# A comparison of two LP solvers and a new IRLS algorithm for $L_1$ estimation

## C.J. Adcock

*University of Westminster, U.K.*

## N. Meade

*Management School Imperial College, U.K.*

*Abstract:* This paper is a comparison of two methods for computing $L_1$ estimates of the parameter vector $\beta$ in the linear model. The main methods in the comparison are in two groups: special purpose linear programming (LP) methods which exploit the structure of the objective function and iteratively re-weighted least squares (IRLS). The special purpose LP methods included in the review are: (i) the Barrodale and Roberts (BR) algorithm and (ii) the modified form due to Bloomfield and Steiger (BS). The IRLS methods is a new development which exploits the piecewise differentiability of the objective function and which avoids the difficulties previously associated with least squares based schemes. All algorithms have been implemented in a common language, in order to provide a better basis for comparison. To summarise: we found that our implementations of the BR & BS algorithms are generally quicker than existing implementations and general purpose LP solvers; the new IRLS algorithm is faster in circumstances where the number of observations is very large relative to the number of parameters to be estimated.

*Key words:* Regression, linear model, minimum absolute deviations, LP solvers, iteratively re-weighted least squares, piecewise differentiability.

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## 1   Introduction

The method of minimum absolute deviation (MAD) or $L_1$ estimation, to give it one of the many names by which the technique is known, is a robust