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# Rough set-based conflict analysis model and method over two universes

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## Abstract

Rough set theory, as a new mathematical tool to handle uncertainty decision making problems, was used to study conflict analysis decision making in late 90's, and then the Pawlak conflict analysis model was established. The approach of rough set provides a new perspective and also gives an effective tool to deal with conflict analysis decision making, both theoretically and practically. In this paper, we propose a new rough set model of conflict analysis: a conflict analysis decision model based on rough set theory over two universes. It is a natural extension of the Pawlak conflict analysis model. Subsequently, we define the conflict matrix and a consistent disagreement matrix on the basis of the model proposed in this paper. Then we can find the intrinsic reasons for conflict and attain a feasible strategy for a conflict situation. Furthermore, we define a positive alliance matrix and a negative alliance matrix for a conflict situation. These can help us analyze the opinions of different agents in the conflict situation. Moreover, we develop a matrix approach for a conflict analysis model based on rough set theory over two universes, which provides a convenient way to analyze and solve the conflict situation. Comparing to the Pawlak conflict analysis model, our proposed model not only could reveal the core causes for a conflict situation but also can find a possible optimal feasible consensus strategy to solve the conflict situation which satisfies the agents as much as possible. Finally, we illustrate the idea and the basic principles established in this paper by analyzing a conflict decision making scenario.

*Keywords:* Rough set, Conflict analysis, Conflict resolution, Rough set over two universes.

## 1. Introduction

Conflicts are widespread in our society owing to the scarcity of physical resources and to the different cultures and religions [61]. Everyone encounters conflict in everyday life. Conflicts are, no doubt, one of the most characteristic attributes of human nature and the study of conflicts is of utmost importance both practically and theoretically. Nowadays, more often we negotiate, specify our views, and analyze the behavior in a given situation. Conflict analysis and resolution play an important role in business, governmental, political and legal disputes, labor-management negotiations, military operations and so on [33]. Many mathematical models for conflict resolution have been proposed and investigated [5, 14, 25, 27 − 32, 48, 49]. The problem to be solved is how to model the conflict situation where there is uncertainty about agreement, neutrality and disagreement among agents [6, 7].

Recently, rough set theory [27] has been applied to handle conflict decision making and various conflict analysis models based on rough set have been proposed by many scholars [1, 2, 4 − 6, 12, 13, 16, 18, 38, 39]. Being a new perspective and method that deals with conflict analysis and resolution, the rough set based conflict analysis has been successfully applied to many fields such as service-resource [20], the scarcity of physical resources [65], Chinese Wall Security Policy [21, 22], decision rules acquiring from information system [41], water resources allocation decisions [10, 11] and risk control and decisions [56, 57], etc. The main concept of rough set theory is binary equivalence relation or indiscernibility relation on the universe of discourse. The objects in universe are classified into piecewise disjoint categories by the indiscernibility relation as equivalent classes. Then the uncertain and vague concepts over the universe are described approximately by the lower and upper approximations determined by the equivalent classes.

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