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Deep learning based ultrasound for measuring blood flow and vascular wall movement simultaneously in artery[1] JUN HONG PARK, EUNSEOK SEO, SANG JOON LEE, Pohang Univ of Sci Tech — Several cardiovascular diseases (CVDs) are closely related with vascular stiffness and interactions of blood flow and vessel wall dynamics. However, conventional techniques cannot accurately measure local vascular stiffness and their interactions. In this study, we propose deep learning based simultaneous measurement of flow-wall dynamics (DL-SFW) for measuring flow velocity and vascular strain with high resolution. Its performance is verified by comparing with conventional velocimetry for tissue-mimicking phantoms. The DL approach is found to improve relative errors in the measurements of velocity, wall shear stress (WSS), and strain. In vivo feasibility is demonstrated by applying DL-SFW to murine carotid artery with different pathologies: aging and diabetes mellitus (DM). Its measurement results are compared with other velocimetry and elastography. With DL-SFW, the abnormal flow-wall dynamic interactions of aging and DM are figured out compared with control group. The corresponding histological analysis shows the effect of the abnormal interactions between blood flow and wall dynamics on the vessel. This technique provides useful information with high-resolution and accurate diagnosis of CVDs.

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