Title: Model-based learning of local soft tissue contractility from limited kinematic data

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Abstract: Active solids are a large class of materials, including both living soft tissues and artificial matter, that share the ability to undergo strain even in absence of external loads. While in engineered materials the actuation is typically designed *a priori*, in natural materials it is an unknown of the problem. In such a framework, the identification of inactive regions in active materials is of particular interest. An example of paramount relevance is cardiac mechanics and the assessment of regions of the cardiac muscle with impaired contractility. The impossibility to measure the local active forces directly suggests us to develop a novel methodology exploiting kinematic data from clinical images by a variational approach to reconstruct the local contractility of the cardiac muscle. By finding the stationary points of a suitable cost functional we recover the contractility map of the muscle. Numerical experiments, including severe conditions with added noise to model uncertainties, and data knowledge limited to the boundary, demonstrate the effectiveness of our approach. Unlike other methods, we provide a spatially continuous recovery of the contractility map without compromising the computational efficiency.