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Meta Uncertainty for Particle Image Velocimetry[1] LALIT RAJENDRAN, SAYANTAN BHATTACHARYA, SALLY BANE, PAVLOS VLACHOS, Purdue University — There have been widespread efforts in the field of Particle Image Velocimetry (PIV) over the past decade to develop a-posteriori uncertainty quantification methodologies to report local, instantaneous uncertainties for each displacement measurement. However, multiple collaborative assessments show that none of the displacement uncertainty quantification methods perform well under all situations, and the methods can predict very different uncertainties for the same flow field as they operate under different assumptions and feature different calculation procedures. To address this issue, we propose an uncertainty combination framework to combine the uncertainty estimates from different schemes to provide a combined estimate, that is on average better than the individual schemes. We introduce ideas from the consensus forecasting literature, and combine estimates from different models based on a meta-analysis of the individual models/methods. We use a particle resampling approach to estimate the response function of a given uncertainty estimation scheme to a given perturbation, and use this to assign weights for the individual uncertainty schemes. The methodology is assessed with synthetic and experimental images for planar and stereo PIV.

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