Artificial intelligence for the assessment of aortic valve calcification in echocardiography

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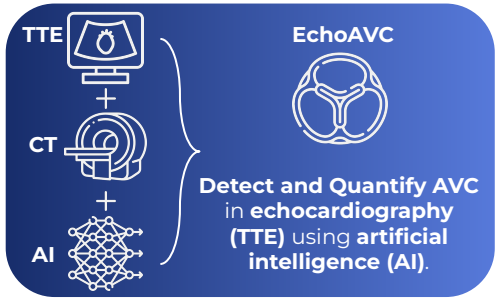
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Background

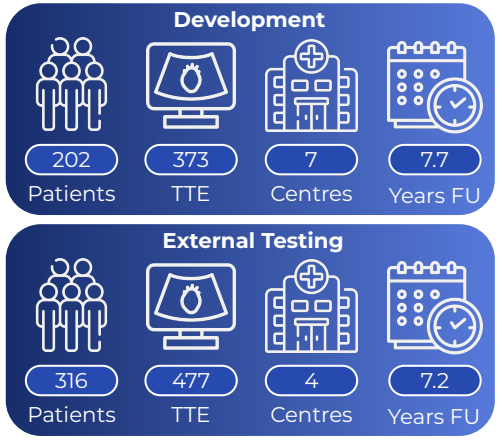
- **Aortic valve calcification (AVC)** is a key predictor of the progression of **aortic stenosis (AS) .**
- Computed tomography (CT) **aortic valve Agatston calcium score (AVCS)** is the gold standard for quantifying AVC.

Purpose

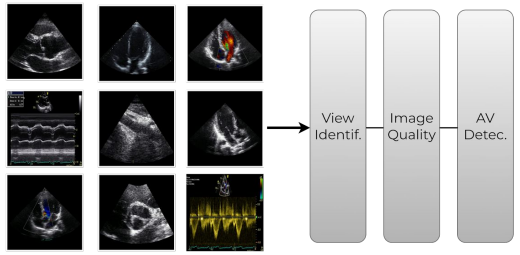


Detect and Quantify AVC in **echocardiography (TTE)** using **artificial intelligence (AI)**.

Study population



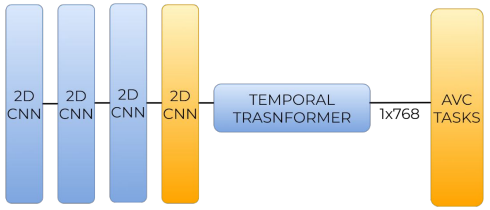
EchoAVC workflow and model overview



1. DATA PREPARATION

Automatic identification of **PLAX, PSAX and 3CH**, **image quality assessment** and **valve detection and cropping**.

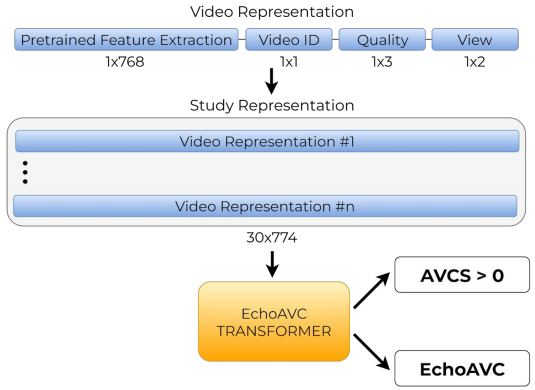
A total of **1,166** videos for training, **1,054** for internal testing and **2,888** for external testing.



2. FEATURE EXTRACTION MODEL

Model was fine-tuned from PanEcho[1] pretrained model, with AVC task-specific heads.

Feature AV video vectors (1x768) were extracted from last hidden layer.



3. AGGREGATOR MODEL

To aggregate information from video to study level, each study was represented by **30 video-level feature vectors** including extracted features and video metadata representations.

A transformer model was trained for **AVC detection** and **EchoAVC quantification**.

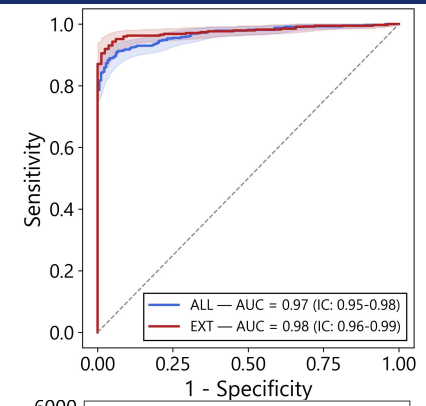
EchoAVC results

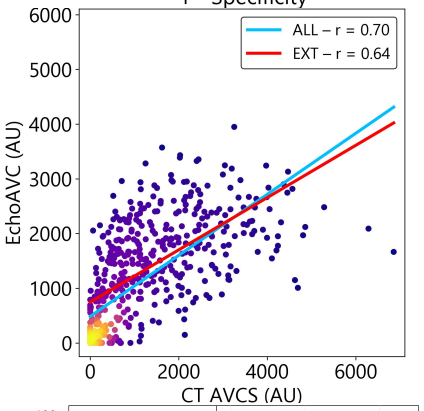
	All Testing	External Testing
AVC Detection (AVCS>0)		
AUROC	0.97	0.98
EchoAVC		
R	0.70	0.64
Med. Error (AU)	48	95

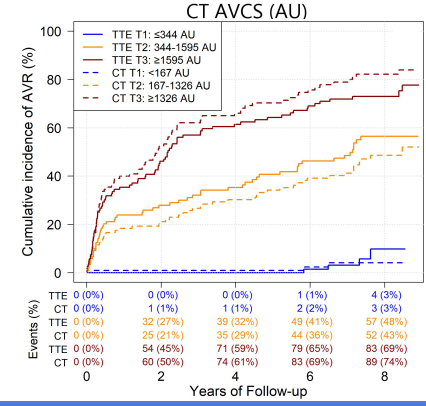
Associations with AS & AVR*

	N	ρ
AS markers		
AV Pres. Grad.	487	0.75
AV Peak Vel.	489	0.76
Future AS Progression		
Δ AV Pres. Grad.	188	0.39
Δ AV Peak Vel.	191	0.43
Δ AVCS CT	194	0.65
Future AVR		
EchoAVC terciles stratification	363	HR=29.3

*all p-values < 0.001







Conclusions

★ **EchoAVC** predicts **aortic stenosis progression** and need for **valve replacement**.

★ An **artificial intelligence** model estimates **AVCS from TTE** with strong **performance and generalizability.**

[1] Holste G, et al. JAMA. 2025;334(4):306–318.

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