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A CHI-SQUARE METHOD FOR RANKING ALTERNATIVES BASED ON THE FUZZY JUDGEMENT MATRIX

Zhiping Fan and Yanping Jiang

Department of Information Systems and Decision Science
School of Business Administration, Northeastern University
Shenyang, P.R. China, 110004

Abstract. This paper presents a chi-square method for ranking alternatives based on a fuzzy judgement matrix about the alternatives provided by the decision maker (DM). First of all, the concepts of fuzzy judgement matrix and its consistency are introduced. Then, a non-linear optimization model is constructed to obtain ranking values of the alternatives and to select the most desirable alternative(s). In order to solve the model, some theoretical analysis and an iterative algorithm are also given. Finally, a numerical example is presented to illustrate the use of the proposed method.
Keywords. Chi-Square, Optimization, Alternative ranking, Fuzzy judgement matrix, Algorithm.

1 Introduction

The ranking of alternatives is critical in decision analysis. It plays an important role in decision-making application. In multiple attribute decision making or group decision making problems, it is often easy for decision maker (DM) to judge which one is good between two alternatives. Thus, the DMs can provide pairwise comparison information on alternatives, which is expressed by judgement matrix (or pairwise comparison matrices). Usually, judgement matrices can be classified into two categories according to different forms of preference information given by a DM: the Saaty's judgement matrix [1] and the fuzzy judgement matrix [2-5]. By far, a lot of research work on ranking alternatives based on the Saaty's matrix has been done, such as the eigenvector method [1], least square method [6], logarithmic least square method [7], Chi-square method [8-11] and so on. In the Chi-square methods, the earliest work was given by Jensen [8] and was extended by Blankmeyer [9]. Wang and Fu [10] used the Chi-square method to solve the group AHP problem. Xu [11] recently proposed the generalized Chi-square method to estimate the weights of Saaty's matrix [11]. On the other hand, little research on ranking alternatives based on the fuzzy judgement matrix can be found. Chiclana *et al* [5] recently proposed a ranking method based