

Improving ultrasound guidance reliability using sensor enhanced deep learning

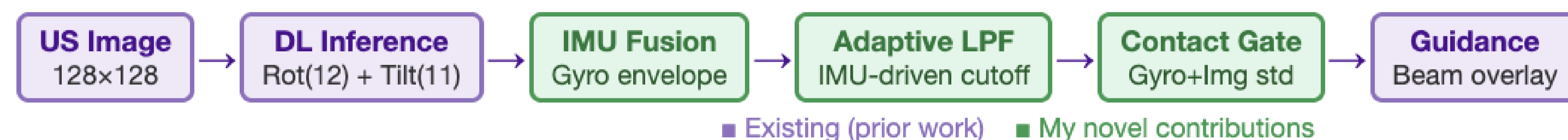
Purpose and aim

Existing AI guidance for echocardiography uses deep learning (CNN) to predict rotation and tilt corrections from ultrasound images.

However, critical gaps remain:

- Jitter - DL outputs oscillate frame to frame, causing distracting guidance
- Fixed filter lag - A static low pass filter adds constant delay, even during fast probe repositioning
- No context awareness - Guidance is displayed even when the probe is lifted off the patient

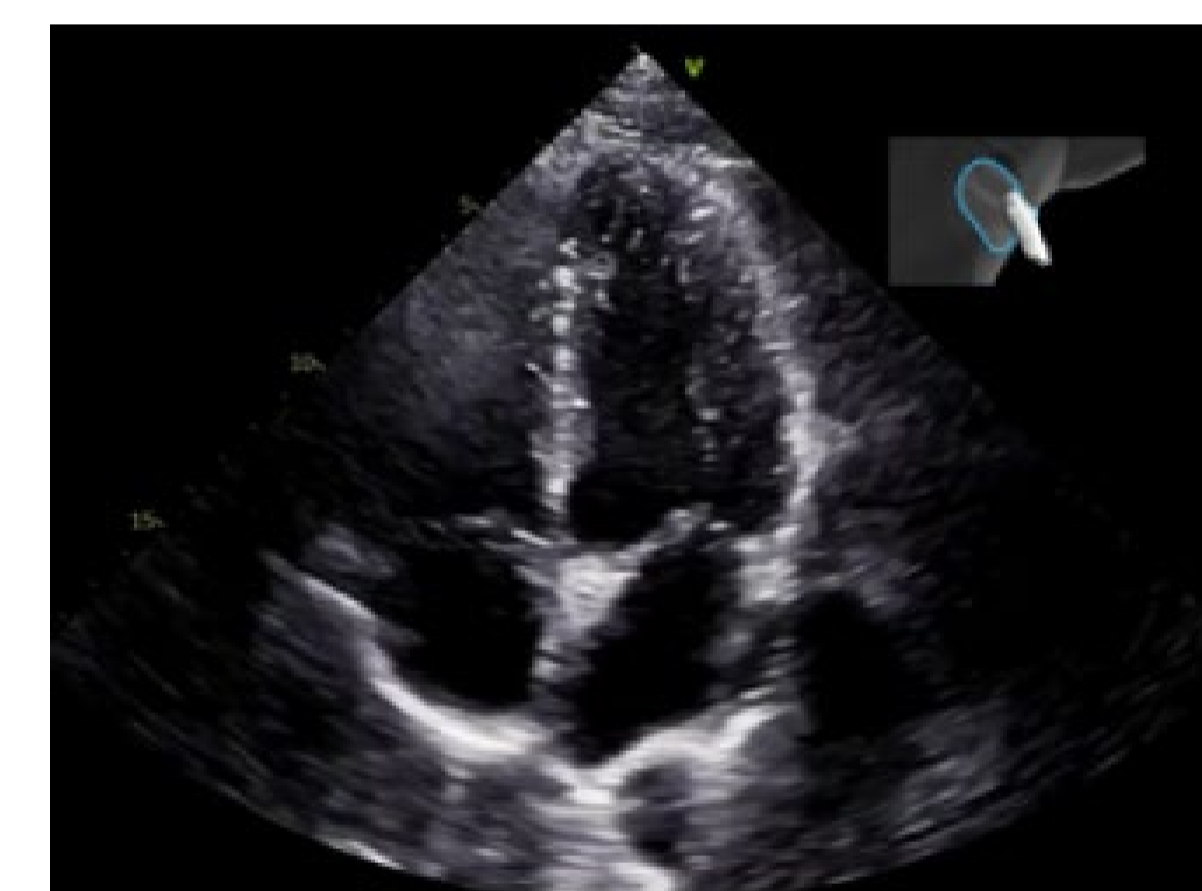
Aim: Bridge these gaps by fusing 3-axis gyroscope data with real time image analysis to make the guidance **responsive**, **stable** and **context aware** - without modifying the existing DL models



Results and important findings

★ Contribution 1: IMU Adaptive Low Pass Filter

- Motion envelope computed from gyroscope angular velocity
- Filter cutoff frequency: low motion → low cutoff (smooth), high motion → high cutoff (responsive)
- Eliminates filter induced lag during fast probe repositioning

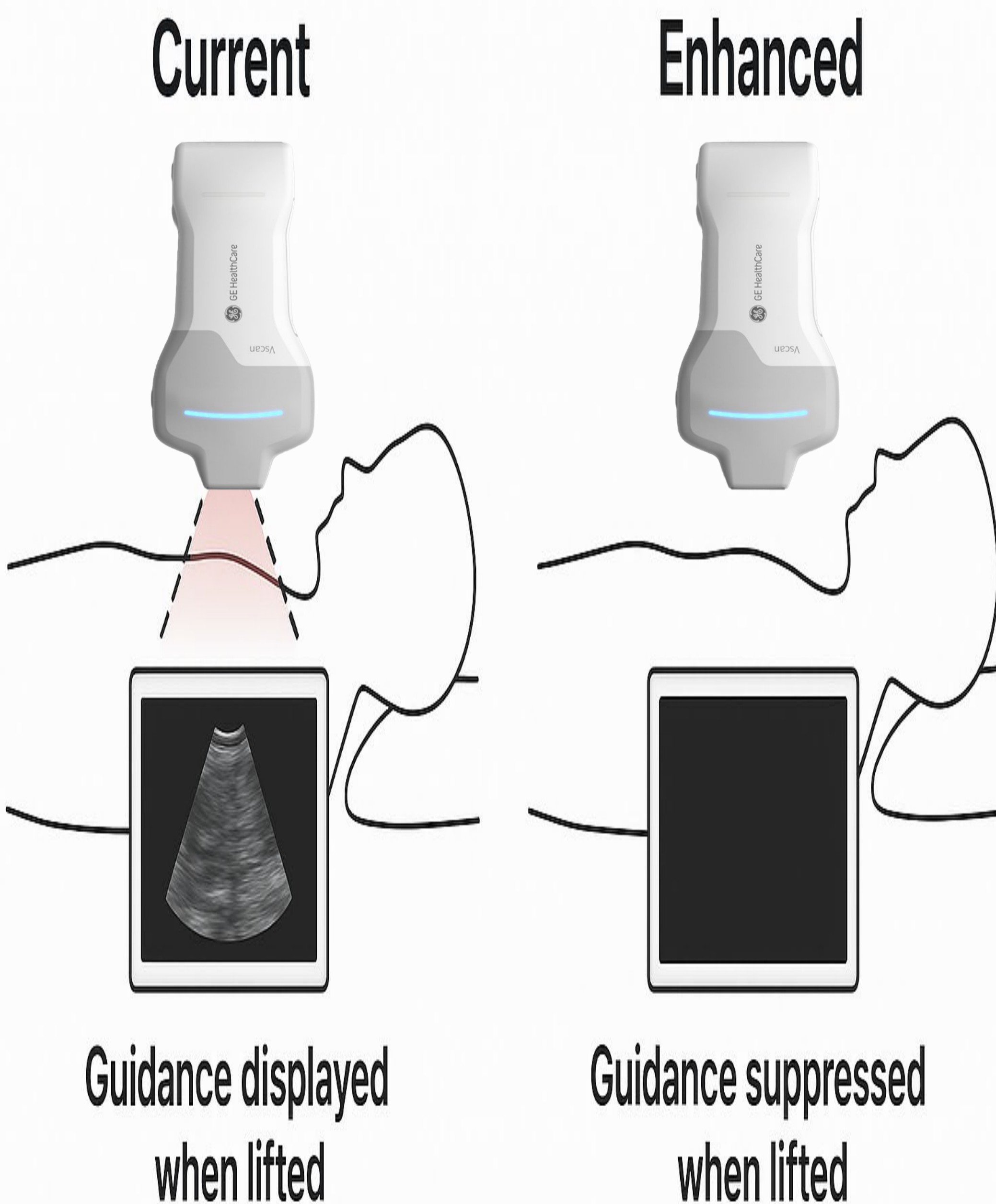


★ Contribution 2: Probe Contact Detection

Gyro gating - sustained angular velocity detects free probe motion

Image homogeneity gating - pixel intensity standard deviation detects tissue absence (air scan)

AND gate: both pass → guidance visible, either fails → guidance hidden



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