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VARESE

Venerdì, 23 Gennaio 2026

UNA HOTELS VARESE

Intelligenza artificiale nella diagnostica senologica: quando ci aiuta?

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Diagnostica Senologica
Fondazione IRCCS Istituto Nazionale dei Tumori Milano

Varese 23 gennaio 2026

Intelligenza artificiale nella diagnostica senologica: quando ci aiuta?

- Screening mammografico
- Diagnostica clinica senologica

} *Work in progress…*

Due percorsi molto simili ma in realtà molto differenti nella metodologia e nella strutturazione del percorso diagnostico.

- La totalità dei sistemi AI per mammografia sono stati allenati e strutturati sui percorsi di screening mammografici:

  - *Più semplici*
  - *Riproducibili*
  - *Standardizzati*
  - *Con grandi numeri*
  - *Meno bias di metodo*
  - *Più necessari*
  - *Meno costosi*

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Intelligenza artificiale nella diagnostica senologica: quando ci aiuta?

- Le prime esperienze di AI per mammografia, rudimentali, risalgono a più di 20 anni fa.

- Negli anni 90 ci si avvale dei sistemi CAD per la diagnostica mammografica ma purtroppo furono un fallimento perché gravati da:
  - Elevato numero di FP
  - Tasso di richiamo molto elevato
  - Affidabilità e accuratezza diagnostica non adeguati

- *Le cose cambiano radicalmente nel 2023 (!!) anno in cui esce il lavoro dei colleghi svedesi (MASAI) che dimostra la affidabilità dell'AI utilizzata nel loro studio (multicentrico prospettico randomizzato)*
- *Il lavoro è oggi considerato un punto di svolta nel mondo mammografico screening e ha aperto la strada ai molteplici lavori che ne sono seguiti, con utilizzo di AI di altri vendor (iCAD, Lunit, ecc)*

transpara®

By ScreenPoint Medical

iCAD

Lunit

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Lancet Oncol 2023; 24: 936–44

2023

Artificial intelligence-supported screen reading versus standard double reading in the Mammography Screening with Artificial Intelligence trial (MASAI): a clinical safety analysis of a randomised, controlled, non-inferiority, single-blinded, screening accuracy study

Kristina Lång, Viktoria Josefsson, Anna-Maria Larsson, Stefan Larsson, Charlotte Högberg, Hanna Sartor, Solveig Hofvind, Ingvar Andersson, Aldana Rosso

Findings Between April 12, 2021, and July 28, 2022, 80 033 women were randomly assigned to AI-supported screening (n=40 003) or double reading without AI (n=40 030). 13 women were excluded from the analysis. The median age was 54·0 years (IQR 46·7–63·9). Race and ethnicity data were not collected. AI-supported screening among 39 996 participants resulted in 244 screen-detected cancers, 861 recalls, and a total of 46 345 screen readings. Standard screening among 40 024 participants resulted in 203 screen-detected cancers, 817 recalls, and a total of 83 231 screen readings. Cancer detection rates were 6·1 (95% CI 5·4–6·9) per 1000 screened participants in the intervention group, above the lowest acceptable limit for safety, and 5·1 (4·4–5·8) per 1000 in the control group—a ratio of 1·2 (95% CI 1·0–1·5; p=0·052). Recall rates were 2·2% (95% CI 2·0–2·3) in the intervention group and 2·0% (1·9–2·2) in the control group. The false positive rate was 1·5% (95% CI 1·4–1·7) in both groups. The PPV of recall was 28·3% (95% CI 25·3–31·5) in the intervention group and 24·8% (21·9–28·0) in the control group. In the intervention group, 184 (75%) of 244 cancers detected were invasive and 60 (25%) were in situ; in the control group, 165 (81%) of 203 cancers were invasive and 38 (19%) were in situ. The screen-reading workload was reduced by 44·3% using AI.

80.033 woman
40.003 with AI (244 cancer detected)
40.030 without AI (203 cancer detected)

CDR AI 6.1
CDR control 5.1

Recall Rates AI 2.2%
Recall Rates control 2.0%

FPR Recall 1,5% AI and control

PPV AI 28,3%
PPV control 24.8%

AI: 184 invasive cancer, 60 in situ
Control: 165 invasive cancer, 38 in situ

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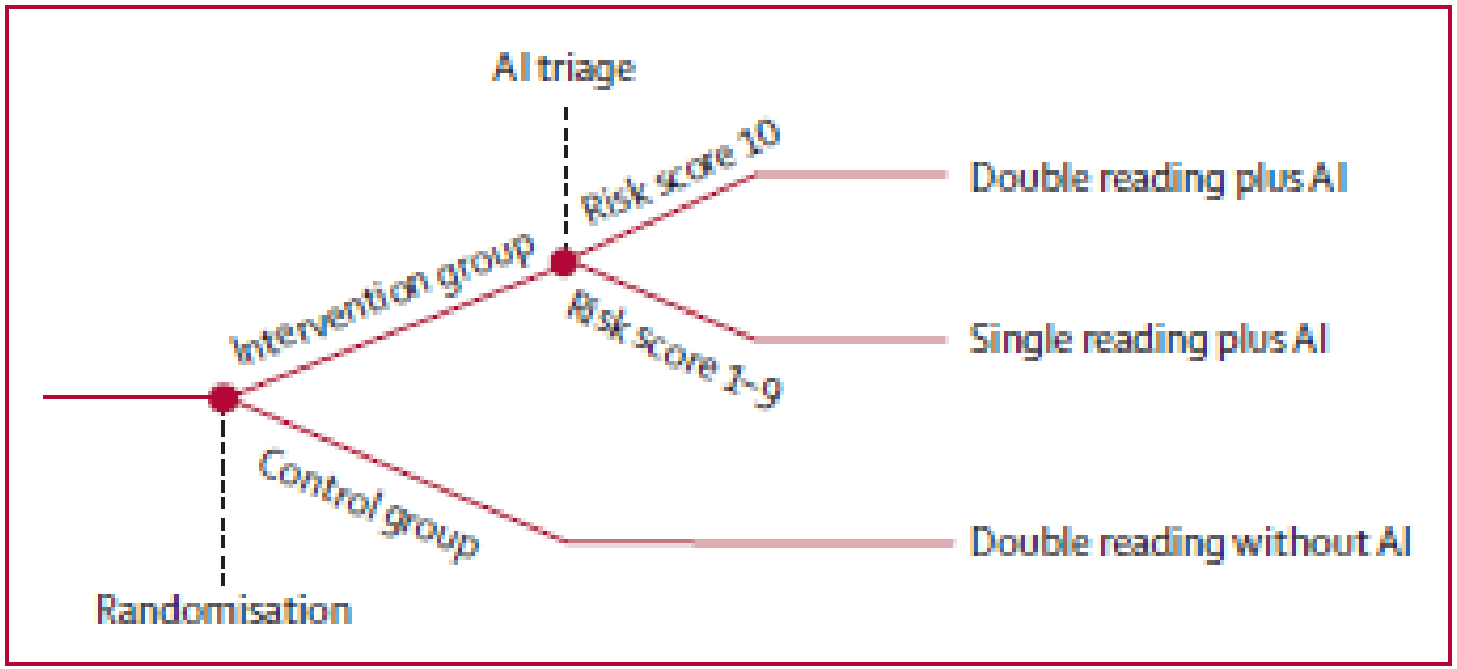
MASAI Study



	Intervention group (n=39 996)	Control group (n=40 024)
Early screening performance		
Number of recalls	861	817
Recall rate, %	2·2% (2·0–2·3)	2·0% (1·9–2·2)
Number of screen-detected cancers	244	203
Cancer-detection rate, per 1000 participants screened	6·1 (5·4–6·9)	5·1 (4·4–5·8)
False positive rate, %	1·5% (1·4–1·7)	1·5% (1·4–1·7)
Positive predictive value of recall, %	28·3% (25·3–31·5)	24·8% (21·9–28·0)
Workload		
Number of screen readings	46 345	83 231
Number of consensus meetings	1584	1576
Consensus meeting rate	4·0% (3·8–4·2)	3·9% (3·8–4·1)

Data are n or point estimate (95% CI).

Table 2: **Early screening performance and workload measures, modified intention-to-treat population**

Interpretation AI-supported mammography screening resulted in a similar cancer detection rate compared with standard double reading, with a substantially lower screen-reading workload, indicating that the use of AI in mammography screening is safe. The trial was thus not halted and the primary endpoint of interval cancer rate will be assessed in 100 000 enrolled participants after 2-years of follow up.

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Screening performance and characteristics of breast cancer detected in the Mammography Screening with Artificial Intelligence trial (MASAI): a randomised, controlled, parallel-group, non-inferiority, single-blinded, screening accuracy study

Veronica Hernström, Viktoria Josefsson, Hanna Sartor, David Schmidt, Anna-Maria Larsson, Solveig Hofvind, Ingvar Andersson, Aldana Rosso, Oskar Hagberg, Kristina Lång

Lancet Digit Health 2025; 7: e175–83

2025

105.934 woman
53.043 with AI (338 cancer detected)
52.872 without AI (262 cancer detected)

CDR AI 6.4
CDR control 5.0

AI: 270 invasive cancer, 68 in situ
Control: 217 invasive cancer, 45 in situ

among 52 872 participants resulted in 262 detected cancers and 1027 recalls. Cancer-detection rates were 6·4 per 1000 (95% CI 5·7–7·1) screened participants in the intervention group and 5·0 per 1000 (4·4–5·6) in the control group, a ratio of 1·29 (95% CI 1·09–1·51; p=0·0021). AI-supported screening resulted in an increased detection of invasive cancers (270 *vs* 217, a proportion ratio of 1·24 [95% CI 1·04–1·48]), wich were mainly small lymph-node negative cancers (58 more T1, 46 more lymph-node negative, and 21 more non-luminal A). AI-supported screening also resulted in an increased detection of in situ cancers (68 *vs* 45, a proportion ratio of 1·51 [1·03–2·19]), with about half of the increased detection being high-grade in situ cancer (12 more nuclear grade III, and no increase in nuclear grade I). The recall and false-positive rate were not significantly higher in the intervention group (a ratio of 1·08 [95% CI 0·99–1·17; p=0·084] and 1·01 [0·91–1·11; p=0·92], respectively). The positive predictive value of recall was significantly higher in the intervention group compared with the control group, with a ratio of 1·19 (95% CI 1·04–1·37; p=0·012). There were 61 248 screen readings in the intervention group and 109 692 in the control group, resulting in a 44·2% reduction in the screen-reading workload.

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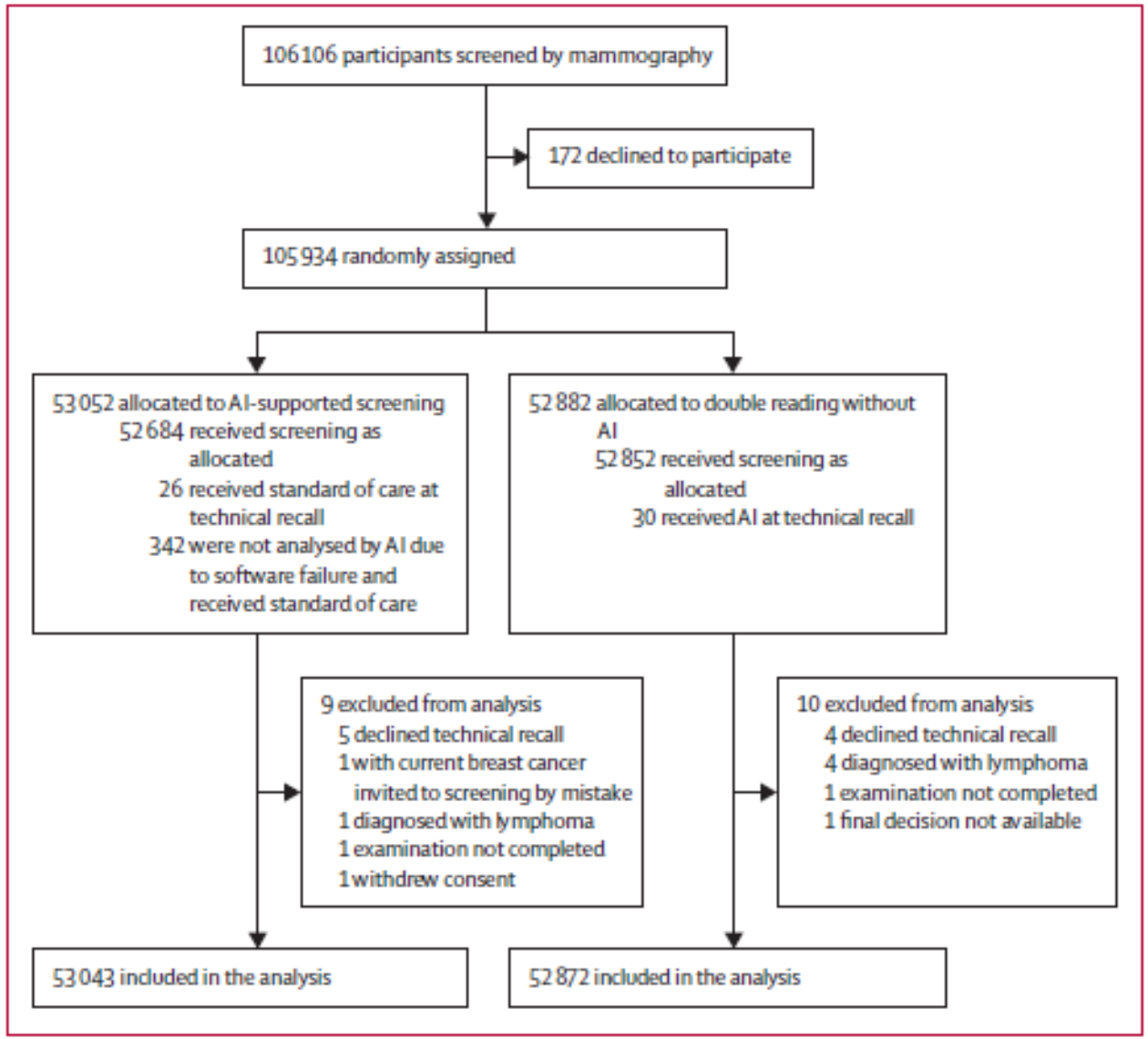

Figure 2: **Trial profile**

AI=artificial intelligence. Due to the technical set-up the technical recalls were randomised de novo but were assessed according to their original allocation (intention-to-treat policy).

	Intervention group (n=53 043)	Control group (n=52 872)	Proportion ratio (95% CI)
(Continued from previous column)			
N stage, invasive			
N0	206 (3·88)	160 (3·03)	1·28 (1·04–1·58)
N1+	60 (1·13)	55 (1·04)	1·09 (0·75–1·57)
N1	55 (1·04)	43 (0·81)	1·27 (0·86–1·90)
N2	1 (0·02)	8 (0·15)	..
N3	4 (0·08)	4 (0·08)	..
Nx	3 (0·06)	1 (0·02)	..
Not applicable§	0	1 (0·02)	..
Missing¶	1 (0·02)	0	..
TNM stage			
0	68 (1·28)	45 (0·85)	1·51 (1·03–2·19)
1	193 (3·64)	139 (2·63)	1·38 (1·11–1·72)
1A	181 (3·41)	135 (2·55)	1·34 (1·07–1·67)
1B	12 (0·23)	4 (0·08)	..
2+	73 (1·38)	76 (1·44)	0·96 (0·69–1·32)
2A	49 (0·92)	44 (0·83)	1·11 (0·74–1·67)
2B	15 (0·28)	17 (0·32)	0·88 (0·44–1·76)
3A	3 (0·06)	10 (0·19)	..
3B	1 (0·02)	1 (0·02)	..
3C	4 (0·08)	4 (0·08)	..
4	1 (0·02)	0	..
Not applicable‖	3 (0·06)	2 (0·04)	..
Missing¶	1 (0·02)	0	..

Data are n (per 1000 screened participants). The rightmost column gives the proportion ratio with 95% CI when the intervention group is compared with the control group. This analysis included only those with at least five cases per single subgroup. HER2 (also known as ERBB2)=human epidermal growth factor receptor 2. ER=oestrogen receptor. *Other invasive miscellaneous: apocrine, papillary, microinvasive, cribriform, and one case of angiosarcoma. †Other in situ: florid lobular, papillary, and mixed papillary and ductal carcinoma in situ. ‡Not applicable due to microinvasive cancer, too small to assess, and one case of angiosarcoma. §Not applicable due to one case of angiosarcoma. ¶One case of unknown N stage due to out-of-county treatment. ‖Not applicable due to Nx stage, and one case of angiosarcoma.

Table 3: **Cancer type and stage; frequency of subcategories of detected cancers**

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From Apr 2021 to Dec 2022, **105,934 women** randomly assigned to AI-supported reading or standard DHR.
Median age 53.7 years.

	CDR	Recalls	Cancers	Invasive	DCIS	**Readings**
AI-supported (n=53,043)	**6.4‰**	1,110	338	270	68	**61,248**
Standard DHR (n=52,872)	**5.0‰**	1,027	262	217	45	**109,692**
	***p*=0.002**					
	+28.0%					**-44.2%**

AI-supported screening:

→ **increased detection of invasive cancers and DCIS**, mainly small LN-negative (+58 T1, +46 LN-negative, and +21 non-luminal A)

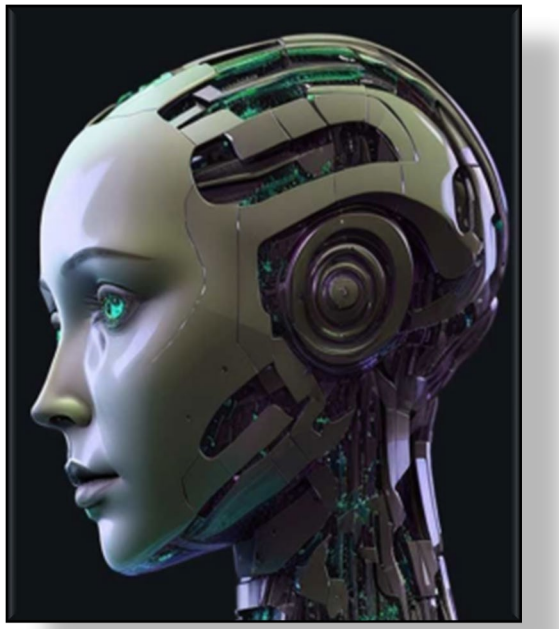
→ **increased detection of DCIS**, with about half of the increased detection being high-grade DCIS (12 more nuclear grade III, and no increase in nuclear grade I)

→ Significantly **higher recall PPV** (p=0.012)

→ Not significantly higher recall rate and FP rate

→ **44% reduction in the workload**

AI contributes to the early detection of clinically relevant breast cancer and reduces screen-reading workload without increasing false positives.



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Observational Study > Nat Med. 2025 Mar;31(3):917-924. doi: 10.1038/s41591-024-03408-6. Epub 2025 Jan 7.

Nationwide real-world implementation of AI for cancer detection in population-based mammography screening

Nora Eisemann [# 1], Stefan Bunk [# 2], Trasias Mukama [3], Hannah Baltus [1], Susanne A Elsner [1], Timo Gomille [4], Gerold Hecht [5], Sylvia Heywang-Köbrunner [6], Regine Rathmann [7], Katja Siegmann-Luz [8], Thilo Töllner [9], Toni Werner Vomweg [10], Christian Leibig [3], Alexander Katalinic [11]

Metrics	AI-supported HDR (n = 261,000)	HDR without AI (n = 202,000)	Absolute difference
CDR	6.7‰	5.7‰	**+1.0‰**
Recall rate	37.4‰	38.3‰	-0.9‰
Recall PPV	17.9%	14.9%	**-3.0%**
Biopsy PPV	64.5%	59.2%	**+5.3%**

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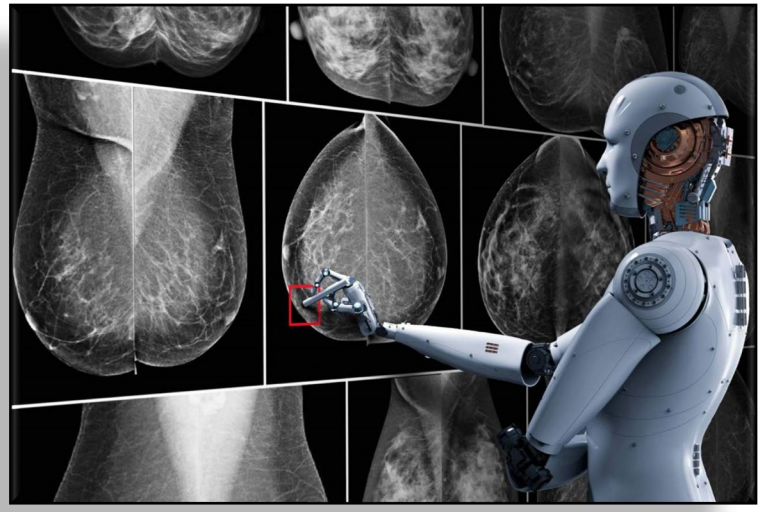
Radiology. 2024 Jun;311(3):e232479. doi: 10.1148/radiol.232479.

Early Indicators of the Impact of Using AI in Mammography Screening for Breast Cancer

Andreas D Lauritzen [1], Martin Lillholm [1], Elsebeth Lynge [1], Mads Nielsen [1], Nico Karssemeijer [1], Ilse Vejborg [1]

Observational before/after design



Reported screening performance in 50−69-yo women:

- ~ 61,000 **before AI** implementation; and
- ~ 58,000 **after AI** implementation (2/3 SHR plus AI; 1/3 DHR plus AI).

Significant changes after AI implementation:

- recall rate decreased by 20.5% (3.1% → 2.5%);
- **cancer detection rate increased by 17.1%** (0.70% → 0.82%);
- false-positive rate decreased by 32.1% (2.39% → 1.63%),
- positive predictive value of recalls increased by 48.7% (22.6% → 33.6%);
- rate of small cancers (≤1 cm) increased by 22.7% (36.6% → 44.9%);
- rate of invasive cancers decreased by 6.2% (84.9% → 79.6%).

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ICad

Journal of *Clinical Medicine*

MDPI

Article

Early Results of Using AI in Mammography Screening for Breast Cancer

Hadar Sandler Rahat [1,2,†], Tal Friehmann [1,2,*,†], Marva Dahan Shemesh [1,2], Shlomit Tamir [1,2], Eli Atar [1,2], Tzippy Shochat [3], Arnon Makori [4] and Ahuva Grubstein [1,2]

This study evaluates audit data of 31,176 mammograms interpreted between 2017 and 2021, comparing 24,373 mammograms prior to AI implementation and 6803 after the integration.

Table 1. Results. Cancer detection rate (CDR), False Negative (FN), and Ductal Carcinoma In Situ (DCIS).

	2019	2020	2021
Overall cancers detected	52 $p = 0.3$	52 $p = 0.4$	64
Cancers detected on mammography	42 (80.7%) $p = 0.05$	47 (90.3%) $p = 0.2$	63 (98.4%)
Malignancy detected in screening mammography in ages 50–74	14 $p = 0.3$	8 $p = 0.8$	9
CDR	6.2/1000 $p = 0.02$	7.2/1000 $p = 0.1$	9.3/1000
CDR in ages 50–74	3.2/1000 $p = 0.004$	3.2/1000 $p = 0.003$	1.8/1000
FN in mammographic screening in ages 50–74	13% $p = 0.02$	13% $p = 0.02$	0%
Stage 1 cancers detected	57.1% $p = 0.05$	100% $p = 0.9$	100%
Percent of DCIS detected	36.4% $p = 0.6$	12.5% $p = 0.7$	20%

screening metrics, with a significance level of $p < 0.05$. **Results**: This study assesses the impact of artificial intelligence (AI) on mammographic screening. The cancer detection rate increased significantly from 6.2 per 1000 in 2019 to 9.3 per 1000 in 2021, with cancers detected on mammograms rising to 98%. Stage 1 cancer detection reached 100%, and the false negative rate dropped to 0%. Additionally, ductal carcinoma in situ (DCIS) detection decreased from 36.4% in 2019 to 20% in 2021. These findings highlight AI's effectiveness

CDR in 2021 with AI: 9.3

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Intelligenza artificiale nella diagnostica senologica: quando ci aiuta?

- …e nella diagnostica senologica clinica?

> *La situazione risulta essere oggi completamente diversa e i sistemi sul mercato sembrano avere alcune problematiche, se non altro per metodologia diversa, approccio diverso, possibilità di metodiche diverse e di alto profilo su cui AI è ancora molto embrionale…*

- Visita senologica
- Ecografia
- CEM
- RM
- Interventistica

…poche esperienze, monocentriche, piccoli numeri…poca letteratura…

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La radiologia medica (2024) 129:202–210
https://doi.org/10.1007/s11547-023-01751-1

BREAST RADIOLOGY

The role of an artificial intelligence software in clinical senology: a mammography multi-reader study

Enrica Bassi[1] · Anna Russo[2] · Eugenio Oliboni[2] · Federico Zamboni[2] · Cecilia De Santis[2] · Giancarlo Mansueto[3] · Stefania Montemezzi[4] · Giovanni Foti[2]

AI in clinical setting

Methods A total of 210 patients with complete clinical and radiologic records were retrospectively analyzed. Pathology was used as the reference standard for patients undergoing surgery or biopsy, and a 1-year follow-up was used to confirm no change in the remaining patients.
The image evaluation was performed by four readers with different levels of experience (a junior and three senior breast radiologists) using a 5-point Likert scale moving from 1 (definitively no cancer) to 5 (definitively cancer).

210 Pazienti

Results The stand-alone AI system achieved an accuracy of 71% (69% sensitivity and 73% specificity), which is overall lower than the value achieved by readers without AI. However, with the aid of AI, a significant increase of accuracy (p value $=0.004$) and specificity (p value $=0.04$) was achieved for the less experienced radiologist and a senior one.
Conclusion The use of AI software as a second reader for breast lesions assessment could play a crucial role in the clinical setting, by increasing sensitivity and specificity, especially for less experienced radiologists.

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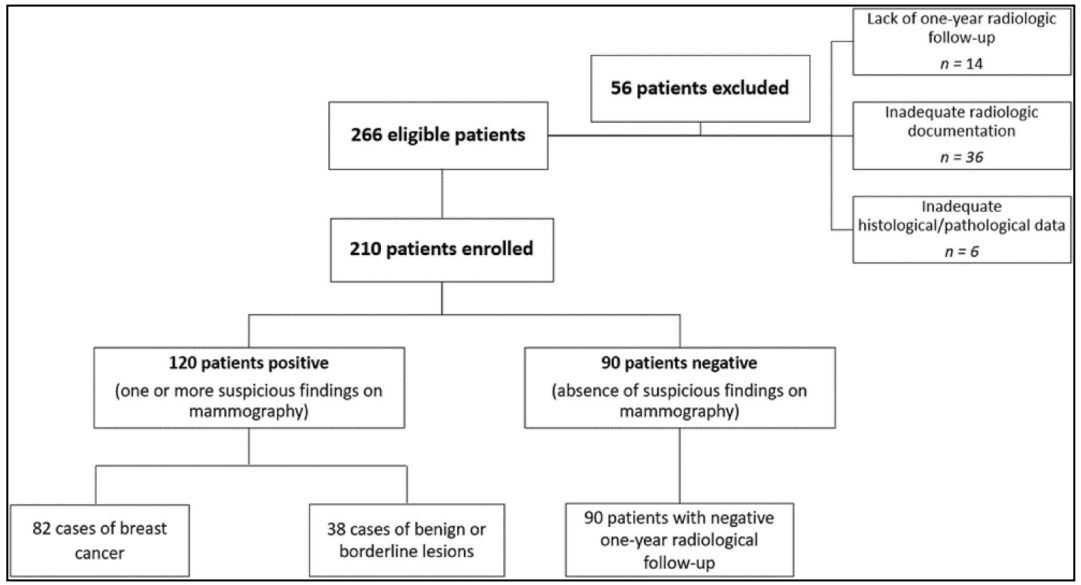
AI in clinical setting



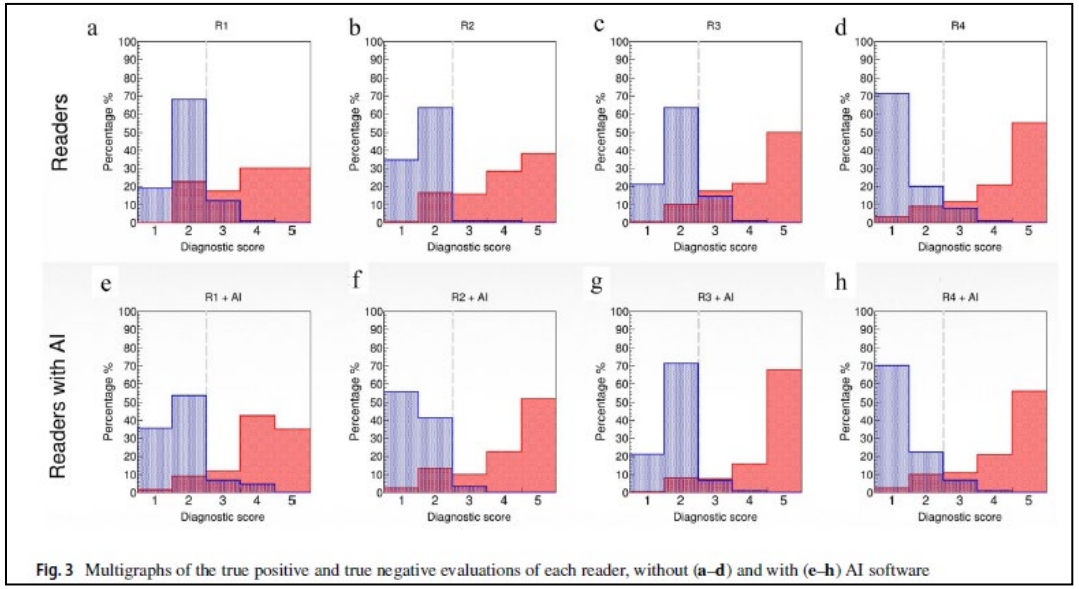


Fig. 3 Multigraphs of the true positive and true negative evaluations of each reader, without (**a**–**d**) and with (**e**–**h**) AI software

Table 2 Diagnostic performance of the AI stand-alone and of the four readers with and without AI

	Sensitivity	Specificity	Accuracy	AUC
AI	69%	73%	71%	0.78
	[61, 77]	[64, 82]	[65, 77]	[0.73, 0.82]
R1	78%	87%	82%	0.92
	[71, 85]	[80, 94]	[77, 87]	[0.89, 0.95]
R2	83%	98%	89%	0.97
	[76, 90]	[95, 100]	[85, 94]	[0.95, 0.99]
R3	89%	84%	87%	0.95
	[83, 95]	[76, 92]	[82, 91]	[0.92, 0.97]
R4	88%	91%	89%	0.96
	[82, 94]	[85, 97]	[85, 93]	[0.94, 0.98]
R1 + AI	89%	89%	89%	0.95
	[83, 95]	[83, 95]	[85, 93]	[0.93, 0.97]
R2 + AI	84%	97%	90%	0.96
	[77, 91]	[93, 100]	[85, 94]	[0.94, 0.98]
R3 + AI	91%	92%	91%	0.97
	[86, 96]	[86, 98]	[88, 95]	[0.95, 0.98]
R4 + AI	88%	92%	90%	0.97
	[82, 94]	[86, 98]	[86, 94]	[0.95, 0.99]

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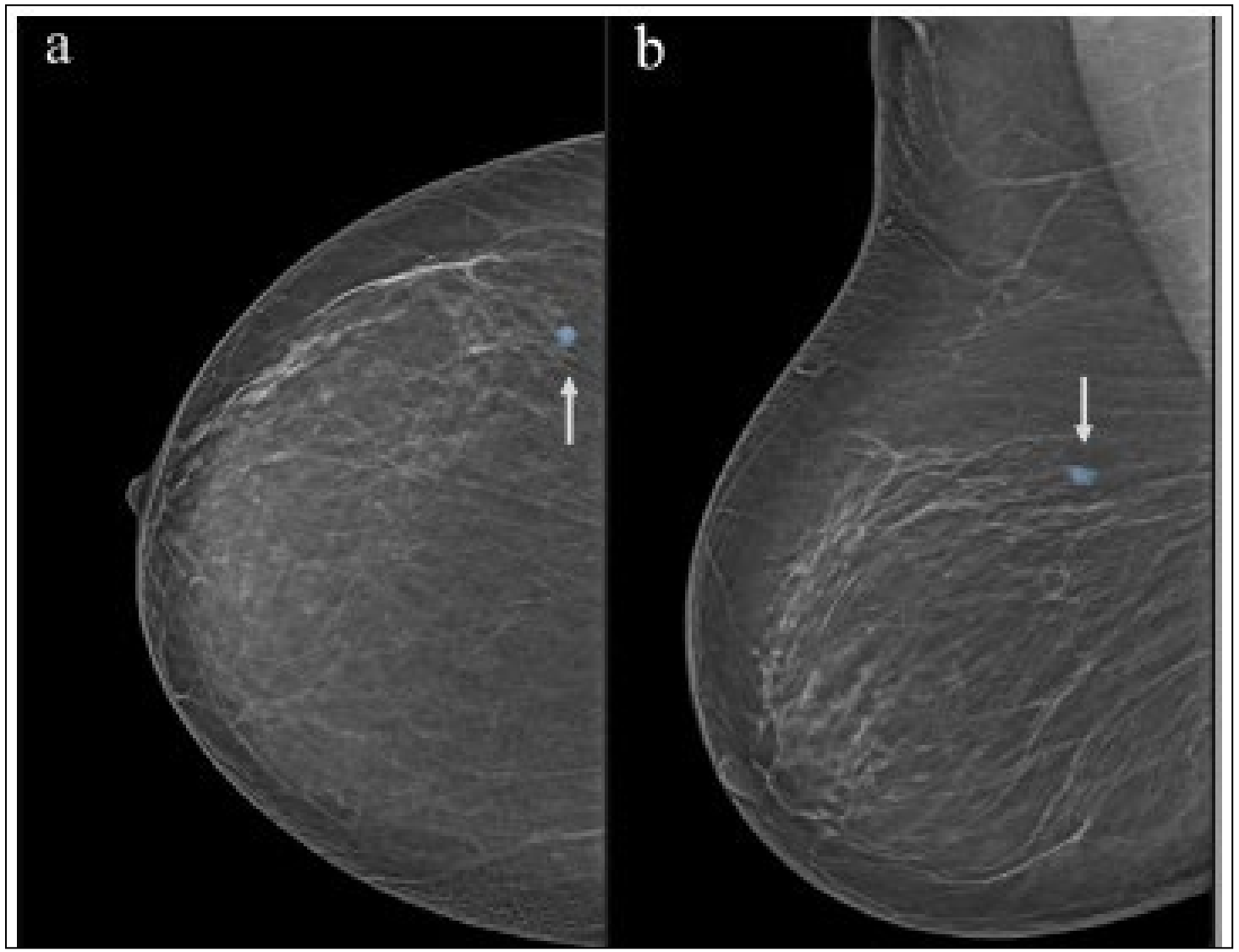
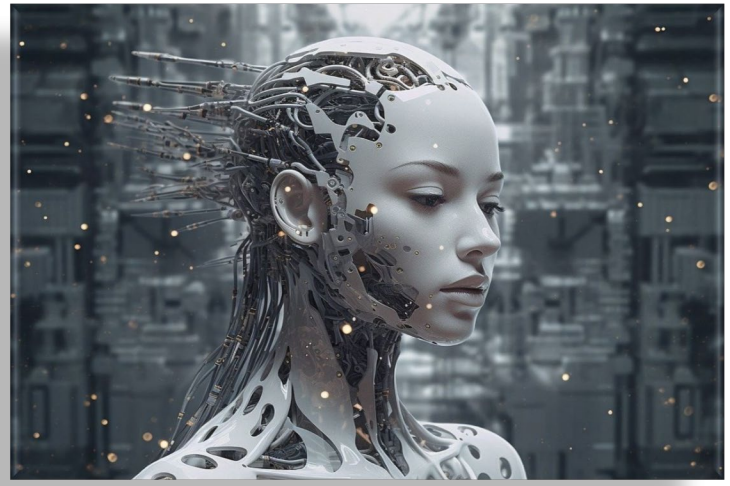
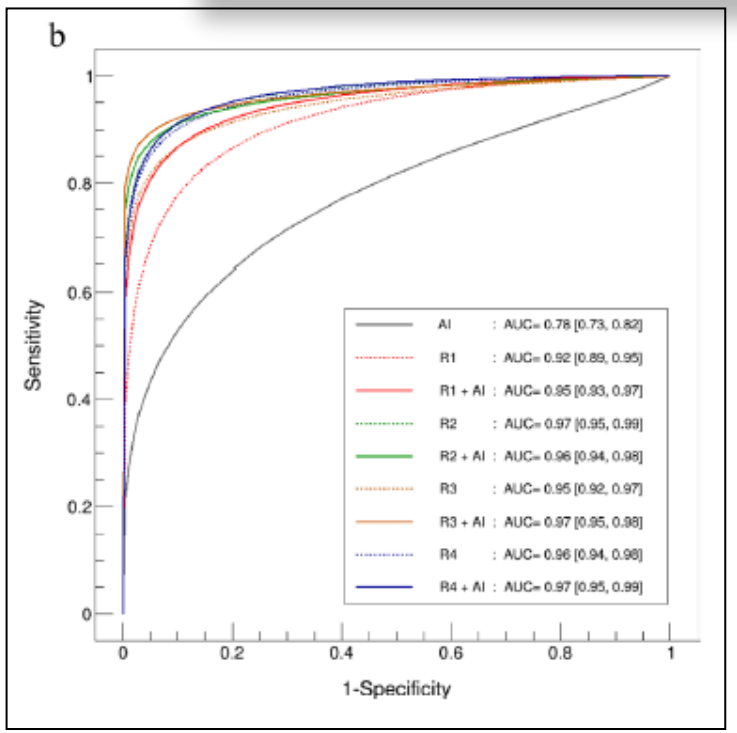
AI in clinical setting







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Radiology

ORIGINAL RESEARCH · BREAST IMAGING

2025

Evaluation of a Mammography-based Deep Learning Model for Breast Cancer Risk Prediction in a Triennial Screening Program

Joshua W. D. Rothwell[1] • Priya Rogers, MBBS, MPhil[2] • Nicholas R. Payne, PhD[1] • Yuan Huang, PhD[1,3] • Joshua D. Kaggie, PhD[1] • Sarah E. Hickman, MBBS, PhD[2,4,5] • Fleur Kilburn-Toppin, MBChB[1,2] • Bahman Kasmai, MSc[6] • Arne Juette, MBChB[6] • Fiona J. Gilbert, MBChB[1,2]

Mirai Score
Deep learning algorithm

Purpose: To evaluate the predictive ability of 3-year risk scores generated by a deep learning algorithm (Mirai) to identify women who developed interval cancers (ICs) in the UK breast screening program, which invites women aged 50–70 years for triennial mammography.

Materials and Methods: For this retrospective study, Mirai processed digital screening mammograms with negative results collected from a 3-year cohort (January 2014 to December 2016) across two sites and two primary mammography systems. Exclusions included screen-detected cancers

Interval Cancer prediction

Score 1: 1% - 3,6 IC (19/524)
Score 2: 5% - 14,5 IC (76/524)
Score 3: 10% - 26,1 IC (137/524)
Score 4: 20% - 42,4 IC (222/524)

Table 4: Mirai 3-year Risk Scores for IC Predictions across Operating Thresholds

	Threshold			
Characteristic	Highest 1%	Highest 5%	Highest 10%	Highest 20%
ICs	3.6 (19/524)	14.5 (76/524)	26.1 (137/524)	42.4 (222/524)
Retrospective classification				
"True" ICs	1.9 (8/414)	11.1 (46/414)	21.0 (87/414)	36.7 (152/414)
"False" ICs	9.6 (10/104)	27.9 (29/104)	45.2 (47/104)	63.5 (66/104)
Unknown	16.7 (1/6)	16.7 (1/6)	50.0 (3/6)	66.7 (4/6)
Grade				
I	0.0 (0/44)	15.9 (7/44)	29.5 (13/44)	47.7 (21/44)
II	5.8 (10/172)	13.4 (23/172)	28.5 (49/172)	45.3 (78/172)
III	3.1 (4/128)	10.9 (14/128)	25.0 (32/128)	44.5 (57/128)
DCIS	1.8 (1/56)	10.7 (6/56)	17.9 (10/56)	26.8 (15/56)
Unknown	3.2 (4/124)	21.0 (26/124)	26.6 (33/124)	41.1 (51/124)
False positives	1324/1343	6635/6711	13285/13422	26622/26844

Note.—Results were obtained for operating thresholds at all possible specificities, simulating the recall of all women assigned a specified percentage of scores. Data are percentages, with numbers of examinations as numerators and total numbers of examinations as denominators in parentheses. Data are the numbers and types of interval cancers (ICs) retrospectively predicted when setting the operating threshold of Mirai to recall the highest percentage of 3-year risk scores. ICs are reported as the percentage of ICs that symptomatically presented within the screening round (n = 524) that were accurately predicted. Where possible, mammograms preceding ICs were retrospectively classified as "true" ICs ("normal/benign" appearance; n = 414) or "false" ICs ("suspicious/uncertain" appearance; n = 104); results were unavailable for six examinations. Recalling women assigned the highest 10% of Mirai risk scores could identify a quarter of all ICs, with higher recall rates further improving prediction. DCIS = ductal carcinoma in situ.

134.217 Woman
524 Cancer

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European validation of an image-derived AI-based short-term risk model for individualized breast cancer screening—a nested case-control study

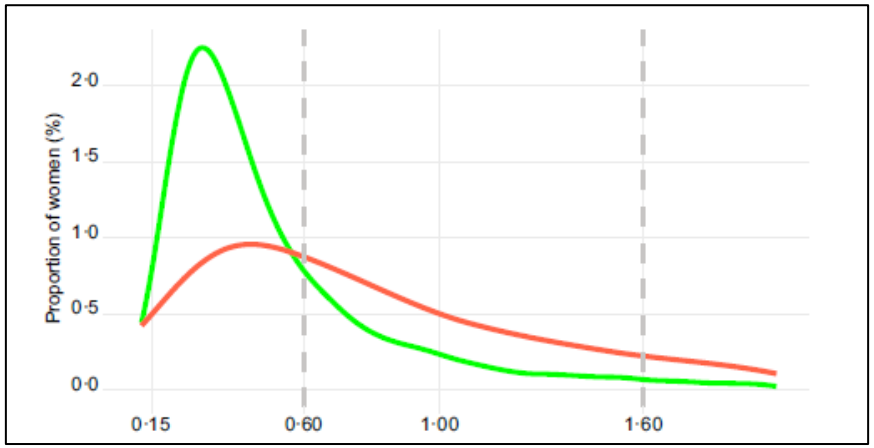
Mikael Eriksson,[a,b,*] Marta Román,[c] Axel Gräwingholt,[d] Xavier Castells,[c] Andrea Nitrosi,[e] Pierpaolo Pattacini,[e] Sylvia Heywang-Köbrunner,[f] and Paolo G. Rossi[e]

The Lancet Regional Health - Europe 2024;37: 100798

Findings The overall adjusted Area Under the receiver operating characteristic Curve (aAUC) of the AI risk model was 0.72 (95% CI 0.70–0.75) for breast cancers developed in four screening populations. In the 6.2% [529/8551] of women at high risk using the National Institute of Health and Care Excellence (NICE) guidelines thresholds, cancers were more likely diagnosed after 2 years follow-up, risk-ratio (RR) 6.7 (95% CI 5.6–8.0), compared with the 69% [5907/8551] of women classified at general risk by the model. Similar risk-ratios were observed across levels of mammographic density.

Interpretation The AI risk model showed generalizable discriminatory performances across European populations and, predicted ~30% of clinically relevant stage 2 and higher breast cancers in ~6% of high-risk women who were sent home with a negative mammogram. Similar results were seen in women with fatty and dense breasts.

739 woman



Clinical guideline[a]	Q1, RR (95% CI)[b]	Q2, RR (95% CI)[b]	Q3, RR (95% CI)[b]
NICE[a]			
General	1 (ref.)	1 (ref.)	1 (ref.)
Moderate	3.6 (2.6–4.9)	3.4 (2.6–4.4)	2.2 (1.7–2.9)
High	5.8 (3.8–8.6)	6.7 (4.9–9.2)	6.1 (4.7–7.9)
USPSTF[a]			
General	1 (ref.)	1 (ref.)	1 (ref.)
Moderate	1.8 (1.1–3.3)	2.0 (1.1–4.0)	2.8 (1.6–5.3)
High	6.1 (3.2–12.2)	8.6 (4.6–17.6)	8.9 (5.0–17.5)

In each density strata the lowest risk group was used as the reference. Risk ratios (RR) were adjusted for study population, mammography vendor, year of mammogram, and age at study-entry. NICE - National Institute of Health and Care Excellence. USPSTF - U.S. Preventive Services Task Force. [a]The NICE guidelines 10-year absolute risk categories were general, moderate, and high using absolute risk cut-off values of 3% and 8%, respectively. The risk cut-offs were adapted to 2-year risks by dividing the 10-year risk cut-offs by 5. This resulted in cut-off values of 0.6% and 1.6%.For the USPSTF guidelines, the 5-year absolute risk categories were general, moderate, and high using absolute risk cut-offs 0.6% (for the average risk of a 40-year-old woman) and 3%. The 5-year risks were adapted to 2-year risk by dividing the 5-year risk cut-offs by 2.5, i.e. 0.24% and 1.2%. [b]A log-binomial model was used to estimate the risk ratios with Wald 95% confidence intervals in tertiles of percent mammographic density using the fully automated STRATUS density tool defined by tertiles in controls.

Table 3: Risk ratios with 95% Wald confidence intervals of the risk of breast cancer at study-entry per NICE and USPSTF guidelines stratified by tertiles of percent mammographic density from lowest (Q1) to highest (Q3).

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cancers

MDPI

Review

AI-Based Characterization of Breast Cancer in Mammography and Tomosynthesis: A Review of Radiomics and Deep Learning for Subtyping, Staging, and Prognosis

Ana M. Mota

Methods: A semi-systematic review was conducted to identify AI-based approaches applied to mammography (MM) and breast tomosynthesis (BT) for tumor subtyping, staging, and prognosis. A PubMed search retrieved 1091 articles, of which 81 studies met inclusion criteria (63 MM, 18 BT). Studies were analyzed by clinical target, modality, AI pipeline, number of cases, dataset type, and performance metrics (AUC, accuracy, or C-index).

Conclusions: AI models can predict key tumor characteristics directly from MM and BT, showing promise as non-invasive tools to complement or even replace biopsy. However, challenges remain in terms of generalizability, external validation, and clinical integration. Future work should prioritize standardized annotations, larger multicentric datasets, and integration of histological or transcriptomic validation to ensure robustness and real-world applicability.

...work in progress...

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Schiaffino et al. European Radiology
https://doi.org/10.1007/s00330-025-11954-x

European Radiology

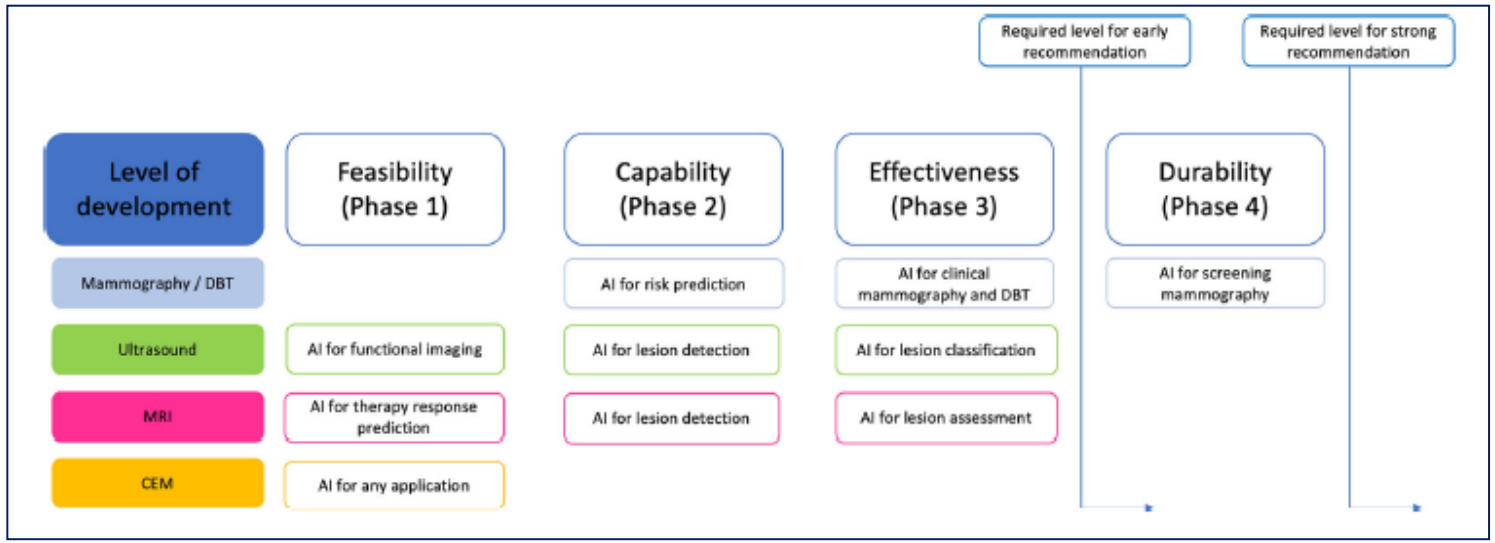
INVITED REVIEW Open Access

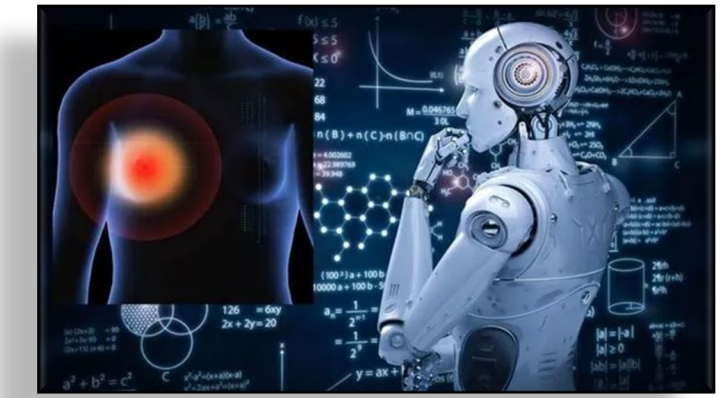
ESR Essentials: artificial intelligence in breast imaging—practice recommendations by the European Society of Breast Imaging

Simone Schiaffino[1,2*], Daniela Bernardi[3,4], Nuala Healy[5,6], Maria Adele Marino[7], Valeria Romeo[8], Ioannis Sechopoulos[9], Ritse M. Mann[9,10] and Katja Pinker[11]

Table 1 Summary of the main available evidence and future perspectives for each breast imaging modality

Imaging modality	Main available evidence	Future perspectives
Screening digital mammography	• Enhanced diagnostic performance, even in prospective randomized studies • Significant workload reduction • Better risk assessment than traditional models	• Extensive external validation studies • Assessment of potential impact on long-term outcomes • Post-marketing surveillance
Digital breast tomosynthesis	• Significant reading time reduction • Optimized workflows • High accuracy, especially in dense breasts	• Validation on large-scale prospective studies • Assessment of potential impact on long-term outcomes • Further integration across vendor systems
Breast ultrasound	• Improved lesion characterization • Reduce unnecessary biopsies • Integration with elastography • Good performance in axillary staging	• Standardize guidelines • Triaging in resource-limited environments • Neoadjuvant therapy response prediction
Breast MRI screening	• Limited value of commercial CAD tools • Preliminary studies on screening sets • Limited diagnostic performance in real screening cohorts	• Validation in real screening cohorts • Workload reduction
Breast MRI advanced applications	• Promising results in recurrence scores and risk prediction • Good performance on molecular subtyping prediction • Improved neoadjuvant therapy response prediction	• Personalized screening based on risk prediction • Neoadjuvant treatment tuning • Development of contrast-free imaging
Contrast-enhanced mammography	• Radiomics-based molecular subtype classification • Promising synthetic image generation	• External validation studies • Development of reduced-contrast or contrast-free techniques





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Intelligenza artificiale nella diagnostica senologica: quando ci aiuta?

La realtà LILT (Lega Italiana per la Lotta ai Tumori, Milano Monza Brianza)

- Sistema ibrido, molto diffuso sul territorio italiano ed in particolare nel centro sud.

Sistemi in prova presso LILT:
iCad
Transpara

Difficoltà nell' allestimento di un percorso ad hoc (server, rete, disponibilità real time, ecc)

- *Valore aggiunto nella diagnostica clinica*
- *Problematiche commerciali*
- *Problematiche legislative*
- *Problematiche medico legali*
- *Problematiche comunicative*

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RIVISTA ITALIANA DI INFORMATICA E DIRITTO
PERIODICO INTERNAZIONALE DEL CNR-IGSG

ISSN 2704-7318 • n. 2/2024 • DOI 10.32091/RIID0166 • articolo sottoposto a peer review • pubblicato in anteprima il 9 ago. 2024

PAOLO ZUDDAS

Intelligenza artificiale in medicina: alcune risposte – significative, ma parziali – offerte dal codice di deontologia medica (in materia di non discriminazione, consenso informato e relazione di cura)

European Commission

Call: EU4H-2024-PJ-02

(EU4H Action Grants 2024)

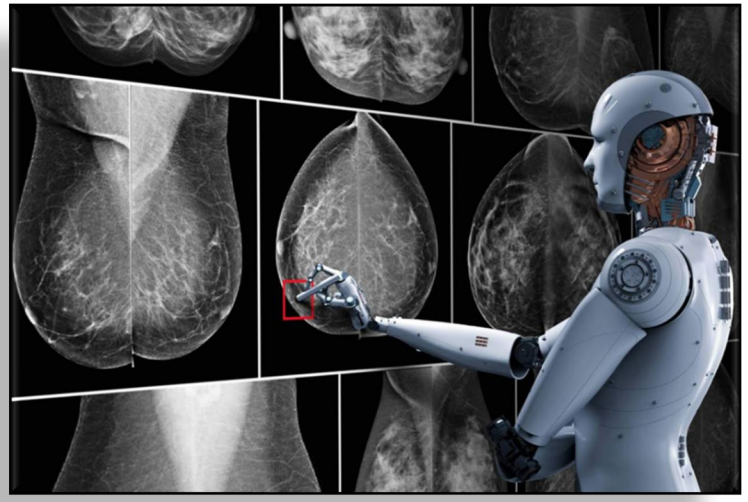
Topic: EU4H-2024-PJ-02-1

Type of Action: EU4H-PJG

(EU4H Project Grants)

Proposal number: 101219312

Proposal acronym: BreastSCan



Type of Model Grant Agreement: EU4H Action Grant Budget-Based

Acronym	BreastSCan
Proposal title	Pan-European Breast Image Platform for Advanced AI-based Breast Cancer Screening
	Note that for technical reasons, the following characters are not accepted in the Proposal Title and will be removed: < > " &
Duration in months	48
Free keywords	Artificial Intelligence, Breast Cancer Screening, Mammography, Data Sharing, European Health Data Space, Imaging, Cancer Image Europe, Data Altruism

Scientific PI: Francesco Sardanelli, LILT Milano Monza Brianza, Milan, Italy
Clinical PI: Federica Pediconi, «Sapienza» University, Rome, Italy
Technical PI: Carlos Telleira, Instituto Aragones de Ciencias de la Salud, Zaragoza, Spain

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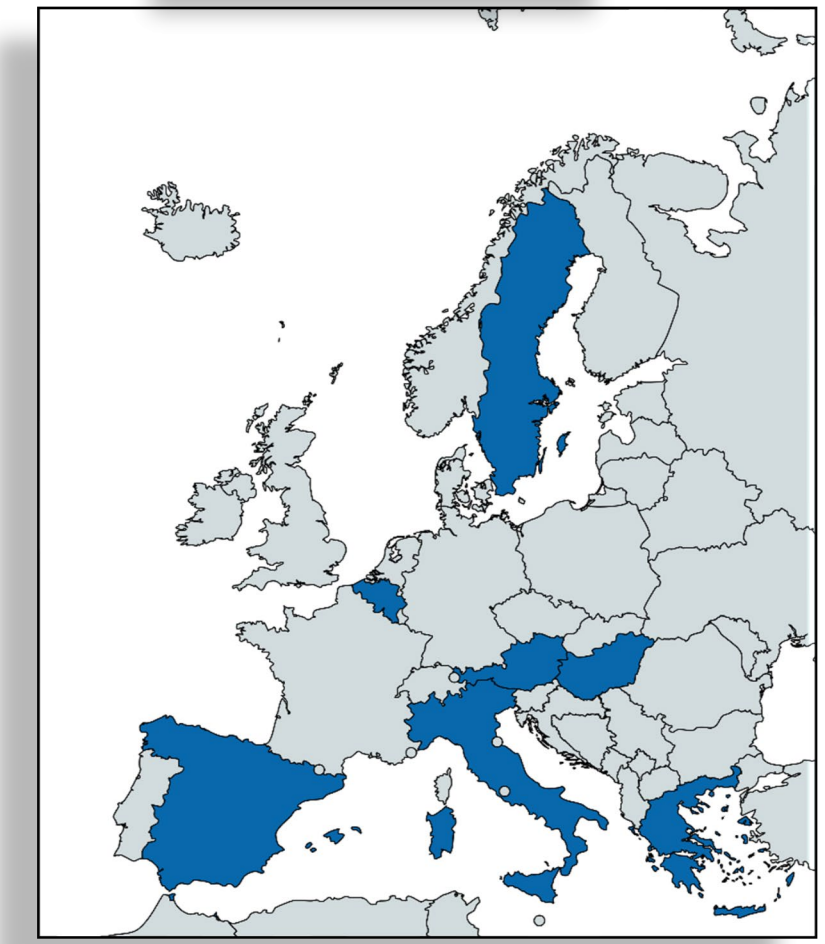
- **Project funded under EU4Health Programme**
- **Start date:** 1st of September 2025
- **End date:** 31st of August 2029

EUCAIM
CANCER IMAGE EUROPE



- ***Create a pan-European platform***
- ***Collect and federate data***
- ***Ensure legal and ethical compliance***
- ***Train and test AI tools***
- ***Empower patients and citizens***

- ***20 partners*** *(14 data holder/providers) from* ***9 EU countries***
- ***≥1 million of breast images*** *(DM/DBT/CEM, ultrasound, MRI) from* ***≥250,000 procedures****, including ≥ 30,000 images from* ***7,500 proven BC cases***

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1. *GEMEINNUTZIGE GMBH ZUR FORDERUNG DER ERFOAT,* ***EIBIR, COO, Austria***
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3. *UNIVERSITA DEGLI STUDI DI ROMA LA* ***SAPIENZA, CCO Italy***
4. *INSTITUTO ARAGONES DE CIENCIAS DE LA SALUD,* ***IACS, TCO, Spain***
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6. *FUNDACION PARA LA INVESTIGACION DEL HOSPITAL UNIVERSITARIO LA FE DE LA COMUNIDAD VALENCIANA,* ***HULAFE, SCO EUCAIM, Spain***
7. *UNIVERSITAT DE VALENCIA,* ***UVEG, Legal, Spain***
8. ***DeepTrace*** *Technologies S.R.L.,* ***Technical partner, Italy***
9. *CENTRUM VOOR KANKEROPSPORING,* ***CvKO vzw, DH/P, Belgium***
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17. *MITERA IDIOTIKI GENIKI, MAIEYTIKI, GYNAIKOLOGIKI KAI PAIDIATRIKI KLINIKI ANONYMI ETAIREIA,* ***MITERA, DH/P, Greece***
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19. *SEMMELWEIS EGYETEM,* ***SE, DH/P, Hungary***
20. *SUSAN G KOMEN ITALIA ONLUS,* ***KOMEN IT, Patients' advocacy, Italy***

AI impact on breast cancer screening

1. **Immediate image quality check**

   Increased quality (→ x-ray dose reduction)

2. **Automatic breast density classification**

   Objective/reproducible → supplementary screening

3. **Cancer detection (lesion classification)**

   AI triage for 1 or 2 AI-supported human readers

4. **Risk stratification**

   Personalized screening based on individual data

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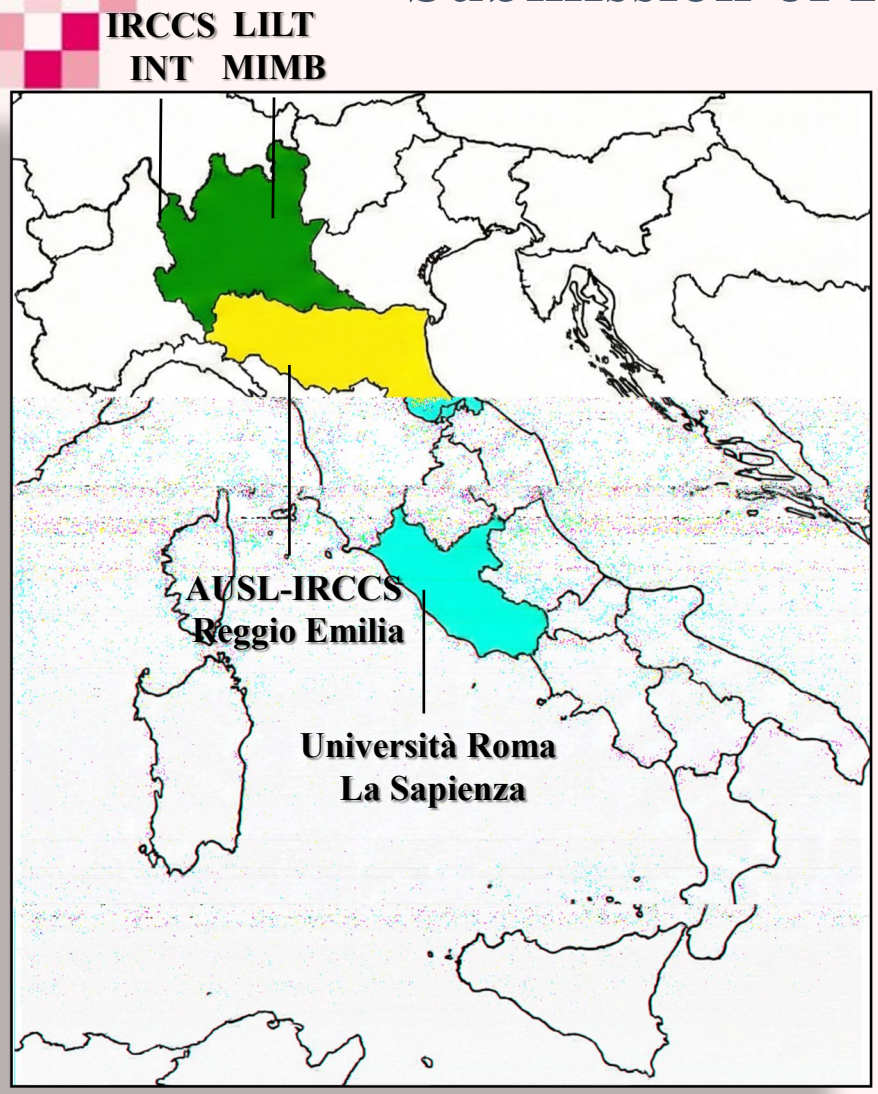
Submission of Italian multicentric observational study



- Italian multicentric observational study

- Four centers
- One shared study protocol

- **LILT MIMB** (Lega Italiana Lotta conto i Tumori)
- **IRCCS INT** (Istituto Nazionale dei Tumori)

- Approved on Dec 2025

- **AUSL-IRCCS Reggio Emilia**
- **Università Roma la Sapienza**

- In communication with the relevant ethics committees

Co-funded by the European Union
BreastSCan is co-funded under the EU4Health Programme 2021–2027 under grant agreement no. 101219312.
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Health and Digital Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Intelligenza artificiale nella diagnostica senologica: quando ci aiuta?

Conclusioni

La mia opinione personale, dopo 30 anni di attività diagnostica senologica…

Sistemi molto performanti, in crescita tecnologica.
Realtà screening di dominio assoluto dell'AI.
Tempo risparmiato in termini di carico di lavoro, contestualizzati alla realtà sanitaria globale.
Scarsa disponibilità di radiologi (in particolare senologi) e quindi dedicati agli screening.
Sistemi riproducibili, standardizzati, performanti nel tempo.
Risparmio economico.
Necessità di ottimizzare il loro utilizzo.
Normative legislative europee che ne regolarizzino il loro utilizzo.
Controllo dei vari Vendor.

Sardanelli and Scaperrotta *European Radiology*
https://doi.org/10.1007/s00330-025-12036-8

EUROPEAN SOCIETY OF RADIOLOGY
European Radiology

SPECIAL REPORT

Artificial intelligence for breast cancer prevention: the vision ahead

Francesco Sardanelli[1*] and Gianfranco Scaperrotta[2]

- AI tools can improve screening mammography interpretation by increasing cancer detection rate by over 25% and reducing reading workload by more than 40%.
- Interesting results were obtained using AI for breast cancer risk stratification, especially using deep learning analysis of the dynamic evolution of mammographic breast density and texture over time.
- **Breast radiologists should also focus on primary (true) prevention by promoting a healthier lifestyle, regular physical exercise, balanced diet and weight control, and smoking cessation.**
- Web-based tools, mobile apps, wearable devices, can support these efforts.
- **AI has the potential to help both primary and secondary breast cancer prevention.**

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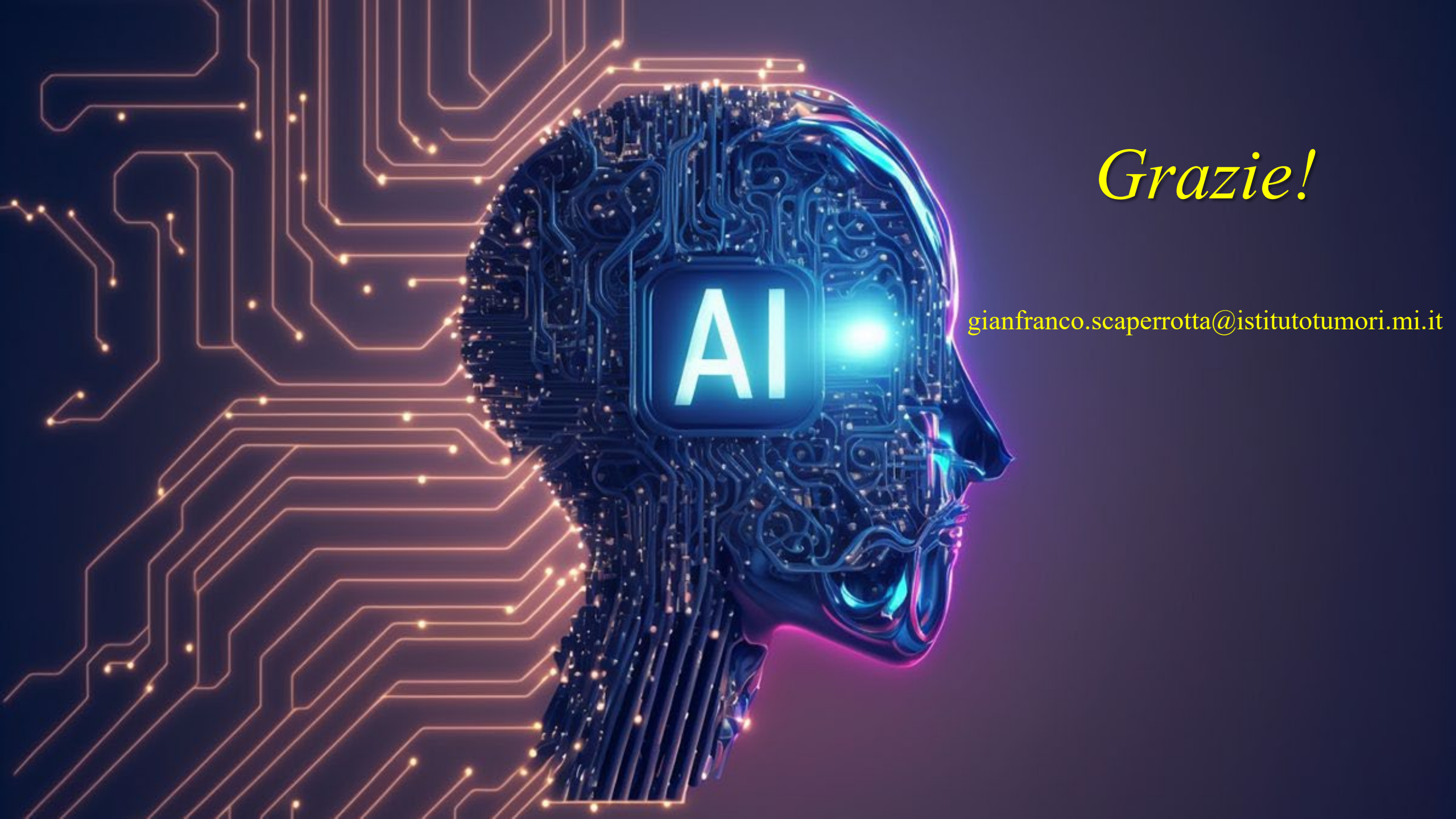

Grazie!

gianfranco.scaperrotta@istitutotumori.mi.it