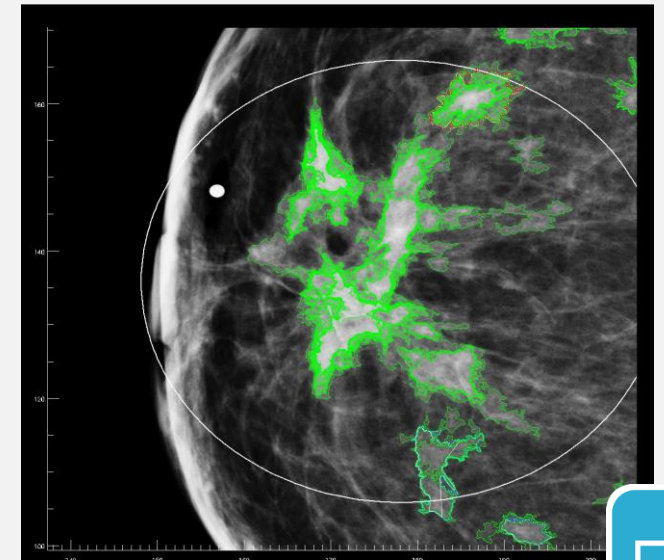
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# CANCER DETECTION (I)

- Microcals prediction accuracy of 93% vs doctors 85%
- Our False Positive rate was 18% vs doctors 45%



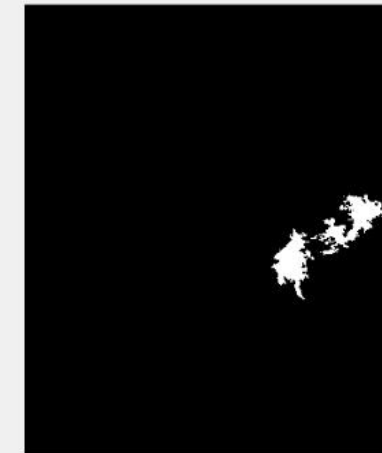
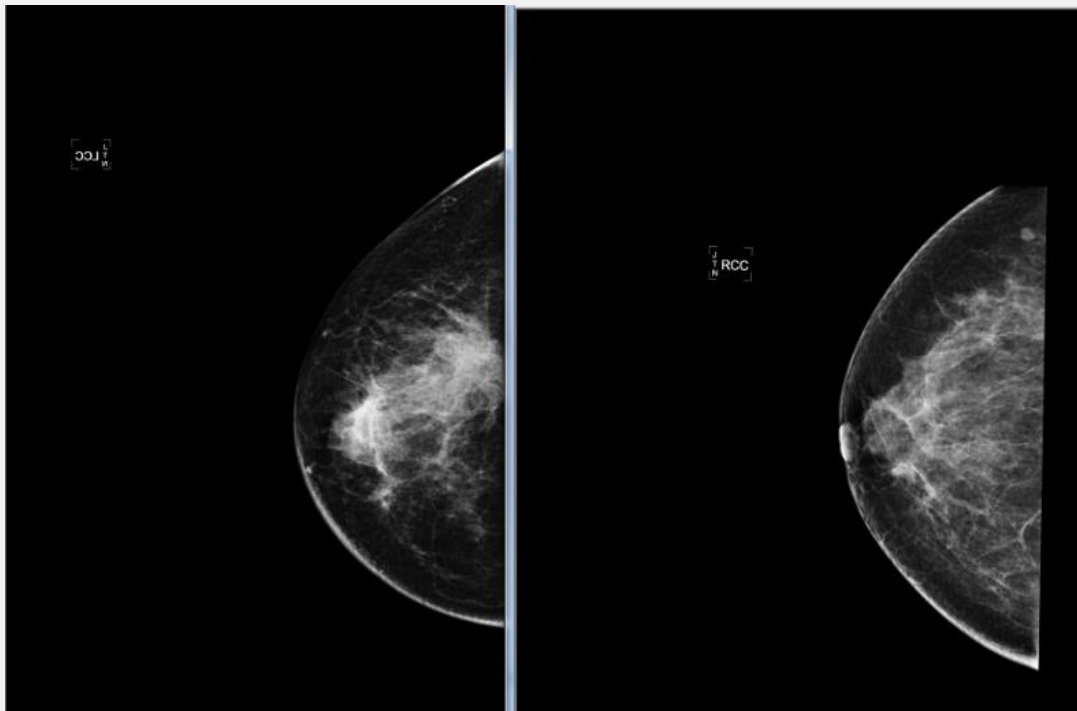
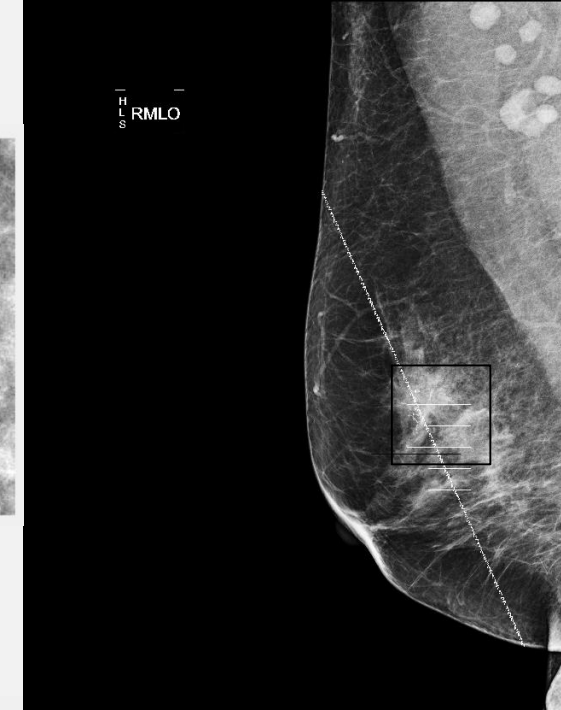
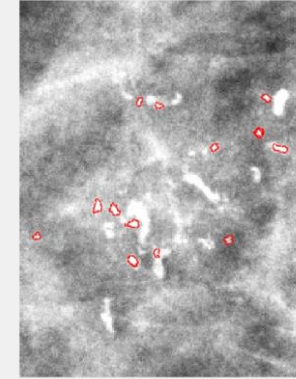
<--Calcs  
Mass-->



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# CANCER DETECTION (II)

Registration between views (bag of contours) and between sides.  
Between views: For calcs, use the number of calcs and deformable shape and relative positions.  
Between sides: use the breast boundary points.



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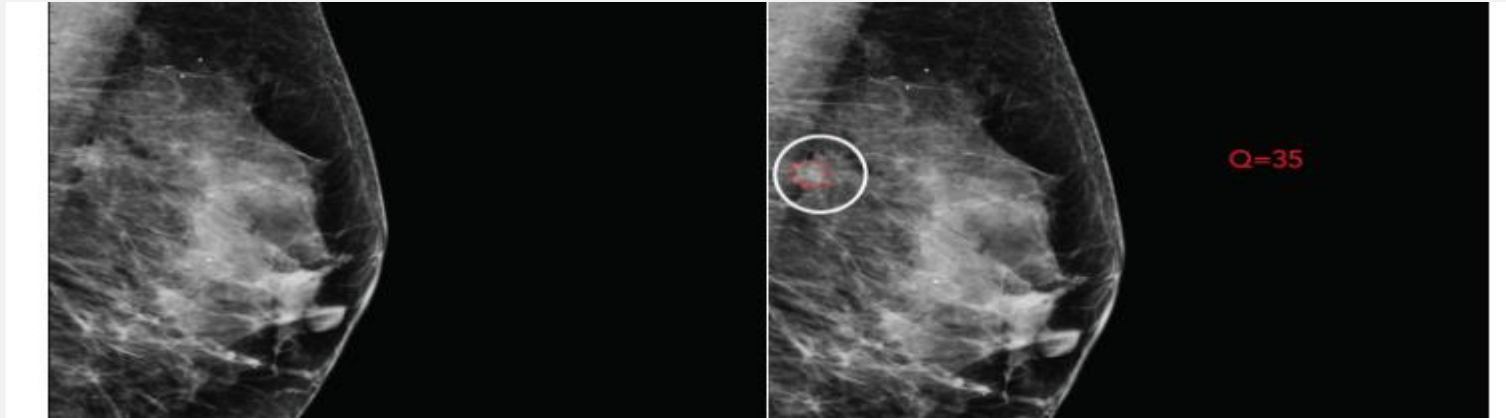


# RADIOLOGY IMAGE ANALYSIS: MAMMO

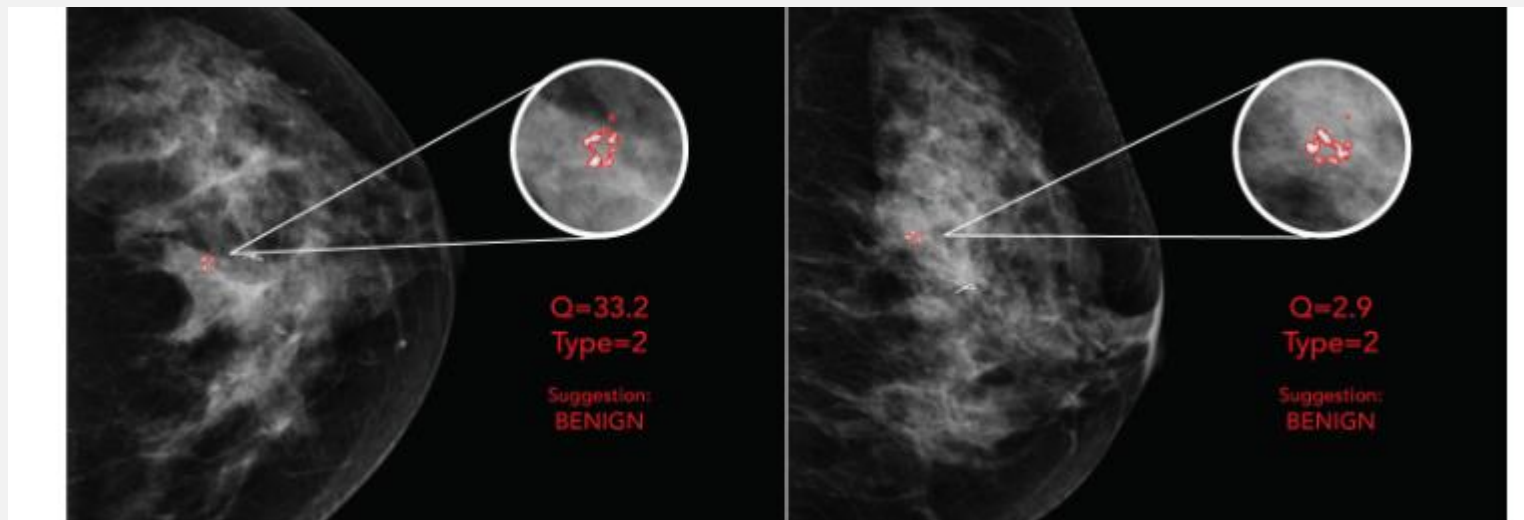
Detect and localize tumor (calcifications, mass/lesions), score it.

Original

Dense breast: correctly detect lesion

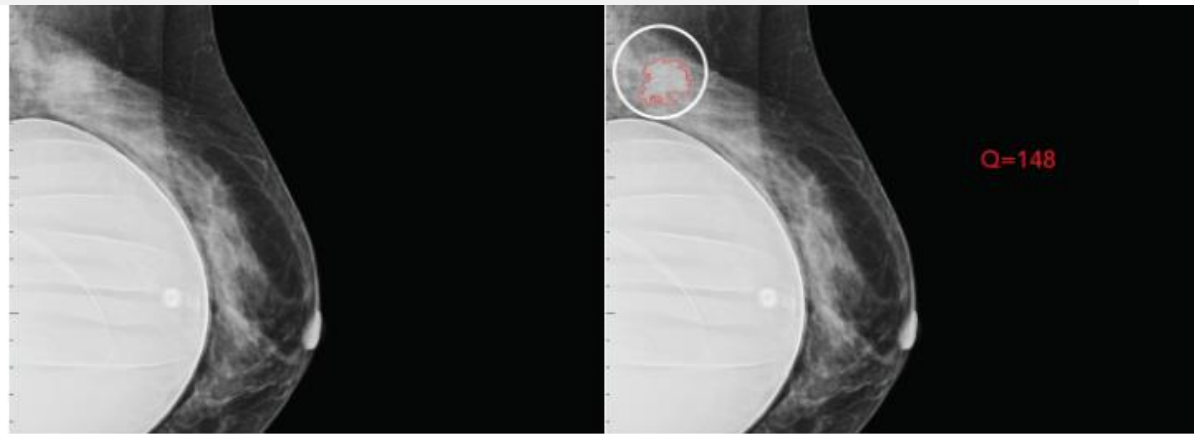
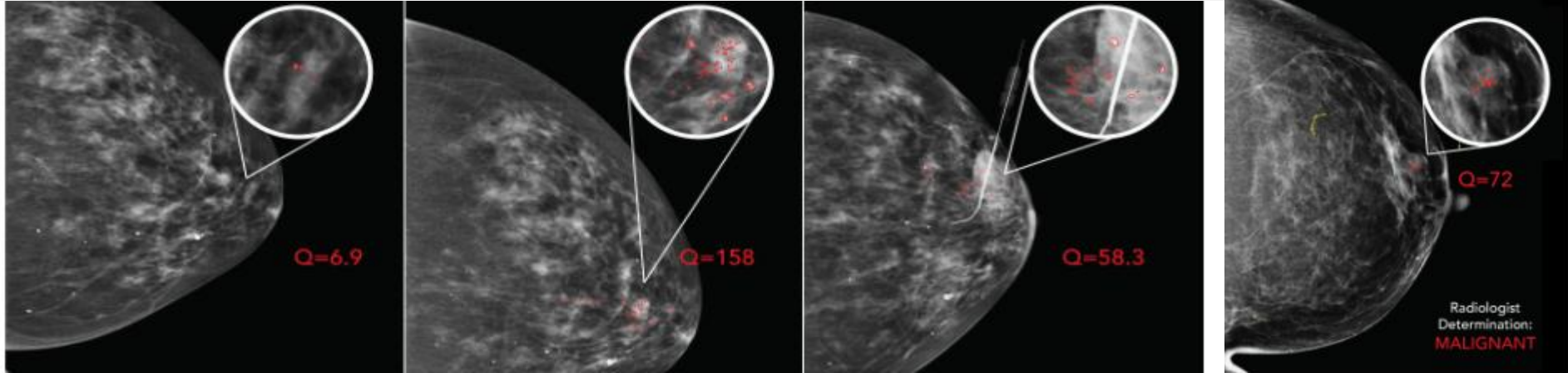


Detect, score and reduce false positives which look like calcs (below)

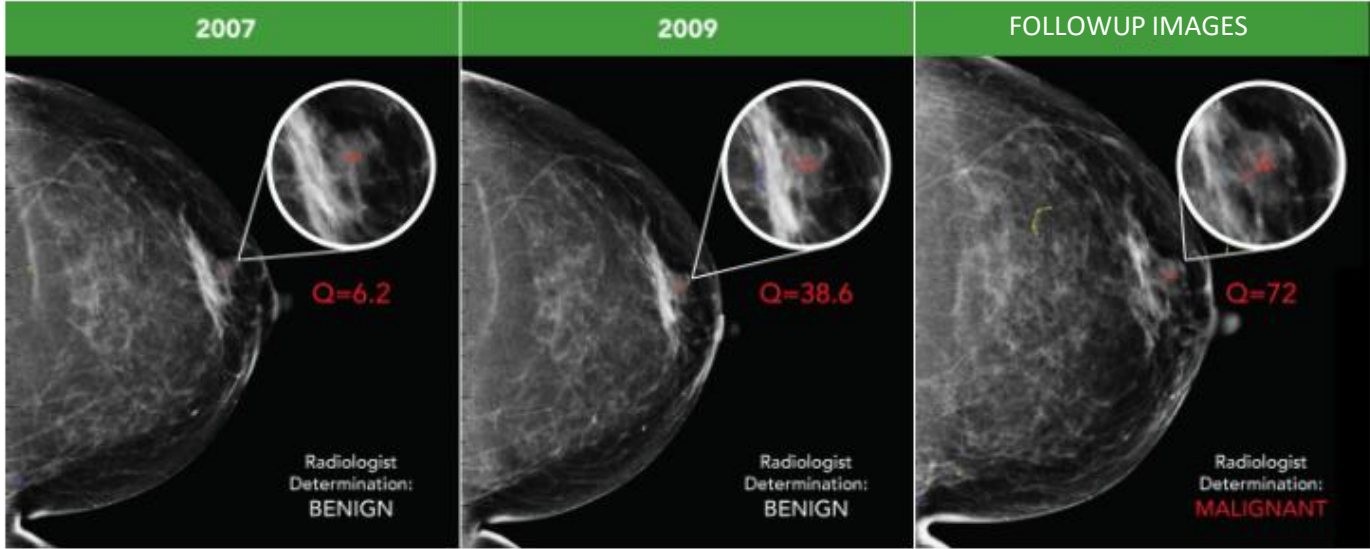


# RADIOLOGY IMAGE ANALYSIS: MAMMO

- More examples of scoring calcs and lesions.

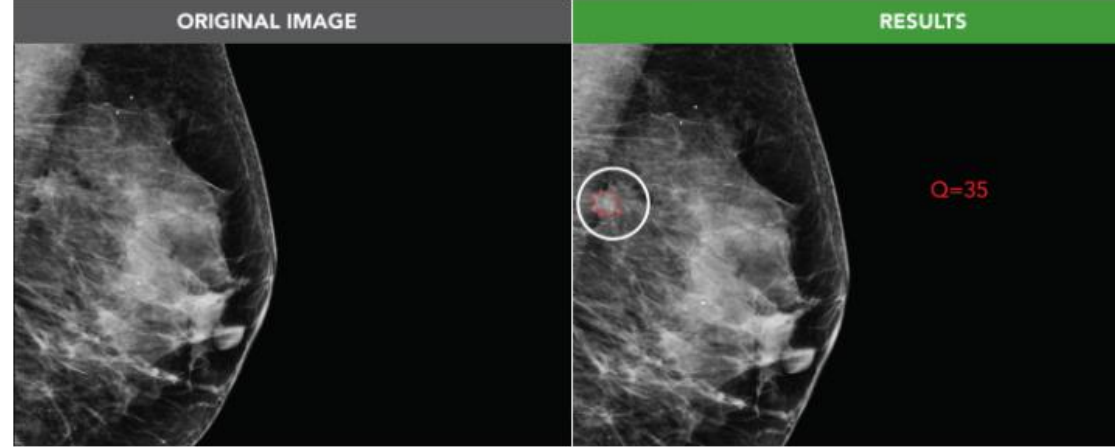


# CASE STUDY 1



**Early Detection:** In a blind review of prior images for particular patients, the algorithm was able to detect and quantify an anomaly and show its evolution over time

# CASE STUDY 2



In this example of a dense breast, the algorithm was able to detect and mark an anomaly

# CASE STUDY 3



In this example of a small dense breast with implants, the algorithm was able to detect and mark an anomaly and distinguish it from background noise





# THANK YOU!

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