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A Novel Echocardiographic Data Fusion Framework for Measuring Intraventricular Flow CATHLEEN M. NGUYEN, University of Washington & UC San Diego, DARRIN J. WONG, SACHIYO IGATA, UC San Diego, CHRISTIAN CHAZO, PABLO MARTíNEZ-LEGAZPI, JAVIER BERMEJO, Hospital Gregorio Marañón, Madrid, Spain, DAMIEN GARCIA, U. of Lyon, France, ANDREW M. KAHN, ANTHONY DEMARIA, UC San Diego, JUAN C. DEL ÁLAMO, University of Washington & UC San Diego — Left ventricular (LV) flow patterns contribute to diastolic suction and minimize cardiac work. However, the clinical impact of mapping LV flow is yet to be realized due to the difficulty of measuring flow inside opaque cavities. The noninvasiveness and portability of echocardiography makes it well suited for clinical assessment of intraventricular flows. Several ultrasound-based flow quantification techniques have been developed including Doppler vector flow mapping and echocardiographic particle image velocimetry. Still, there exists key limitations such as assumption of planar flow and dependence on Doppler encoding velocity or the need for a finely tuned contrast infusion and high imaging frame rate. To exploit the strengths and mitigate the limitations, we developed a statistically robust data fusion modality that combines bright-mode contrast-agent and color-Doppler sequences acquired with different encoding velocities to infer intraventricular velocity fields. Our model uses Bayesian estimation to fuse the data from these different sources by enforcing priors based on the physics of the flow: mass conservation, momentum balance, boundary conditions, and temporal and spatial smoothness. We tested this method on human patients and a large animal model.

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