



A web-based application for BI-RADS description of breast ultrasound images

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Project Goals

- Train breast ultrasound imaging novices and increase inter-expert agreement
- Generate a web-application that includes:
 - A collection of breast ultrasound images annotated by expert radiologists
 - An AI model capable of detecting and describing tumors
 - A graphical interface to compare the user's descriptions with those of the AI model, other experts, and their own previous descriptions, by means of statistical data and graphs
- Allow users to improve their diagnostic skills by learning from other radiologists, from the AI, and from themselves.

Selecting a tumor

Select an image from the dataset

In the “describe” page you can select tumors from three public databases [1,2,3]
Apply a filter for tumor name or for the number of times you have described them
Choose a tumor or allow the app to select a random one

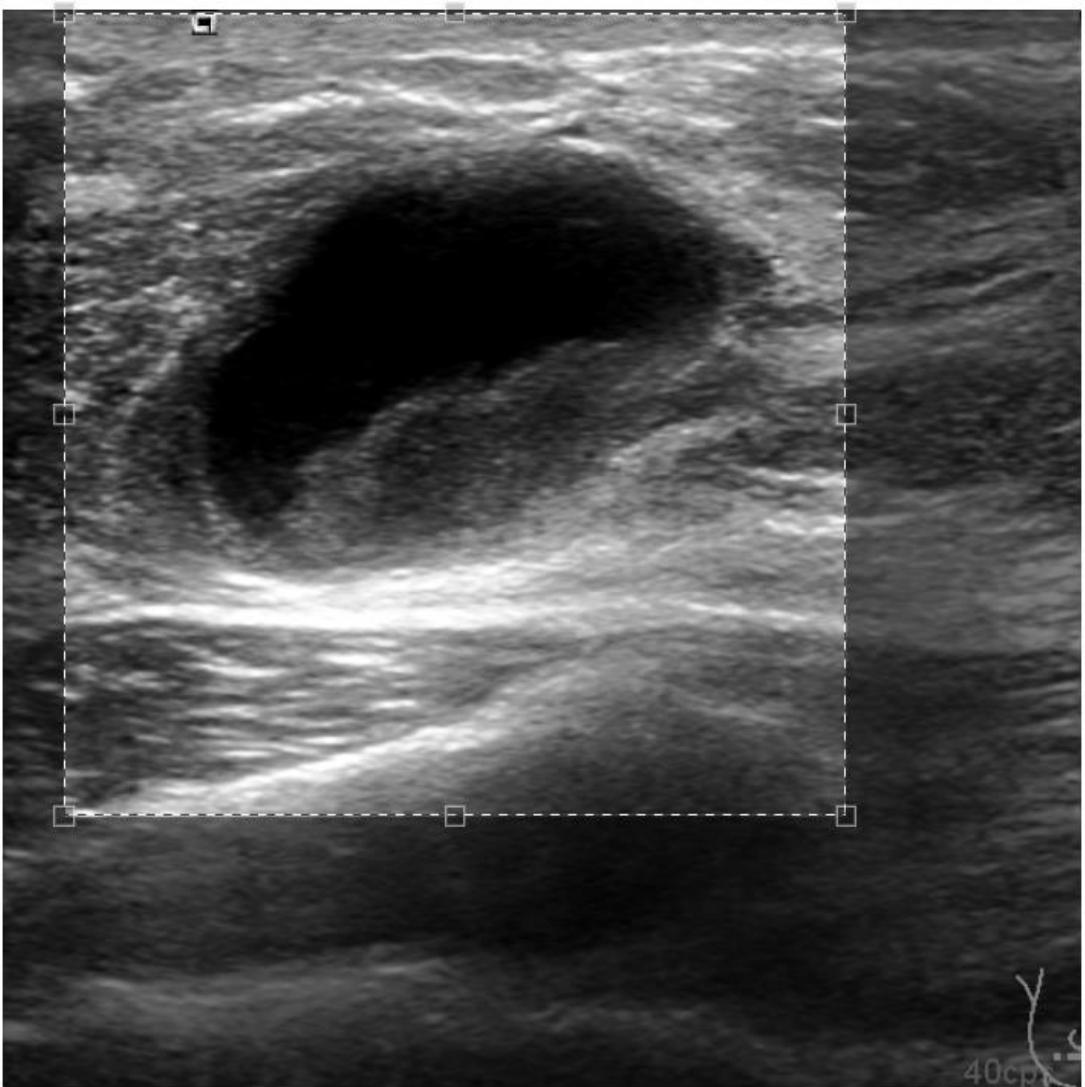
Number of nodules to describe with this filter: 109

Number of nodules described with this filter: 230



Upload your own image

You can also upload your own image
Crop and select the ROIs of one or more tumors
Use the AI model to help you in the process
Save the crops to your database and describe them

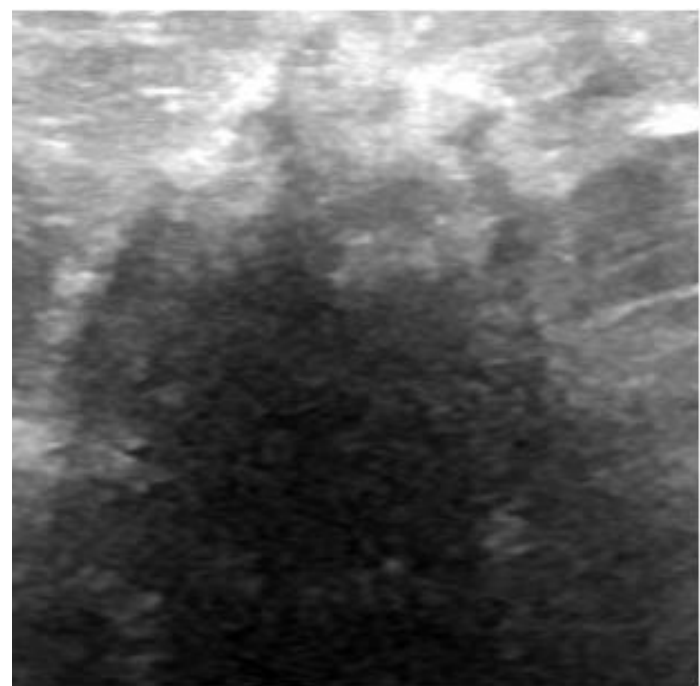


Select a crop with your mouse and click on “Crop Image”.



Describing a tumor

Describe a tumor, save the results, and compare your description with that of the AI model (in blue) and other experts (in green).



Special cases

Number of experts for this descriptor 0

- ☐ simple cyst
- ☐ clustered microcysts
- ☐ complicated cyst
- ☐ mass in skin
- ☐ mass on skin
- ☐ lymph node
- ☐ postsurgical fluid collection
- ☐ fat necrosis

0.00%
0.07%

BI-RADS

Number of experts for this descriptor 3

- ☐ 2
- ☐ 3
- ☐ 4A
- ☐ 4B
- ☒ 4C
- ☐ 5

0.00%
0.00%
0.05%
7.51%
37.97%
2 of 3
54.47%
1 of 3

Shape

Number of experts for this descriptor 3

- ☐ oval
- ☐ round
- ☒ irregular

0.04%
0.09%
99.87%
3 of 3

Margin

Number of experts for this descriptor 3

- ☐ circumscribed
- ☐ microlobulated
- ☒ indistinct
- ☐ angulated
- ☐ spiculated

0.09%
2.81%
60.33%
2 of 3
2.31%
34.46%
1 of 3

Orientation

Number of experts for this descriptor 3

- ☐ parallel
- ☒ no orientation
- ☐ not parallel

33.91%
1 of 3
44.61%
1 of 3
21.48%
1 of 3

Echogenicity

Number of experts for this descriptor 3

- ☐ anechoic
- ☒ hypoechoic
- ☐ heterogeneous
- ☐ hyperechoic
- ☐ isoechoic
- ☐ complex cystic and solid

0.01%
82.28%
2 of 3
15.13%
1 of 3
2.57%

Posterior

Number of experts for this descriptor 3

- ☐ no features
- ☐ enhancement
- ☒ shadowing
- ☐ combined pattern

3.73%
0.33%
95.93%
3 of 3

Calcifications

Number of experts for this descriptor 3

- ☒ no calcifications
- ☐ calcifications

3 of 3

Statistics: evaluating your performance

Calculate your intracorrelation (the agreement with yourself when describing the same tumors) and intercorrelation with other experts (in parentheses the number of tumors considered in the comparison)

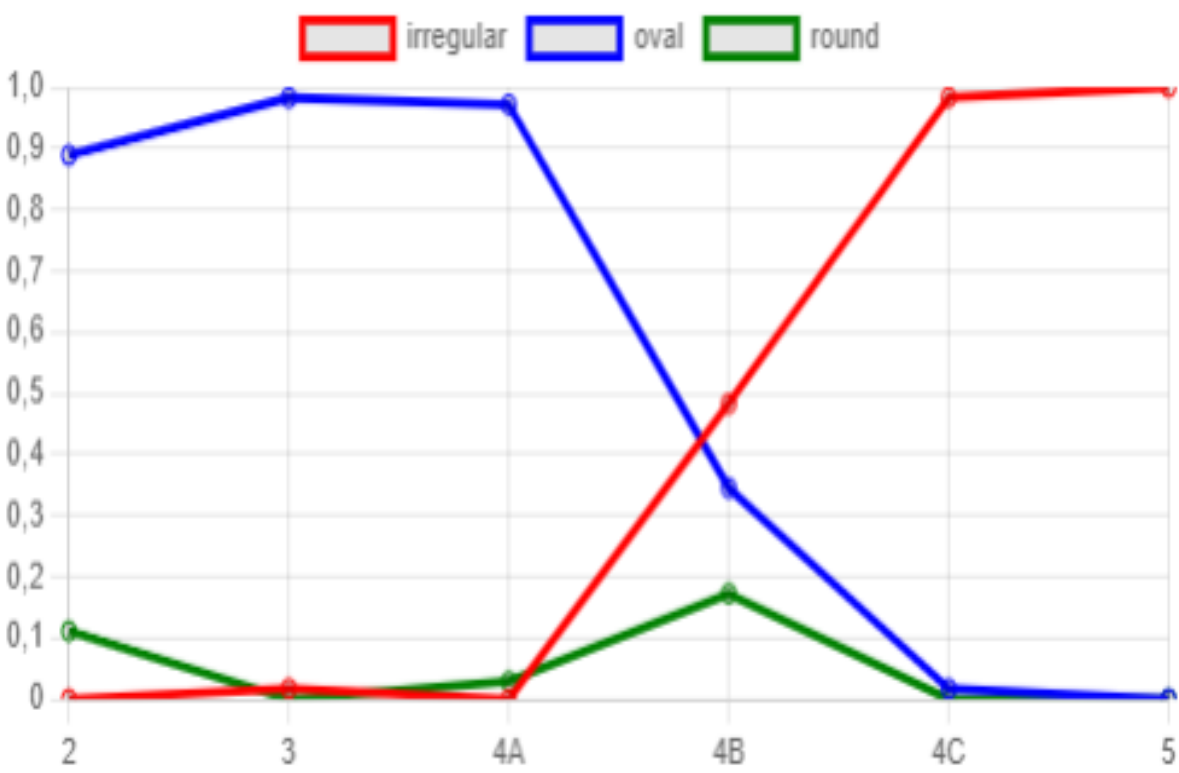
Shape	Margin	Orientation	Echogenicity	Posterior	Calcification	Suggestivity	BI-RADS
Intracorrelation							
0.76 (16)	0.76 (16)	0.29 (16)	0.59 (16)	0.78 (16)	0.76 (16)	1 (16)	0.76 (16)
Intercorrelation (Manuela)							
0.73 (252)	0.46 (251)	0.49 (256)	0.53 (254)	0.54 (242)	0.47 (174)	0.33 (62)	0.49 (256)

Compare the importance you give to each descriptor with other experts. The example below shows the probabilities of each feature inside the shape descriptor when estimating the BI-RADS malignancy

Your graphs

Shape

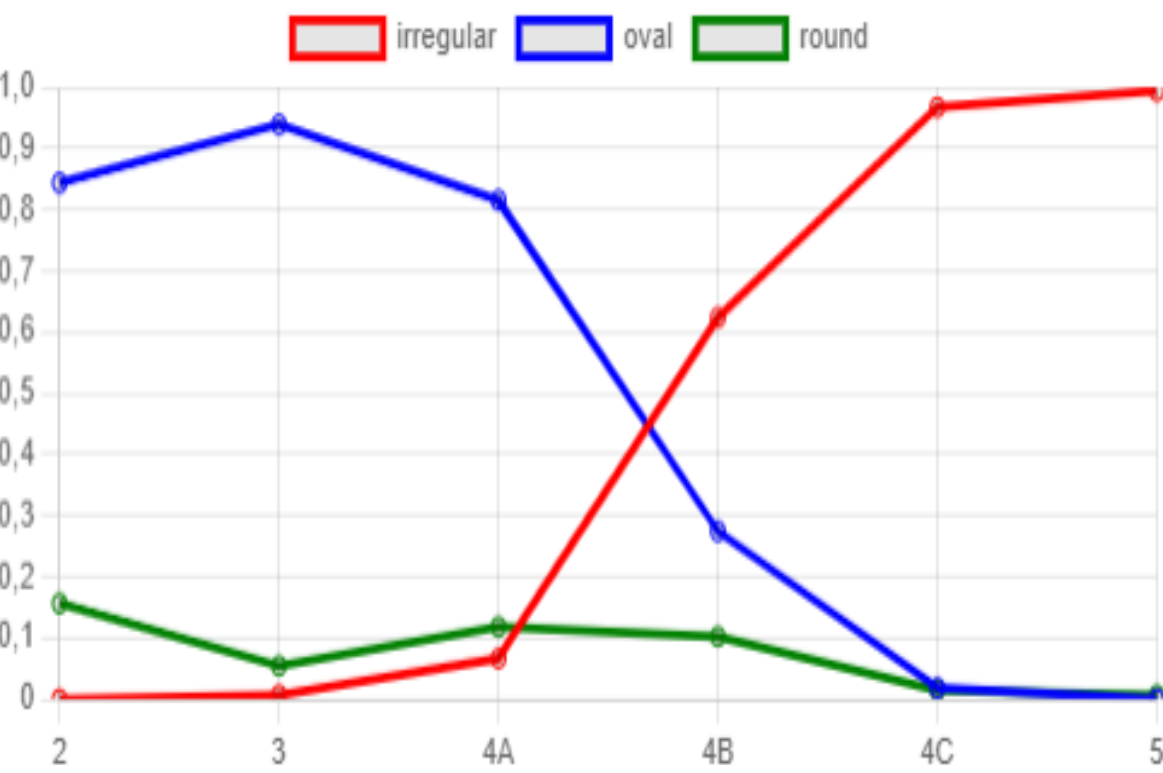
(Number of descriptions: 272)



Compared with Overall (experts: 2)

Shape

(Number of descriptions: 1534)



Next steps

- Increase the number of tumors (uploaded by users or from other datasets)
- Enhance the AI model with the descriptions introduced by users
- Collaborate with more experts to validate and improve the application
- Integrate more interactive and educational features to further support learning and diagnostic skills

References

[1] W. Al-Dhabyani, M. Gomaa, H. Khaled, A. Fahmy, Dataset of breast ultrasound images, Data in brief, vol. 28, p. 104863, 2020. [2] M. H. Yap et al., “Automated breast ultrasound lesions detection using convolutional neural networks,” IEEE journal of biomedical and health informatics, vol. 22, no. 4, pp. 1218–1226, 2017. [3] Y. Zhang et al., “BUSIS: a benchmark for breast ultrasound image segmentation,” in Healthcare, vol. 10. MDPI, 2022, p. 729. MDPI, 2022.