CATÁLOGO DE PUBLICACIONES IIMAS-UNAM

REPORTES DE INVESTIGACIÓN

1. *Roland England, Susana Gómez and René Lamour, "*A study of the index of differential-algebraic equations for optimal control problems*",* 30 pp.

Vol. 12, No. 62 . . . . . **$30.00**

Abstract

In a previous paper ([5]), we introduced a methodology to express optimal control problems in terms of a system of Differential Algebraic Equations (DAEs). This system is obtained using calculus of variations to get the Kuhn-Tucker conditions. The inequalities associated with the complementarity conditions are converted to equalities by the addition of a new variable.

The well-conditioning of the problem can be ex-pressed in terms of the index of the resulting system of DAEs, which is a measure of the difficulty involved in obtaining a numerical solution. The index indicates the number of differentiations required, in the process of solving the system, and is determined in the specific examples which are given here, by carrying out these differentiations analytically. In a general numerical procedure, they would be carried out, explicitly or implicitly as part of the numerical algorithm.

This material is presented again here (for completeness) with some important corrections, and in addition, the concept of the *tractability index* is also introduced as a general purpose way of determining the index, by establishing which part of the system of DAEs must be differentiated and how many times. There are alternative ways of determining an index (see for instance [13]).

2. *Guillermina Eslava, Catalina Palmer and Ignacio Méndez,* "Variance estimation in a complex health sample survey", 14 pp.

Vol. 11, No. 61. . . . . .**$20.00**

Abstract

Different types of variance estimators were obtained from the 1996 National Nutrition Sample Survey of Rural Areas in Mexico database. In order to compare estimates of variances and confidence intervals for the population proportion of non malnourished children living in rural areas of Mexico, which were obtained by ratio estimators, the Jackknife and Linearization methods were used at national and state levels. The balanced half-sampling method was used only in those states where two primary sampling units were selected on each stratum. The variance estimation methods were compared for the proportion of non malnourished children at national, and state level. The main conclusions are: 1. Jackknife is simpler than the Taylor linearization and as efficient for the estimation of the variance of ratio estimates, though it does not give estimators of the variance for each stage of the design as linearization does. 2. When the

coefficient of variation of the denominator in the ratio estimator is less than 0.1, the Jackknife and Balanced half-sampling variance estimates for the ratio estimate are similar; when this coefficient is greater than 0.2 the confidence intervals are so wide and the estimation is not recommended, this occurred in five states when there were few primary sampling units. 3. For the variance estimation of the median, a non smooth statistic, when the number of primary sampling units is large, more than 30, and the coefficient of variation is less than .10, the Jackknife variance estimation for the median may be as good as the balanced half sampling estimate.

3. *Guillermina Eslava and Francis H.C. Marriott*, "Similarity measures for classification", 11 pp.

Vol. 10, No. 60. . . . . .**$12.00**

Abstract

Modern methods of classification are more flexible and rely less on distributional assumptions than classical discriminant analysis. Among the simplest and most effective is classification based on k Nearest Neighbours (kNN). This depends on identifying the k individuals with the smallest dissimilarity, or largest similarity, to each data point. The choice of k, and the choice of a metric in the state space, determine the characteristics of the method.

Defining a suitable metric is not straightforward. In general, data can consist of observations on continuous variables, membership of ordered categories or membership of unordered categories. Gower (1971) suggested a similarity measure that could be used for all these types of data, and the present paper describes a modified form of that measure and shows how it can be used for kNN classification.

4. *Susana Gómez and J. Longina Castellanos*, "A new implementation of the tunneling methods for bound constrained global optimization", 18 pp.

Vol. 10, No. 59. . . . . .**$20.00**

Abstract

A detailed presentation for new implementation, of the Tunneling Methods developed in Levy, A.V. and Montalvo, A. (1985) and Barrón, C. and Gómez, S. (1991) is shown. The authors propose some variants to the original method and derive tolerances for crucial aspects of the methods. The efficiency and performance of the new code is compared with the results presented in Levy, A.V. and Montalvo, A. (1985).

5. *Roland England and Susana Gómez*, "Expressing optimal control problems as differential algebraic equations", 15 pp.

Vol. 9, No. 58 . . . . . **$16.00**

Abstract

The purpose of this paper is to determine the well-conditioning of an optimal control problem in terms of the index of a system of Differential Algebraic Equations (DAEs), and to indicate a possible approach to the numerical solution of such a problem.

The index of a system of DAEs is a measure of the difficulty involved in obtaining a numerical solution and indicates the number of numerical differentiations required in the process.