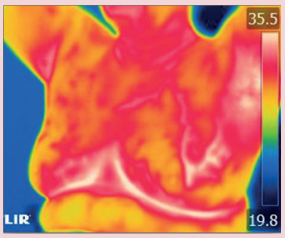
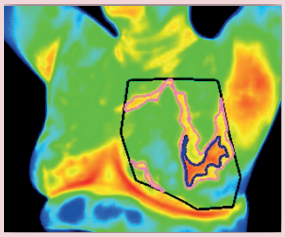
Niramai

How is THERMALYTIX® different from THERMOGRAPHY ?

SUMMARY

	Thermography	Niramai Thermalytix®
Output Image		
Non-contact	Yes	Yes
Radiation-free	Yes	Yes
Uses Infrared Cameras	Yes	Yes
Interpreted by	Human	Computer + Doctor
Environment dependency	Yes	No
Temperature Analysis	Absolute temperature values	Relative temperature values
Thermal Sensitivity	1 deg C	0.02 deg C
Thermal Max-Min	Trial-and-Error	Automated
Image Quality Check	No	Yes
BIRADS Assessment	No	Yes
Repeatable Results	No	Yes
Patient Reports with scores	No	Yes
Vascularity Analysis	No	Yes
Differentiates benign and malignant hotspots	No	Yes
Results from Single Scan	Rare	Always
Improves over time	No	Yes
Annotated thermal images	No	Yes
Sensitivity (a study with same dataset)	68.7%	88.9%
Specificity (a study with same dataset)	65.37%	79.5%
Clinically proven through systematic studies	No	Yes

Description of Differences between Thermography and Thermalytix®

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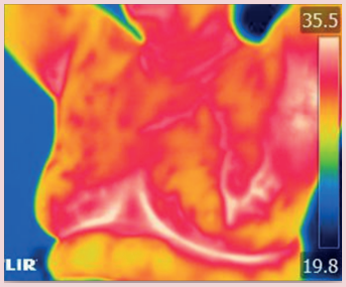
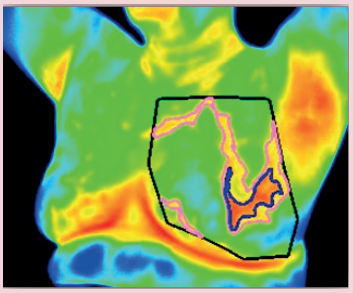
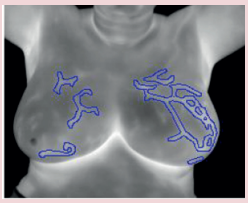
Output Image		
User Experience	Radiation-free, Non-contact, Pain-free	Radiation-free, Non-contact, Pain-free
Principle of Operation	Visual assessment of color coded temperature values obtained by infrared cameras to detect asymmetrical patterns.	Computer-aided analysis of temperature values obtained from infrared cameras, using novel thermal and vascular radiomics analyzed by pre-trained machine learning models.
Thermal Sensitivity	Very difficult to comprehend temperature differences below 1°C through the human eye. (i.e., 32°C and 33°C can be differentiated)	Thermalytix uses temperature values directly from the thermal sensor- which identifies minute temperature differences of 0.02°C (i.e., 32°C and 32.02°C can be differentiated).
Mode of Evaluation by the reader	As depicted in the image above, the thermographer has to read colour images of all shades of yellow to orange. Human eye has limitations in identifying different color shades.So the thermographer modifies the max and min temperatures to be able to detect the asymmetric high thermal activities with human eye.	The Thermalytix software extracts individual temperature values of each pixel from the infrared camera and creates a new heat map with automatically identified max and min temperature values. It generates thermal images with right image contrast to visualize abnormalities (as seen above). It is not dependant on the colour scheme used by the camera nor ambient temperature
Subjectivity	The results are subjective as it depends upon many factors such as the skill of the interpreting thermographer, pattern recognition capability, the maximum and minimum temperature used for thermal image, the humidity, distance of subject from camera, etc. The report is thus a qualitative report based on the impression of the interpreter.	Objective quantification of thermal patterns is performed, with scores indicating the level of asymmetry. Differences in temperature patterns are derived using relative temperature differences, rather than absolute and not dependent on humidity levels, distance of subject from camera, etc. A completely quantitative interpretation with repeatable results due to computer aided analysis.

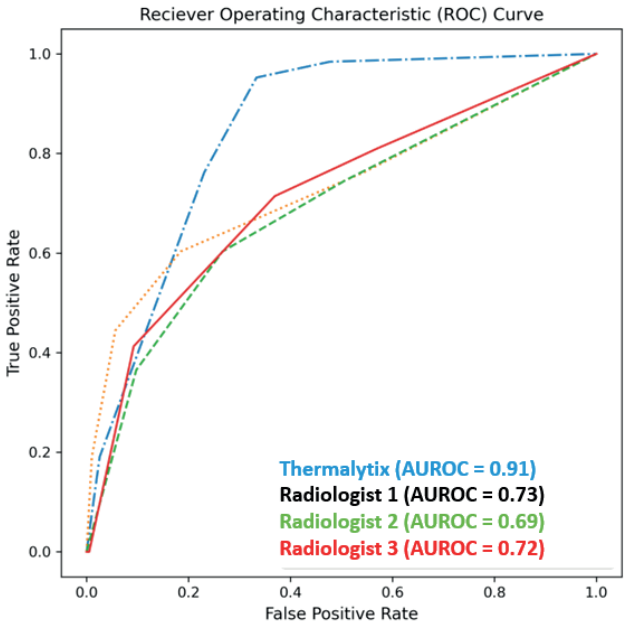
	Thermography	Niramai Thermalytix®
Detection of hotspots	Manual interpretation to identify hotspots based on absolute temperature values	Automated computation of the hotspot threshold based on historic data of cancer and non-cancer patients, and using relative temperature distribution. Additional analysis of every hotspot using novel clinically proven AI algorithms to determine whether it is benign or suspected malignancy.
Vascularity	Manual interpretation uses gray scale images to estimate potential vascular areas	 Thermalytix identifies vessel-like patterns and marks the same to enhance visualization of increased vascularity, neo-vascularisation which are typical indicators of malignancy. Additionally 17 Vascular radiomic features are computed and used to determine the final risk score for the patient.
Inherent capacity for improvement	Thermographer can learn over time	The Thermalytix algorithm learns and improves continuously using AI. Newer ML models are released after repeat clinical testing.
Output	Thermographers usually compare thermal images of the same patient across 3 months and then decide if there are changes to the images over time.One-shot interpretation of thermal images is rarely provided	One-shot interpretation is possible. Scores indicating the probability of malignancy or breast abnormality are generated instantly. Final impression of BScore is analogous to ACR BIRADS scoring and is easily interpretable by any breast radiologist or trained physician. The generated probability scores can also be used to monitor breast health of the patient over time too.

CLINICAL PERFORMANCE of THERMALYTIX® and THERMOGRAPHY STUDY

STUDY DESIGN : Multisite Blinded Study

Sample Size : 258

- Three senior radiologists trained in thermal interpretation independently assessed breast thermal images (manual thermography)
- AI-based Thermalytix analyzed the thermal images in parallel.
- All of these women went through standard imaging for ground truth.



UKIO
UK IMAGING & ONCOLOGY
June 2023, Liverpool, UK

Test Name	Sensitivity	Specificity	PPV	NPV
Thermalytix	88.9% (81.1%-96.6%)	79.5% (73.8%-85.2%)	58.3% (48.5%-68.2%)	95.7% (92.5%-98.8%)
Manual Thermography				
Reader 1	60.3% (48.2%-72.3%)	81.5% (76.0%-86.1%)	51.4% (41.8%-60.9%)	86.4% (82.2%-90.6%)
Reader 2	74.6% (63.8%-85.4%)	50.8% (43.8%-57.8%)	32.9% (25.2%-41.0%)	86.1% (79.8%-92.4%)
Reader 3	71.4% (60.8%-82.8%)	63.8% (56.3%-69.8%)	38.5% (29.6%-47.3%)	87.2% (81.7%-92.7%)
Average	68.77%	65.37%	40.93%	86.57%