Chapter 3
Analytical Review of the Applications of Multi-Criteria Decision Making in Data Mining

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ABSTRACT

In recent years, multi-criteria decision making (MCDM) is a significant part of operations research (OR) and has become an interesting topic to researcher who works in the data mining (DM) field. The aim of this chapter is to provide an in-depth presentation of the contribution of MCDM in the field of DM. In order to develop a reliable knowledge base on accumulating knowledge from previous studies, we present a review of the usage of MCDM methods in DM field. The chapter presents methodology and application. The result shows that the most usage of MCDM in DM consists of evaluating classification algorithms, weighting criteria, and ranking association rules and clusters. Finally, some future research directions are suggested at the end of chapter.

INTRODUCTION

Since 1990, the most crucial tool for discovering knowledge from large databases has been data mining (DM) (Khademolqorani & Hamadani, 2013, p. 389). DM is a broad umbrella term that is used to describe collecting, cleaning, processing, analyzing and gaining useful insights from data (Aggarwal, 2015, p. 1).

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As Data mining techniques (DMT) is an interdisciplinary research topic, so it can be integrated with different methods. This integration may open new insights into the problems associated with DMT (Liao et al., 2012, p. 11307).

From a range of various DM algorithms, data clustering is an important part of DM which provides many clues and insights into how data can be grouped into meaningful segments. Clustering algorithms, group similar observations in the same group (Bramer, 2016, p. 8; Güçdemir & Selim 2015, p. 1023). Using clustering we can group observations, however it does not give any information about the priority of clusters. Multi-Criteria Decision-Making (MCDM) can be useful to be combined with clustering algorithms. In fact, MCDM can be used to rank clusters (Güçdemir & Selim 2015, p. 1026). Using the combination of MCDM and DM is not limited to ranking clusters.

The aim of this chapter is to examine the applications of MCDM in DM algorithms. It is very important to understand previous studies and trends. The chapter contains various MCDM methods like MADM category (AHP, TOPSIS, VIKOR, and ELECTRE), MODM category, DEA category and DM methods like Clustering (K-means, 2 Steps), classification algorithms, association rules mining and other related algorithms. In fact, the aim of this chapter is presenting new suggestions for future studies by considering various types of problems.

Figure 1 presents the chapter framework. As it shows, in the first step we tried to gather papers related to both MCDM and DM. For achieving this aim we start searching by these keywords: data mining and name of popular data mining methods (for instance classification algorithms, decision tree, Naïve Bayes, k-nearest neighbors, machine learning, neural network, SVM, clustering and association rules) and multi-criteria decision-making and name of popular MCDM methods (for

Figure 1. Chapter framework