Echocardiography image quality assessment: human subjectivity and artificial intelligence predictions in multi-centre data

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Background

Image quality in echocardiography is crucial for precise diagnosis. However, its assessment is subjective, as it relies on the observer experience and perception.

Artificial intelligence algorithms offer a potential solution by optimizing image acquisition and enhancing its subsequent analysis.

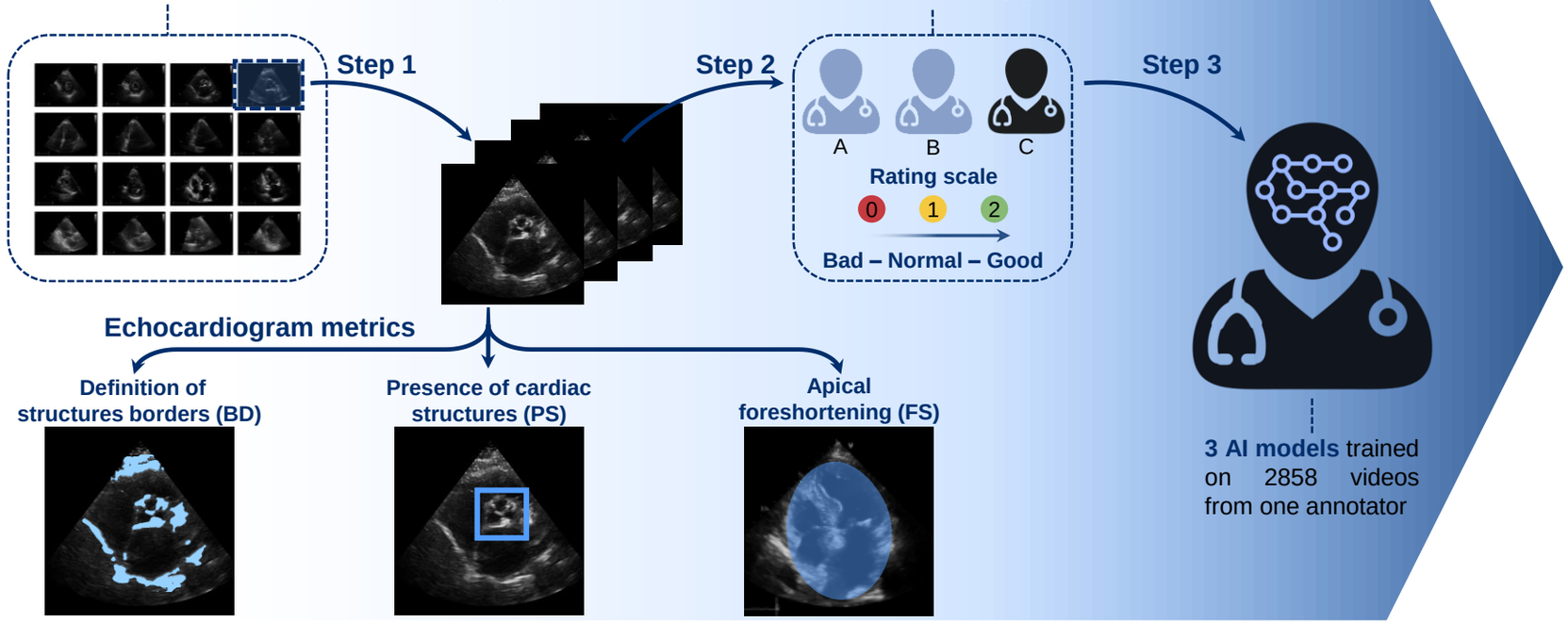
Purposes

- Identify the most relevant features of echocardiography images that influence perceived quality.
- Quantify these features using AI.
- Evaluate their variability across different observers and centres.

Methods

488 TTE studies from Vall d'Hebron University Hospital (VH) with **clinical study quality** annotated during care

3 cardiologist annotated the 3 metrics for **6831** VH and **1000** CAMUS [1] **videos**



Results

Agreement results

	BD	PS	FS
Inter-observer agreement			
VH Agreement	56%	48%	46%
CAMUS Agreement	21%	35%	N/A
Internal Validation agreement			
All Raters vs AI	60%	54%	**53%**
Single Rater vs AI	**62%**	**58%**	51%
External Validation agreement			
CAMUS vs AI	**57%**	19%	N/A

Annotations vs clinical study quality

	BD p-value	PS p-value	FS p-value
Clinical study	**<0.001**	0.864	0.440

Factors influencing Border Definition

	Annotated p-value	AI prediction p-value
BMI ↓	**0.042**	**0.001**
Cardiomyopathy ↓	**0.028**	0.525

Conclusions

- Echocardiography image quality is subjective and mainly depends on the clarity of cardiac structures borders.
- AI models can learn to assess image quality. However their generalization may be limited.

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[1] S. Leclerc, *et al.* "Deep Learning for Segmentation using an Open Large-Scale Dataset in 2D Echocardiography" in IEEE Transactions on Medical Imaging, Sept. 2019