Adventures in Approximation Error

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Abstract

Jari Kaipio was one of the pioneers of Computational Bayesian Inverse Problems and put was key to putting Finland at the forefront of modern approaches to Inverse Problems. In this talk I will present one of his key ideas : Approximation Error Modelling. In this approach the concept is directly to account for systematic (epistemic) errors by modelling them through the statistics of a training set. The normal methods for Maximum A Posteriori estimation can be used, with a multivariate Gaussian term for the likelihood. The advantage is that low-cost computational models can be used for the forward and adjoint problems. In collaboration with Jari we studied this appraoch extensively for some non-linear problems in Optical Diffusion Tomography over a variety of systematic errors arising from various approximations, both computational and physical. In all cases the results gave results commensurate with more detailed models, at a fraction of the computational cost.