PanEcho: Complete Al-enabled echocardiography interpretation with multi-task deep learning



TEXAS

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MOTIVATION

- Echocardiography is the main cardiac imaging modality Pros: Cheap, real-time, safe, portable \succ <u>Cons</u>: Noisy, operator-dependent \Rightarrow Al solutions lag behind
- Existing AI solutions are single-view & single-task Inefficient to deploy many specialized models Real-world workflow calls for multi-view, multi-task analysis
- Goal: An AI "pan scan" for echocardiography
- Requirements:
 - \blacktriangleright Performs all key tasks forming a complete report
 - > Integrates information from all cardiac views
 - > Generalizes to diverse patient populations
 - > Open-source & reproducible

	INTERN	ATION/	AL VALID	ATIO	
^AV Stenosis -			AV Peak Velocity (m/s) -		
MV Stenosis -	 YNHHS (USA) RVENet+ (Hungary) EchoNiet Dynamic (USA) 		LVPWd (mm) -		 RVENet+ (Hungary) EchoNet-Dynamic (USA)
*LV Systolic Dysfunction -	EchoNet-LVH (USA)		IVSd (mm) -		EchoNet-LVH (USA)
*Increased LV Size -		H	RV S' (cm/s) -	*	
Elevated LVOT PG -		⊢ _	E/e' Ratio -	8	
RV Systolic Dysfunction -			Global Longitudinal Strain (%) -		
LV Wall Motion Abnormalities -		⊨ ♦	Aortic Root Dimension (mm) -		
Pericardial Effusion -			TAPSE (mm) -		
*LV Diastolic Dysfunction -			LVIDs (mm) -		
*MV Regurgitation -			RVIDd (mm) -		
*TV Regurgitation -			LAIDs (mm) -		
*Increased LV Wall Thickness -			LV Ejection Fraction (%) -		
*Increased LA Size -			RA Transverse Dimension (mm) -		
*AV Regurgitation -		⊢━┥	TV Peak Gradient (mmHg) -		
*Increased RV Size -			RV Systolic Pressure (mmHg) -	₩ ₩	
Bicuspid AV -			LA Volume (cm^3) -	•	
Elevated RA Pressure -		H	LV ES Volume (cm^3) -		
Increased RA Size -			LV ED Volume (cm^3) -		
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 AUC Mean Absolute Error (MAE)					
0.91 median AUC (18 tasks) 0.13 median NMAE (21 tasks)					







> Developed with **1.2M videos** (>50M images) from Yale-New Haven Health System > Performs **39 interpretation tasks** (18 diagnosis, 21 measurement) from **all views** > Internationally validated at multiple sites & on limited "point-of-care" scans





INTERPRETABILITY

e Lef	t Ventricular Function A2C	Right Ventricle A2C			
AX A3C PSAX A4C Sow A5C	0.95 0.90 0.85 PSAX	A4C 0.95 0.90 PLAX PLAX PSAX			
	Subcostal	Subcostal Valvular Regurgitation			
	AUTIIC VAIVE A2C	Color			
AX A3C PSAX A4C Sow A5C	PLAX 0.95 0.90 0.85 PSAX PSAX Subcostal	A2C [2D] (
ectly identifies key views per task					
С	ONTACT	MODEL/CODE			

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