# The role of AI in the diagnosis of thyroid nodules

Pablo Valderrabano, MD, PhD
Department of Endocrinology and Nutrition
Ramón y Cajal University Hospital, IRYCIS
Madrid, Spain

pablo.valderrabano@salud.madrid.org

# Disclosures

- I am going to discuss unpublished data
- I am co-inventor of ULISSES methodology and PI of ULISSES studies

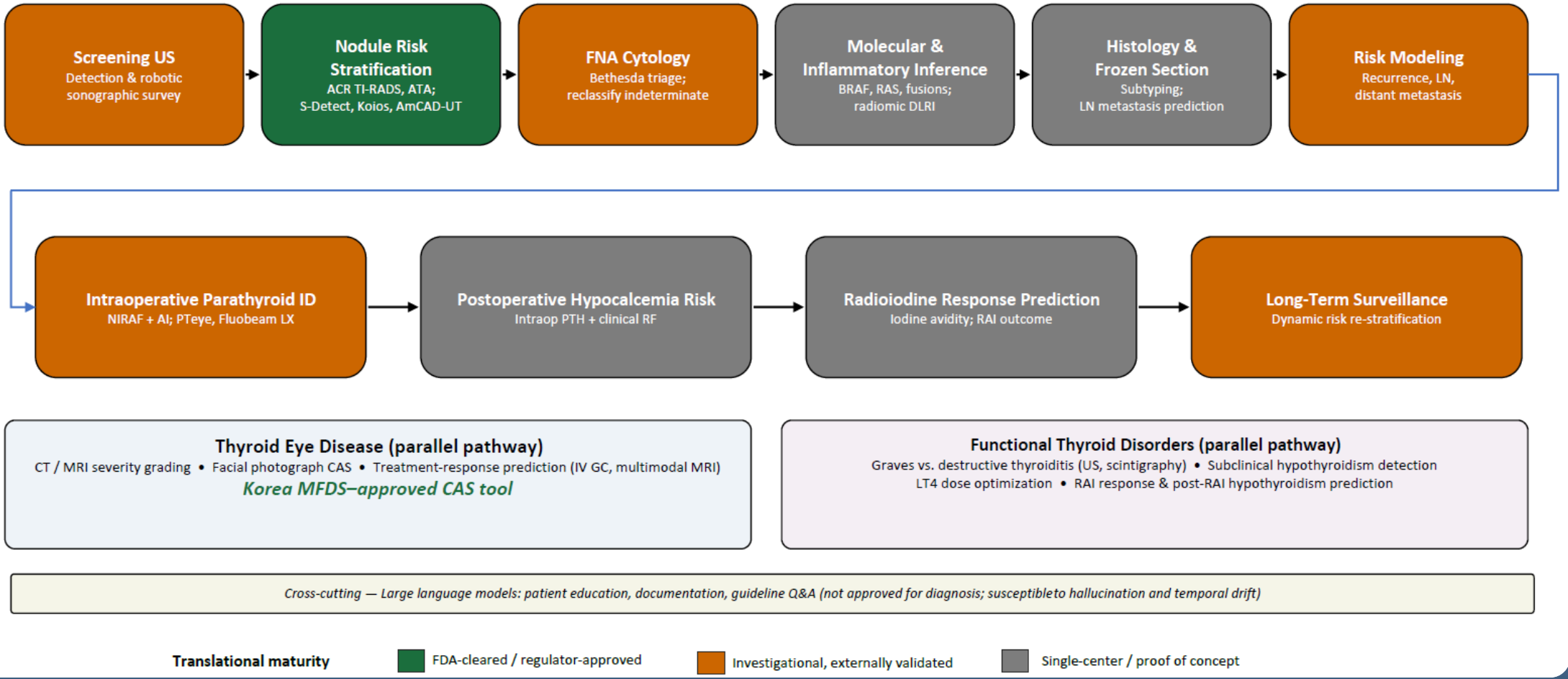
January 2026

- **By 2028:** Robots will outperform human surgeons
- **By 2030:** More robot surgeons than human ones on Earth.



# Artificial Intelligence Applications Across the Thyroid Clinical Pathway

*Nodes color-coded by translational maturity*




*Thomas & Díaz Soto. Endocrine Practice. In Press*

Table 1. Commercial AI Systems for Thyroid Nodule Evaluation Cleared by the U.S. Food and Drug Administration

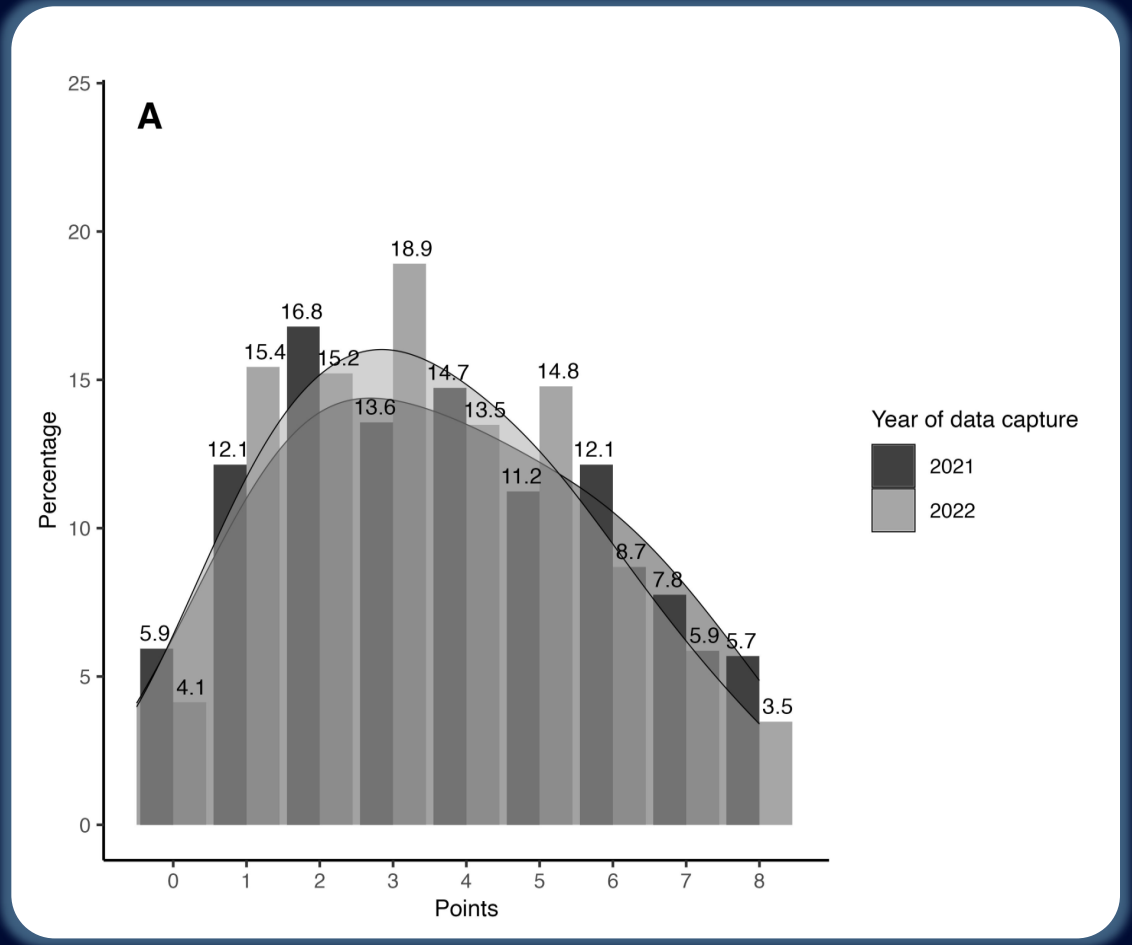
| *Product* | *Vendor* | *Hardware/Operating system(s)* | *PACS integration* | *U.S. modalities supported* | *Automatic nodule selection* | *Automatic segmentation* | *RSSs* | *Reporting function* |
|---|---|---|---|---|---|---|---|---|
| AmCAD-UT | AmCad BioMed (Taipei, Taiwan) | Microsoft Windows or Android | Yes | Static grayscale and color Doppler | Yes | Yes | ACR TI-RADS, EU-TIRADS, K-TIRADS, ATA Guidelines, AACE/ACE/AME, BTA | Yes |
| Koios DS Thyroid | Koios Medical (Chicago, IL) | Server or GE LOGIQ series scanner | Yes | Static grayscale images and clips | No | Yes | ACR TI-RADS, ATA Guidelines | Yes |
| S-Detect | Samsung Healthcare (Seoul, South Korea) | Samsung RS85 Prestige or V8 scanners | Yes | Static grayscale and color Doppler | Semi-automated | Yes | ACR TI-RADS, EU-TIRADS, K-TIRADS (in the U.S., features are completed manually) | Yes |
| See-Mode Thyroid | See-Mode Technologies (Melbourne, Australia) | Browser-based | Yes | Static grayscale and color Doppler | Yes | Yes | ACR TI-RADS | Yes |
| Thyroid Sono | Exo Imaging (Santa Clara, CA) | Dedicated computer running Linux | Yes | Static grayscale images and clips | No | Yes | ACR TI-RADS | Yes |
| tUS Infinity and Thyroid Diagnostics | PIUR Imaging (Vienna, Austria) | Windows 10 | Yes | Static grayscale image | No | Yes | ACR TI-RADS[a] | Yes |

[a]Not yet approved in the United States.

AACE, American Association of Clinical Endocrinology; ACE, American College of Endocrinology; ACR, American College of Radiology; AME, Associazione Medici Endocrinologi; ATA, American Thyroid Association; BTA, British Thyroid Association; EU-TIRADS, European TIRADS; K-TIRADS, Korean TIRADS; TIRADS, Thyroid Imaging, Reporting and Data System.

*Thomas & Tessler. Thyroid. 2026;36(2):133-140*

# Ultrasound reports have insufficient quality




*Valderrabano et al. Eur Thyroid J. 2025; 14 e240390*

87 % of ultrasound reports provide incomplete information

On average, only 3 of the 8 required features are reported

This leads to unnecessary new tests

* Study conducted in 2025 in the Community of Madrid (Spain).

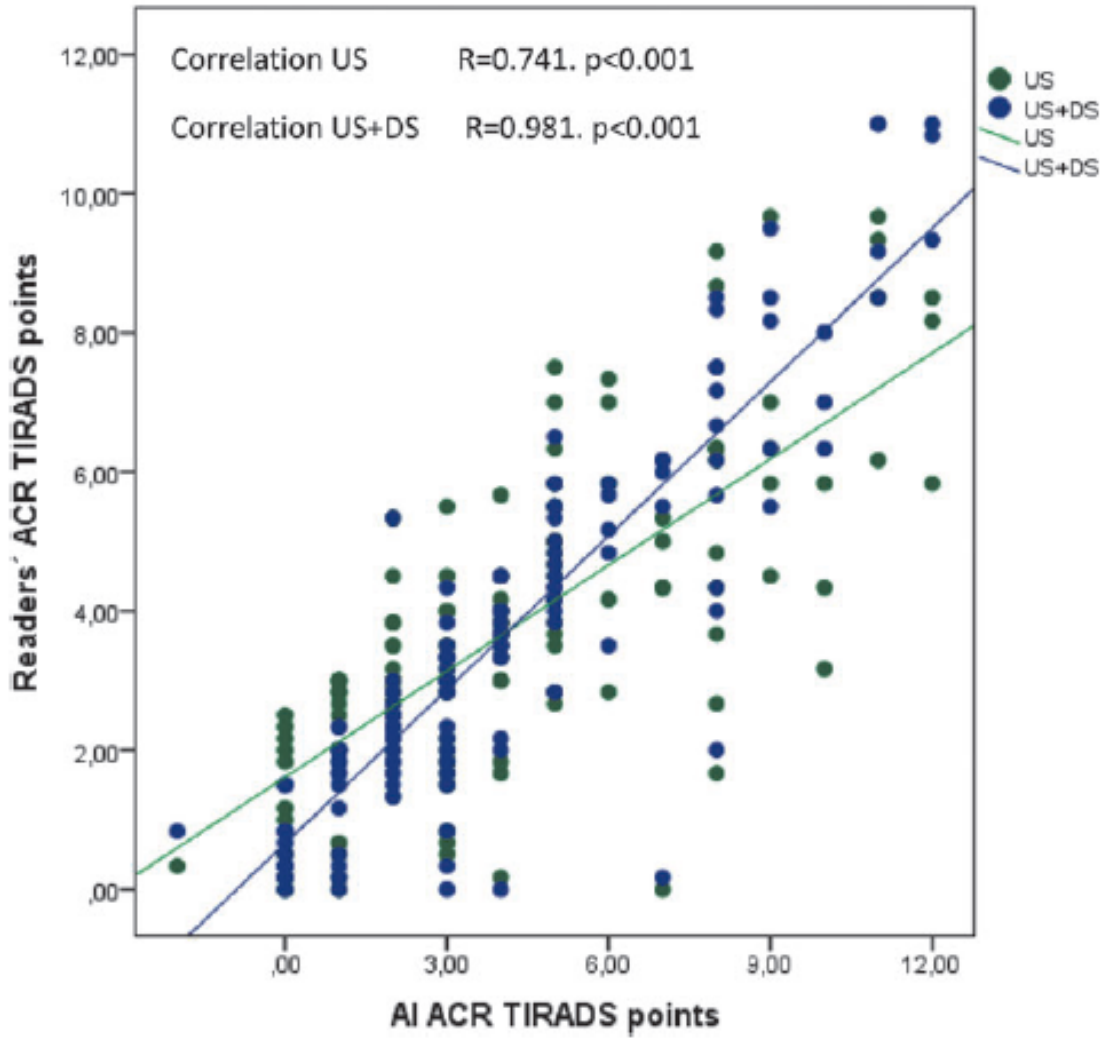



**FIG. 3.** Correlation between the readers and the AI ACR TI-RADS score. ACR TI-RADS, American College of Radiology Thyroid Imaging Reporting and Data System.

*Fernández Velasco et al. Thyroid. 2024; 34(4):510-18*

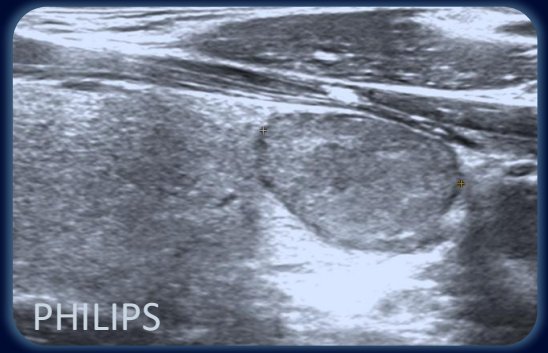
**Table 2** Inter-observer agreement for sonographic features (Free-marginal kappa)

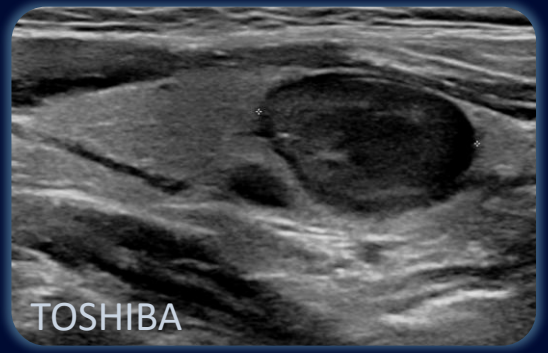
| Sonographic feature (n categories) | % overall agreement | Free-marginal kappa |
|---|---|---|
| Echogenicity (4) | 51% | 0.35 (0.31–0.39) |
| Composition (4) | 75% | 0.66 (0.62–0.70) |
| Margins (2) | 75% | 0.50 (0.43–0.55) |
| Echogenic foci (3) | 85% | 0.77 (0.73–0.81) |
| ETE (2) | 91% | 0.82 (0.78–0.86) |
| Suspicious lymph nodes ($n = 116$) (2) | 90% | 0.80 (0.72–0.89) |
| Sonographic pattern (5) | 49% | 0.36 (0.32–0.41) |

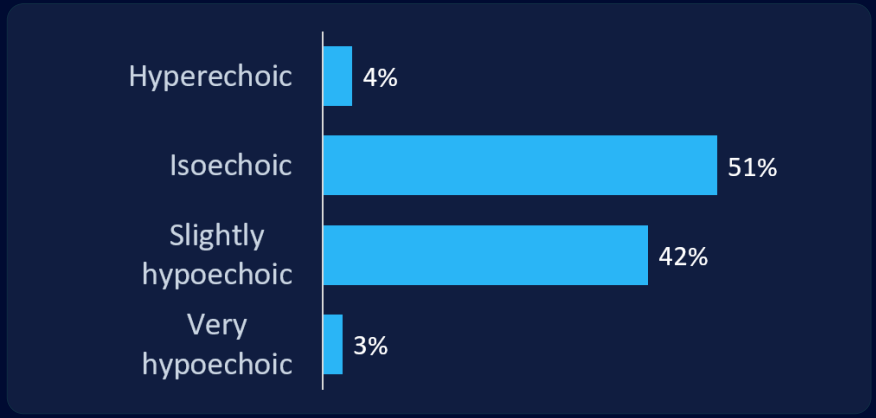
*Lam et al. Endocrine. 2019; 66(2):278-287*

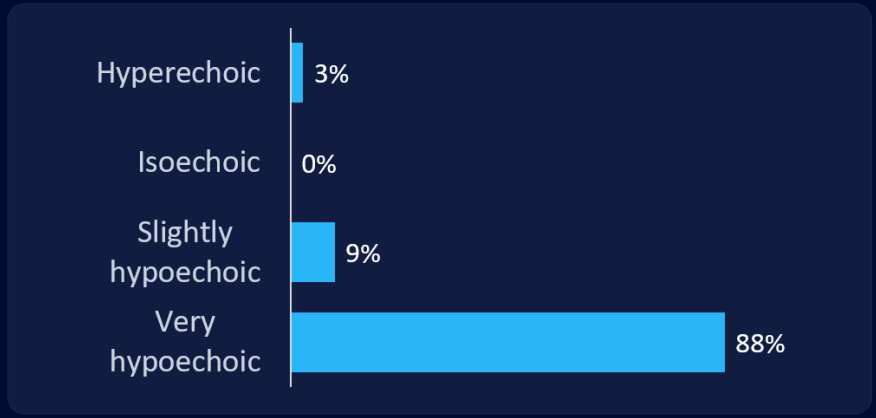
# Ultrasound imaging is not standardized

**1** same nodule, **2** scanners, **3** interpretations




* A survey of 80 endocrinologists at SEEN 2025 regarding the echogenicity of the nodule in each image.
Both images show the same lesion, acquired using two different ultrasound scanners.

# Limitations of current AI FDA-approved tools

- Trained on non-standardized images
  - Manually labeled (subjective interpretation)
  - Improve interobserver agreement → default effect
- Trained on binary output (benign – malignant)
  - Good for PTCs (less clinical impact)
  - Underperformance on FTC, OTC, MTC…
  - Little benefit for expert observers (better for junior profiles)
  - Selection bias of training datasets → overestimate risk in low malignancy prevalence settings
- Frame dependency

# Barriers for implementation of available AI tools

- Limited availability outside of research settings
- Lack of high-quality independent prospective validation studies
- Uncertain added value in clinical practice
- Limited reimbursement by payers

# What do we need?

- Image standardization
- Cine-loop analysis
- Prospective multicenter data collection and validation

# ULISSES

Standardizing the future of ultrasound imaging

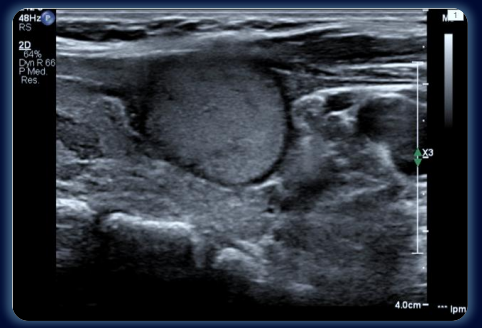
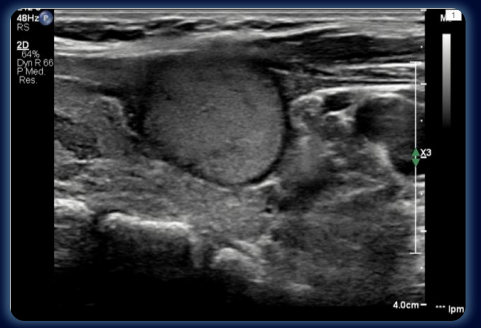
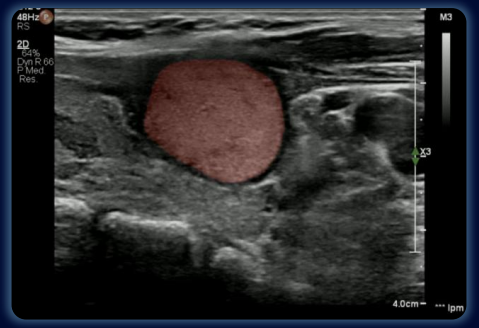
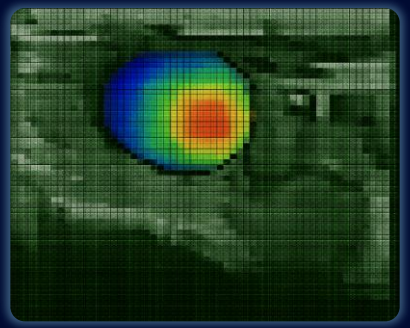
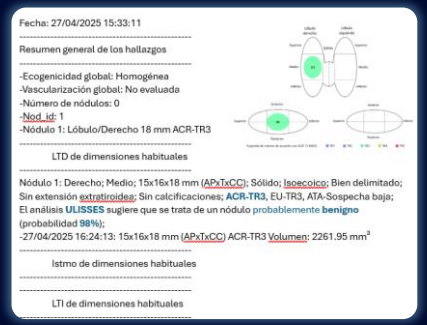


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# The ULISSES project

Developing software for automatic, objective, precise, reproducible analysis of ultrasound imaging


Image/video upload

ULISSES standardization

Autosegmentation

Unpublished data

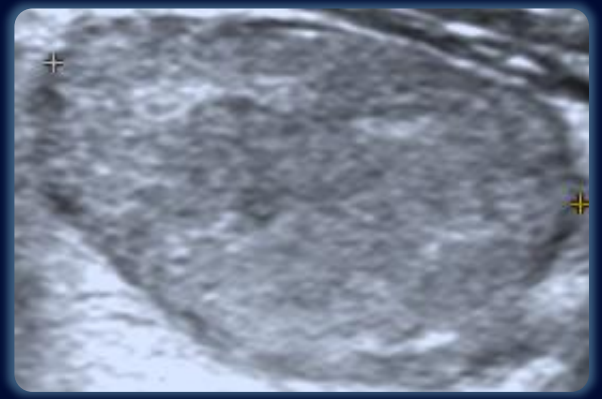
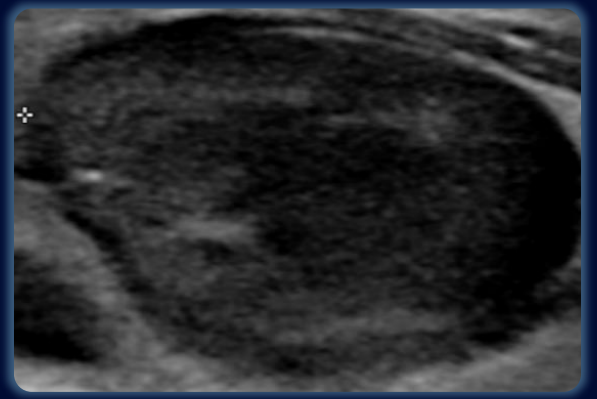
AI diagnostic software

Structured report

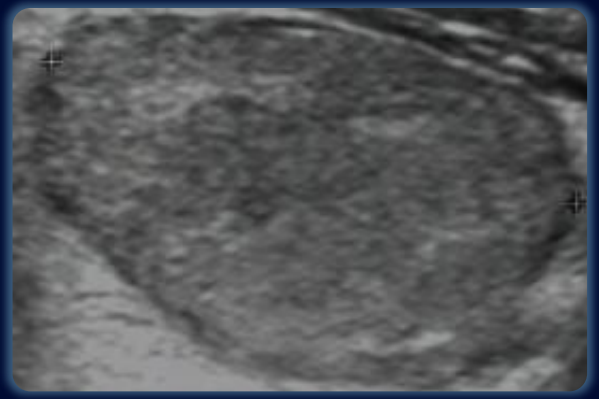
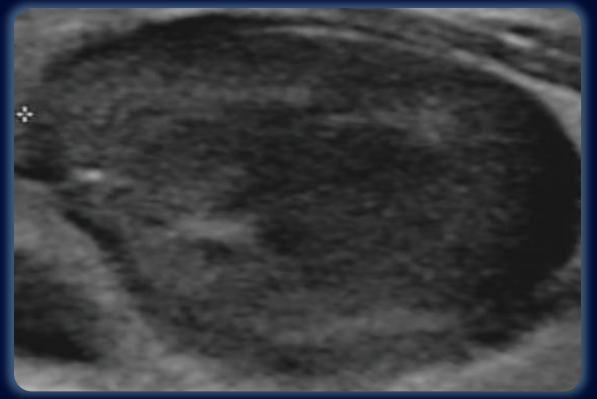
# Visual results of ULISSES standardization

PHILIPS TOSHIBA

Original images

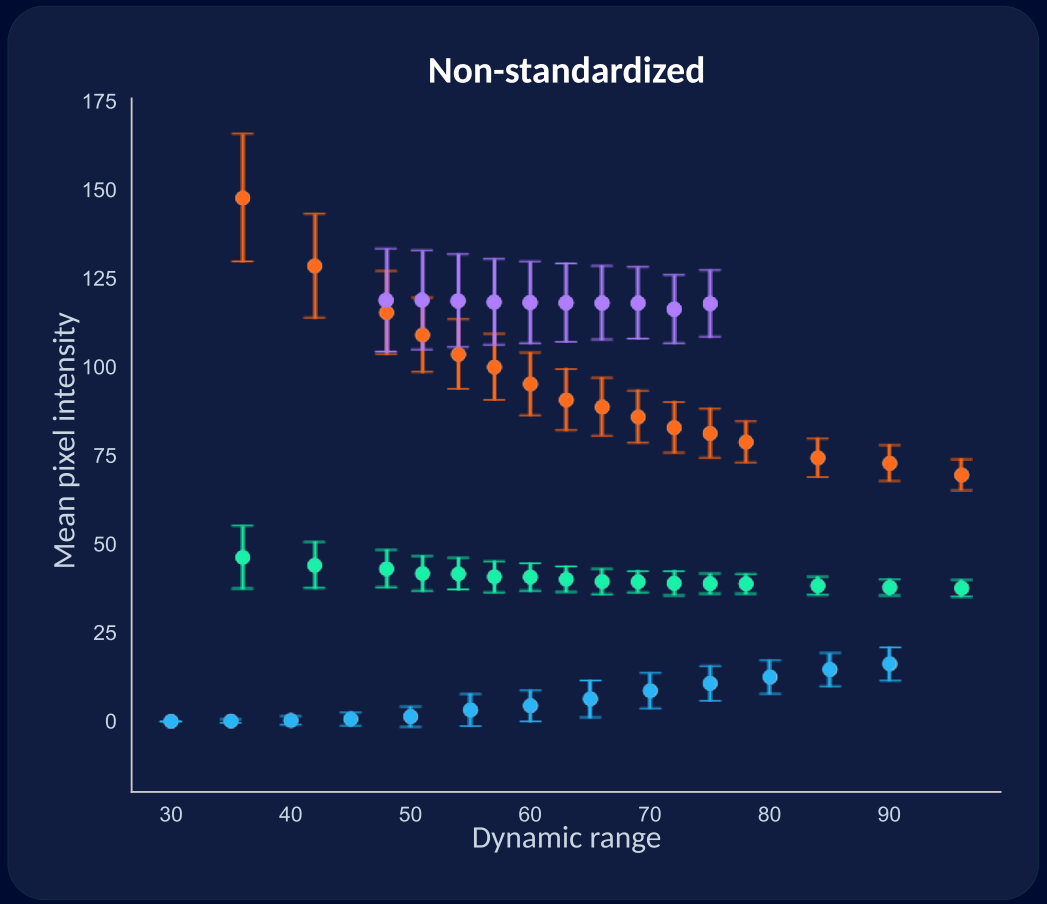
Standardized images

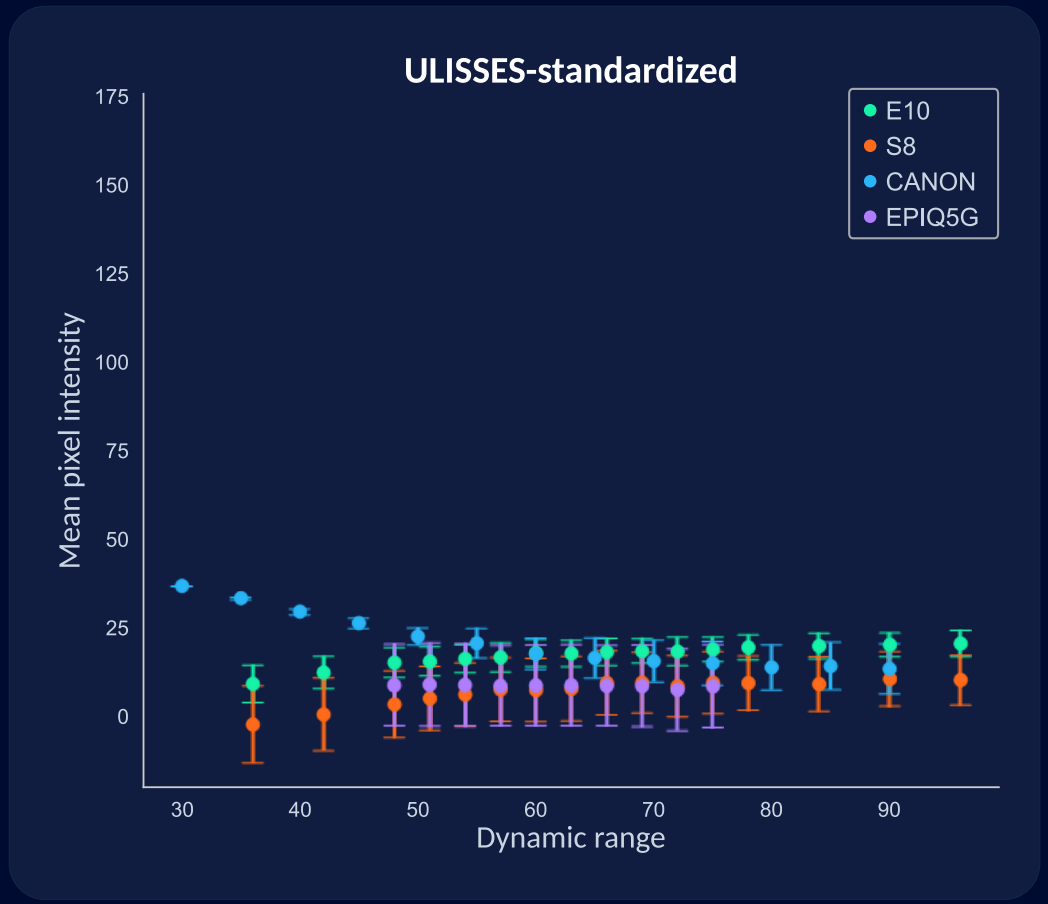



Unpublished data

# Scientific evidence

The more comparable the data, the greater the accuracy

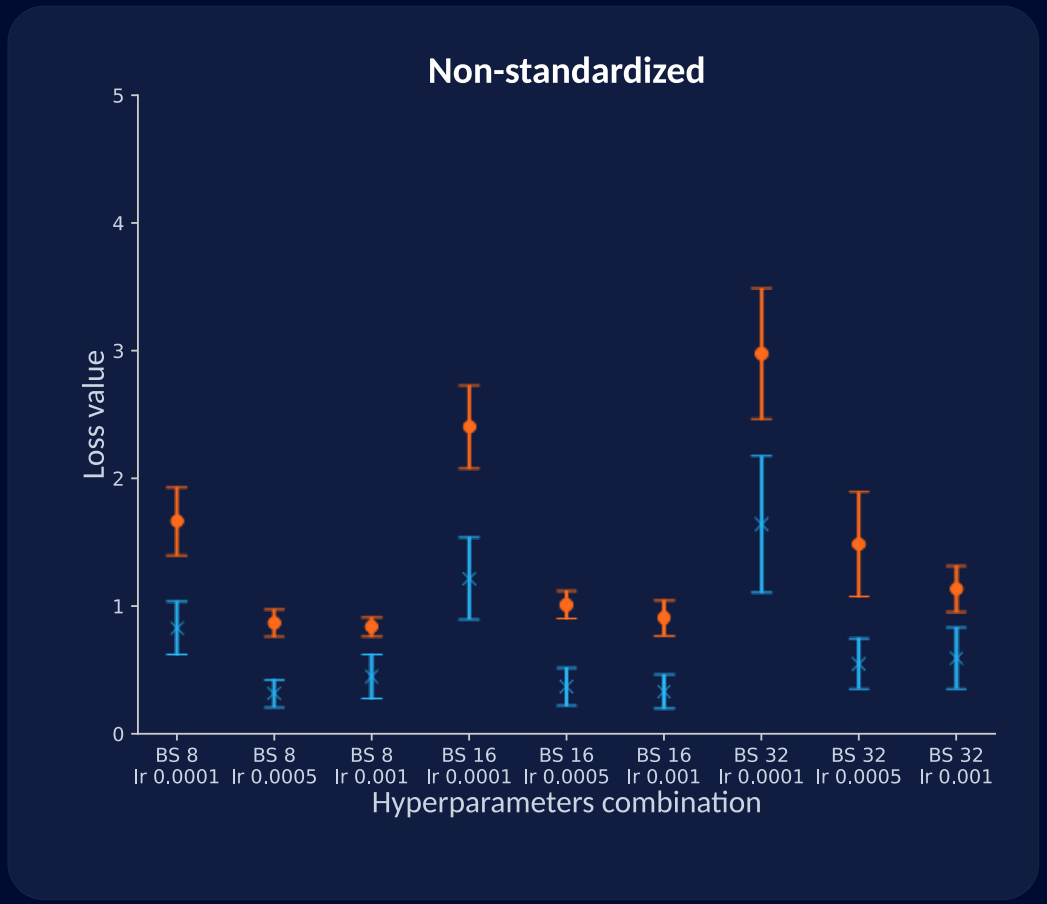


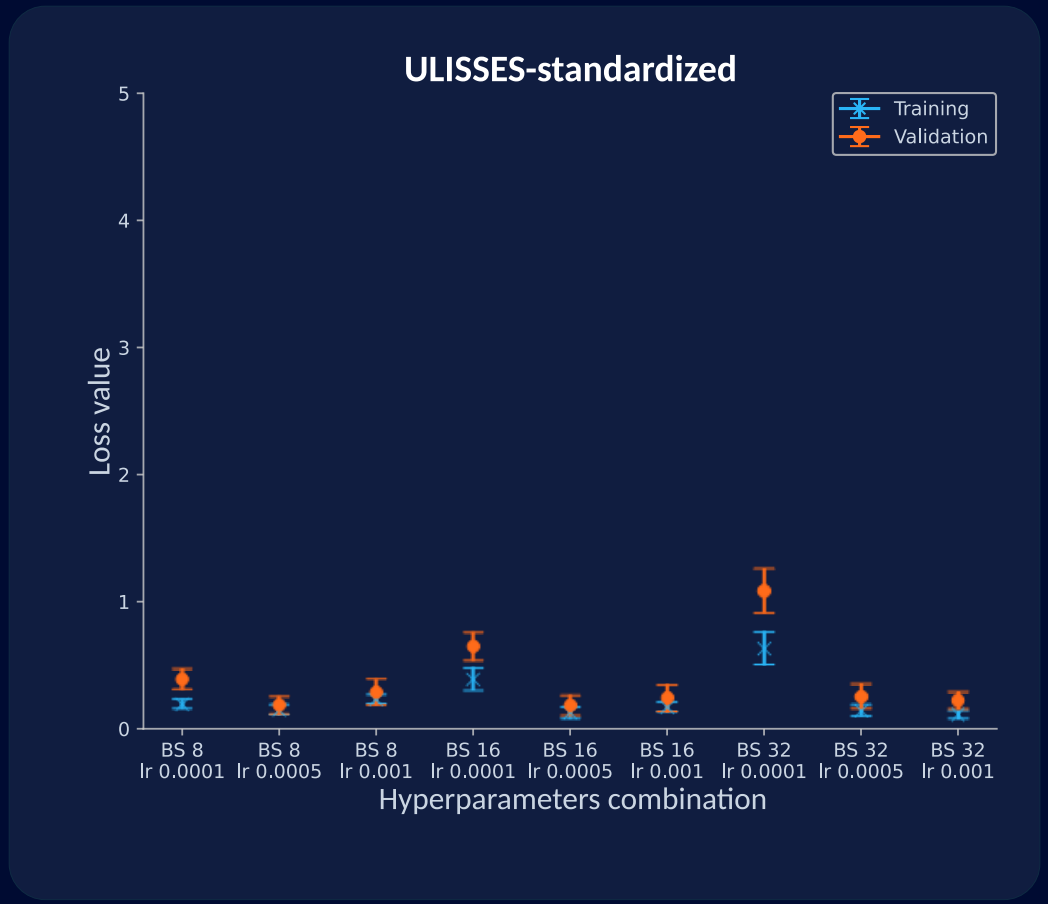




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# Scientific evidence

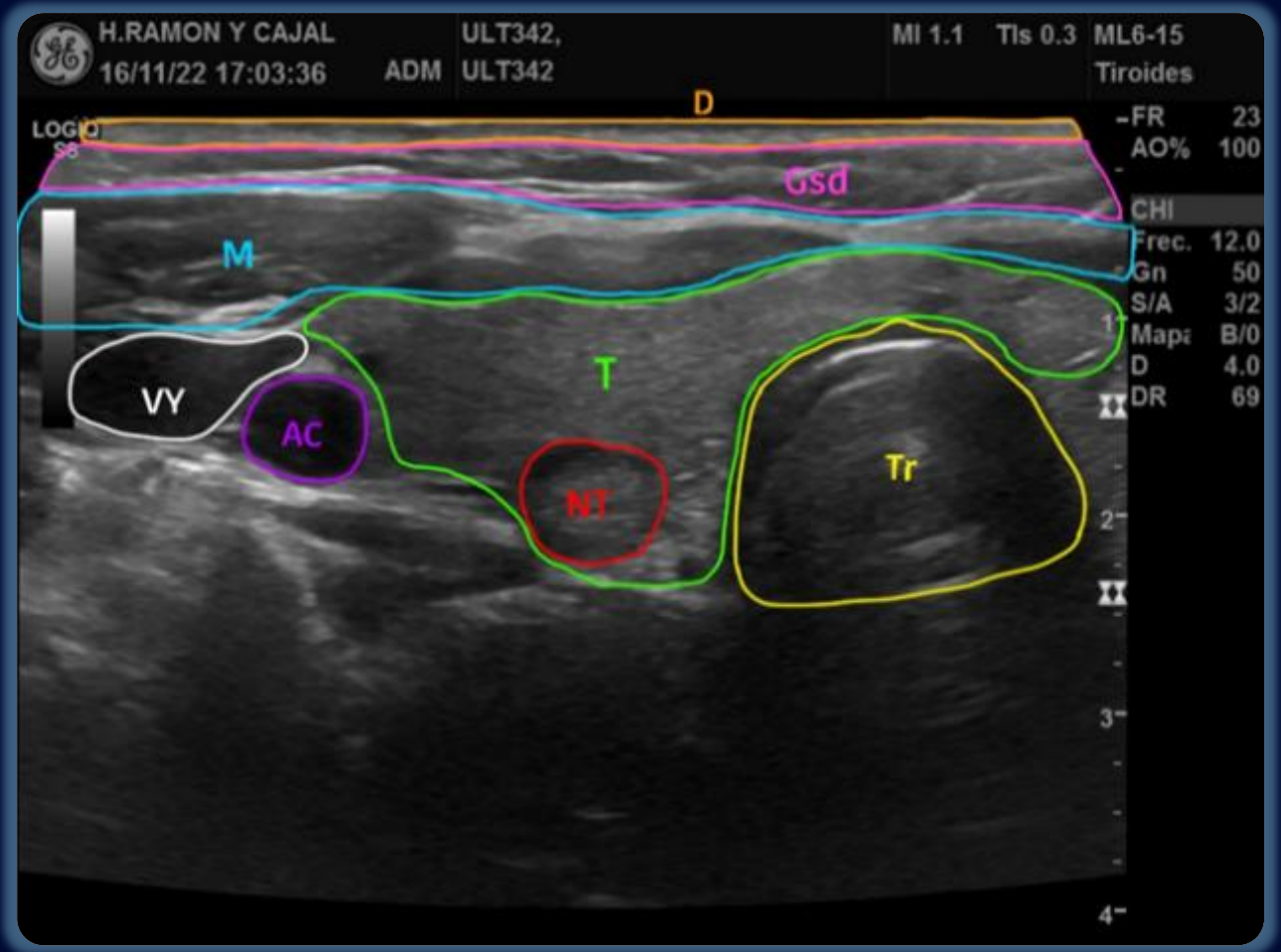
The more comparable the data, the greater the accuracy




Unpublished data

# Multiclass automatic segmentation

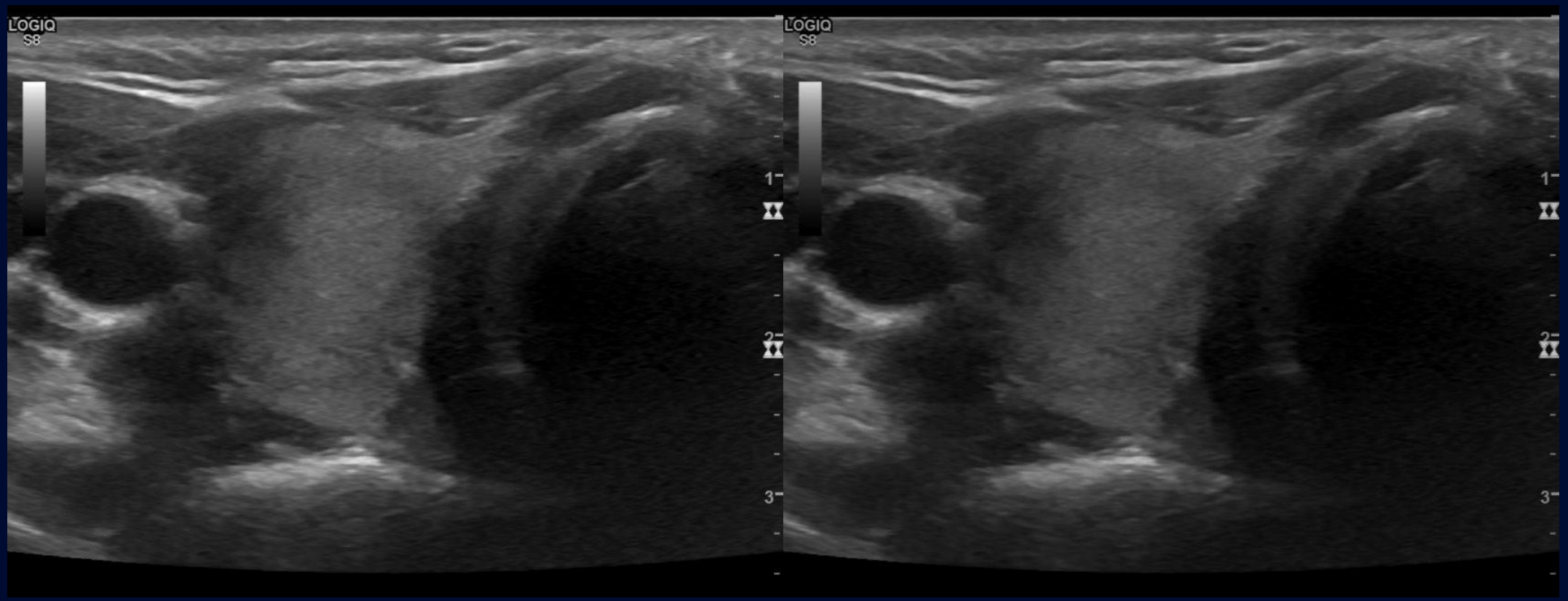



Trained with:

- >6000 images/frames
- >550 nodules
- Histologic/Cytologic correlation

*De Diego Peña et al. Under review*

# Automatic segmentation – Cine-loops

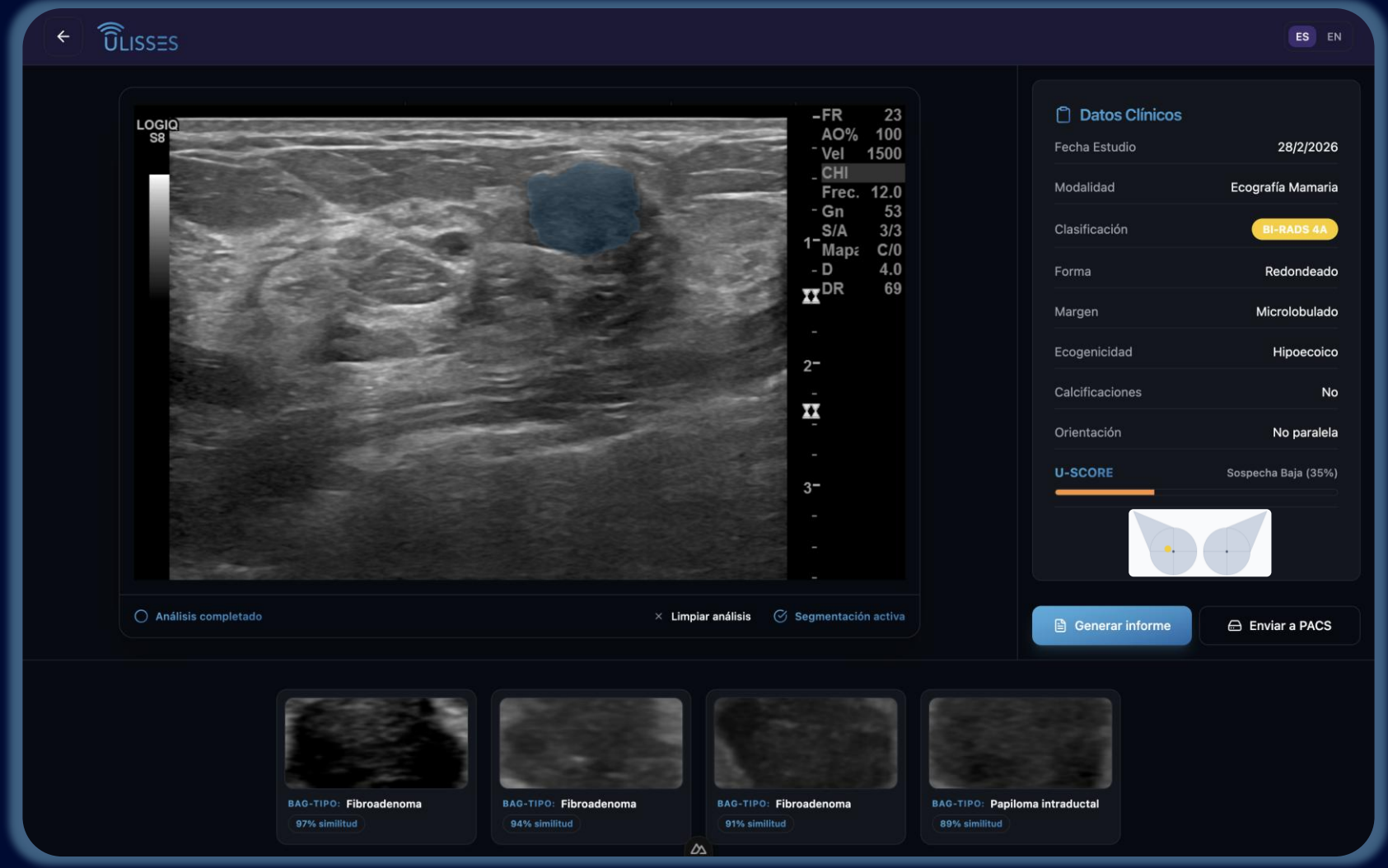



Unpublished data

# ULISSES-Thyroid – Under development

- Prospective images and cine-loops of > 700 thyroid nodules
  - 15% malignant
- Retrospective images of >250 resected thyroid nodules
  - 70% malignant
- PI26/01819 - ULISSES-Thyroid (4 yrs)
  - Hospital Universitario Ramón y Cajal
  - Hospital Universitario Son Espases
  - Hospital Clínico Universitario Valladolid

# ULISSES-Breast - Explicability module




Unpublished data

ULISSES



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SaludMadrid Hospital Universitario Ramón y Cajal

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pablo.valderrabano@salud.madrid.org