MIA: A program for multivariate information analysis

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Information analysis is a method used in the quantification of communication systems (Miller, 1953). It has been applied to the study of information transfer and the sequential analysis of behaviors over time, and it can be used to generate models of interactive behavior. Following original mathematical formulations (Shannon & Weaver, 1949), information analysis was used to measure information transfer and learning in human systems (Garner, 1962) and has been applied to the study of animal and human communication (Dingle, 1972; Haldane & Spurway, 1965). This program was designed for the analysis of conflict-resolution communications of married couples (Billings, 1979).

The MIA program calculates several information statistics (contingent uncertainty reduction) for a criterion measure and three predictor variables. Previously developed programs calculated criterion uncertainty reductions for a single criterion and one predictor (Aspey & Feinstein, 1977; Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). MIA calculates both main and partial contingency reduction terms. The theoretical orientation, terms, and computational algorithms for the multivariate case are derived mainly from the presentation by Garner (1962).

Description. The MIA program consists of three major segments, corresponding to the number of predictors chosen for the analysis. These segments are subdivided into three components. The first component reorganizes the raw data matrix into contingency matrices from which transitional probabilities are calculated. The second component calculates the contingent uncertainty reduction. Finally, these statistics are summed and weighted for each matrix, and appropriate contingent uncertainty statistics (in bits) are computed. Modularized subroutines for each of these components will facilitate the inclusion of other routines or the modification of present routines to suit various applications.

Input to the program may be in any form such that contingency matrices may be constructed. At present, the program is designed to read a particular data set and construct these matrices. These routines, however, can

be easily modified to read any set of raw data. The main analysis routines require input only in the form of these matrices.

Output includes total uncertainty (in bits) for criterion and each predictor, contingent uncertainty reduction in criterion for each predictor, partial contingent uncertainty reduction in criterion for each predictor, and system redundancy.

Restrictions. Besides the input restrictions mentioned previously, there is some resource limitation on the maximum number of predictor and criterion categories or levels. The amount of processing time and memory required increases exponentially with the number of predictor and criterion categories.

Language. The main analysis routines for MIA are written in ANSI FORTRAN IV. Some utility routines were written in assembler (Xerox, META-SYMBOL). This form should allow for the immediate transfer of all analysis routines to any system that supports standard FORTRAN IV. Some routines responsible for input/output and file maintenance would probably have to be rewritten in the appropriate assembler or a higher level language in order to accommodate a particular operating system.

Availability. Complete source listings of all MIA routines, copies of this paper, documented output from an illustrative example, and a program manual are available free of charge from J. Mike Williams, Department of Psychology, John Dewey Hall, University of Vermont, Burlington, Vermont 05401.

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