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A DATA-INFORMED, PATIENT-SPECIFIC FRAMEWORK FOR THE QUANTIFICATION OF ABDOMINAL AORTIC ANEURYSM RUPTURE RISK

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An abdominal aortic aneurysm (AAA) can be fatal in case of rupture. Previous studies have shown that personalized computational models may provide better rupture risk indicators than e.g. the diameter criterion used in clinical practice, e.g. in [1]. Uncertainties about important vessel wall quantities in patient-specific models, however, remain a challenge and need to be quantified accordingly, while the simulation models have to remain sufficiently accurate. We present a framework that incorporates elaborate personalized models and patient-specific probability distributions built from experimental data. The modeling of the uncertainties is accomplished via Gaussian process regression and enables the prediction of invasive vessel wall properties based on non-invasively accessible features. To establish a link between uncertain input quantities and peak wall stress in the AAA, we use Kriging surrogate models trained using an active learning strategy. As rigorous estimate of the probability of rupture for the particular AAA can be calculated using a novel index [3], an index similar to [2]. The framework is retrospectively validated on a patient cohort and compared to existing approaches.

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