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Inference under a two-stage adaptive design for non-linear regression models with normal errors

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In this work, we assume that a response variable is explained by several controlled explanatory variables through a non-linear regression model with normal errors. The unknown parameter is the vector of coefficients, and thus it is multidimensional.

To collect the responses, we consider a two-stage experimental design; in the first-stage data are observed at some fixed initial design; then the data are used to estimate an optimal design at which the second-stage data are observed. Therefore, first- and second-stage responses are dependent. At the end of the study, the whole set of data is used to estimate the unknown vector of coefficients through maximum likelihood.

In practice it is quite common to take a small pilot sample to demonstrate feasibility. This pilot study provides an initial estimate of unknown parameters which are then used to build a second-stage design and add additional data to improve the estimate. See, for instance, [1] and [2] for a scalar case. Accordingly, we obtain the asymptotic behaviour of the maximum likelihood estimator under the assumption that only the second-stage sample size goes to infinity, while the first-stage sample size is assumed to be fixed. This contrasts with the classical approach in which both the sample sizes are assumed to become large and standard results maintain for the asymptotic distribution of the maximum likelihood estimator.

References

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