

# Non-Concave Penalized Likelihood with NP-Dimensionality

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## **Abstract**

Penalized likelihood methods are fundamental to ultra-high dimensional variable selection. How high dimensionality such methods can handle remains largely unknown. In this paper, we show that in the context of generalized linear models, such methods possess model selection consistency with oracle properties even for dimensionality of Non-Polynomial (NP) order of sample size, for a class of penalized likelihood approaches using folded-concave penalty functions, which were introduced to ameliorate the bias problems of convex penalty functions. This fills a long-standing gap in the literature where the dimensionality is allowed to grow slowly with the sample size. Our results are also applicable to penalized likelihood with the  $L_1$ -penalty, which is a convex function at the boundary of the class of folded-concave penalty functions under consideration. The coordinate optimization is implemented for finding the solution paths, whose performance is evaluated by a few simulation examples and the real data analysis. This is a joint work with Professor Jianqing Fan.