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**Matthias Chung\*** (mcchung@vt.edu), **Julianne Chung** and **Dianne O’Leary**. *Optimal Inversion Matrices for Inverse Problems*.

We present a new framework for solving ill-posed inverse problems by compute an optimal regularized inverse matrix. An optimal regularized inverse matrix is obtained by incorporating probabilistic information and solving a Bayes risk minimization problem. We present theoretical results for the Bayes problem and discuss efficient approaches for solving the empirical Bayes risk minimization problem. Our approach is illustrated on examples from image processing. Once computed, the optimal regularized inverse matrix can be used to solve inverse problems very efficiently. (Received December 18, 2014)