

USING A NONLINEAR DISCRIMINANT FUNCTION FOR SOLVING DISCRIMINANT ANALYSIS PROBLEMS

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Abstract. To solve a discriminant analysis problem, linear programming has been useful for finding a linear discriminant function. In this paper we present a mathematical programming approach to find a nonlinear discriminant function. It is believed that a nonlinear discriminant function can be more useful than a linear one.

1. Introduction. A discriminant analysis problem seeks a discriminant function $f(x)$ which is used to separate the given groups of vector-valued data G_1, G_2, \dots, G_m and provides an allocation rule for placing future unclassified data into one of the groups.

In this paper we construct a nonlinear discriminant function using a linear program. In fact, we construct a general polynomial, of degree n , in the vector x to be used as a discriminant function. Clearly, a nonlinear discriminant function is more effective than a linear one, since a linear function can be treated as a special case ($n = 1$) in the mentioned polynomial.

In this paper, we assume that a subjective ranking (order relation) has been imposed on the groups G_1, G_2, \dots, G_m . That is, for any two distinct groups of data G_i and G_j either G_i is preferred to G_j or G_j is preferred to G_i . Without loss of generality, we may assume that G_i is preferred to G_j whenever $i > j$. This order relation is denoted by writing $G_j \prec G_i$ if $i > j$. Thus, we are given

$$G_1 \prec G_2 \prec \dots \prec G_m.$$

This assumption arises in many problems and it is possible to use, in some cases, artificial intelligence techniques to determine the subjective rankings discussed above in [5]. This will not be discussed in this paper, rather we will assume that the rankings have been given.