

UTA Method

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Abstract

This report contains the summary of the chapter **UTA Methods** from the Book : Multiple Criteria Decision Analysis. This document was made during my internship at LAMSADE in the summer of 2017.

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Chapter 1

Introduction

In 1982, E. Jacquet-Lagrèze and J. Siskos proposed a decision method called UTA. This method is proposed by the Multi-Attribute Utility Theory (MAUT) that build a utility function based on the DM¹ preferences.

Assuming that the decision is given, the UTA method will find the rational basis for the decision being made. Or how can we use the DM's preference leading to the exact same or "similar" decision.

The UTA method is used to solve of multi-criteria problems. It build a utility function based on the preferences of the DM. This method consist in solving a linear program.

UTA methods adopt the aggregation-disaggregation principles. The aggregation is where the model is known and the preferences are unknown, while the disaggregation is where the model is based on a given preferences

¹Decision Maker

Chapter 2

Method

2.1 Principles and Notation

2.1.1 Weighted form

A weighted form of the UTA Method has the following form:

$$u(g) = \sum_{i=1}^n p_i u_i(g_i) \quad (2.1)$$

subject to normalization constraints:

$$\begin{cases} \sum_{i=1}^n p_i = 1 \\ u_i(g_{i*}) = 0, u_i(g_{i*}) = 1, \forall i = 1, 2, \dots, n \end{cases} \quad (2.2)$$

where $u_i, i = 1, 2, \dots, n$ are non decreasing real valued functions, and p_i is the weight of u_i .

2.1.2 Unweighted form

An unweighted form of the UTA Method has the following form:

$$u(g) = \sum_{i=1}^n u_i(g_i) \quad (2.3)$$

subject to normalization constraints:

$$\begin{cases} \sum_{i=1}^n u_i(g_{i*}) = 1 \\ u_i(g_{i*}) = 0, \forall i = 1, 2, \dots, n \end{cases} \quad (2.4)$$

2.2 Development

The value of each alternative $a \in A_R$ may be written as:

$$u' [g(a)] = \sum_{i=1}^n u_i [g_i(a)] + \sigma(a) \forall a \in A_R \quad (2.5)$$

where $\sigma(a)$ is a potential error relative to $u' [g(a)]$.

We use the linear interpolation to estimate the marginal value function. For each criteria, the interval $[g_{i*}, g_i^*]$ is cut into $(\alpha_i - 1)$ equals interval, and the end points g_i^j are given by the formula:

$$g_i^j = g_{i*} + \frac{j-1}{\alpha_i - 1} (g_i^* - g_{i*}) \forall j = 1, 2, \dots, \alpha_i \quad (2.6)$$

2.3 UTASTAR

2.4 Analysis

Chapter 3

Variants

Chapter 4

Applications and UTA-Based DSS

Bibliography

- [1] Salvatore Greco, Matthias Ehrgott, Jose Rui Figueira *Multiple Criteria Decision Analysis*. State of the Art Surveys.