Title:
A Pseudo-Maximization Approach for Self-Normalized Processes

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Abstract:

Self-normalized processes are basic to many probabilistic and statistical studies. They arise naturally in the the study of stochastic integrals, martingale inequalities and limit theorems, likelihood-based methods in testing and estimation, and Studentized pivots and bootstrap-t methods for confidence intervals. They are unitless (in standard form) and robust due in part to the fact that in contrast to standard normalization, large values of the observations play a lesser role as they appear both in the numerator and the denominator of self-normalization. Herein we survey a number of results for self-normalized processes in the case of dependent variables and describe a key method called "pseudo-maximization", that has been used to derive these results. We also show that this powerful method can be applied to extend the results to the multivariate case, where self-normalization consists of multiplying by the inverse of a positive definite matrix (instead of dividing by a positive random variable in the scalar case). This multivariate extension is ubiquitous in statistical applications, examples of which are given.