PREDICTIVE RISK MINIMIZATION FOR THE EXPECTATION MAXIMIZATION ALGORITHM WITH POISSON DATA

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The Expectation Maximization algorithm is a reliable non-linear iterative method for approximating the solution of inverse problems when the forward model is linear, the emitting source is non-negative and data are Poisson variables. As the number of iterations plays the role of a regularization parameter, the main issue is to select it in order to regularize the solution. In this talk we present an estimator of the predictive risk and we propose to stop the algorithm when this estimator reaches its minimum value as a function of iterations. From the theoretical point of view, the estimator relies on a first order approximation of the non-linear iteration and the predictive risk is computed as the expectation of the Kullback-Leibler divergence. While the weakness of this method is the computational burden needed at each iteration, the strength is that it only depends on available data, and therefore it does not need any 'a priori' information. We also point out that this estimator can be thought of as a Poisson variant of the SURE (Stein's Unbiased Predictive Risk Estimator) which is defined for Gaussian noise. Finally, we show the performance of this method when applied to the count-based image reconstruction problem of the STIX (Spectrometer/Telescope for Imaging X-rays) instrument mounted onboard Solar Orbiter.