A Rough Set Theory Approach for Rule Generation and Validation Using RSES

Hemant Rana, School of Computer and Information Sciences, Indira Gandhi National Open University, New Delhi, India
Manohar Lal, School of Computer and Information Sciences, Indira Gandhi National Open University, New Delhi, India

ABSTRACT

Despite significant progress in e-learning technology over previous years, in view of huge sizes of data and databases, efficient knowledge extraction techniques are still required to make e-learning effective tool for delivery of learning. Rough set theory approach provides an effective technique for extraction of knowledge out of massive data. In order to provide effective support to learners, it is essential to know individual style of learning for each learner. For determining learning style of each learner, one is required to extract essentials of style of learning from a large number of parameters including academic background, profession, time available etc. In such scenario, rough theory proves a useful tool. In this paper, a rough set theory approach is proposed for determining learning styles of learners efficiently, so that based on the style, a learner may be provided learning support on the basis of requirement of the learner. These is achieved by eliminating redundant and ambiguous data and by generating reduct set, core set and rules from the given data. The results of this study are validated through RSES software by using same rough set analysis.

KEYWORDS
Decision Rules, E-learning, Learning Style, Reduct, Rough Set Theory, Row Reduction, RSES Software

1. INTRODUCTION

E-learning databases have a large number of pieces of information related to learner’s profiles, content management, learning management. Patterns hidden in this information provide new knowledge (Cios, Pedrycz & Świniarski, 1998). Learning style is one of important factors in e-learning. Learning styles provide environments and situations to the learners in an e-learning system. The prediction of learning style in early stage is advantageous for students so that learning may become easier and less stressful in the future. Analysis of learning styles is often related with handling incomplete and inconsistent data. Existing intelligent techniques (Wolf, Oliver, Herbert & Michael, 2000), of analysis of such data used for the purpose include neural network, genetic algorithms, decision trees and fuzzy set. Rough
Set is a mathematical approach developed in the early 1980s (Zdzislaw, 1998) (Matteo, 2003). The rough set theory deals with uncertain and incomplete data to extract knowledge from large databases. It plays an important role to efficiently extract rules for extracting rules from such databases. It has potential for knowing learner’s learning styles on the basis of learner’s data, and the knowledge of styles, in turn, can make e-learning procedure more interesting, decision friendly, and user friendly (Rana & Lal, 2014) (Rana, Rajiv & Lal 2014).

The advantage of Rough Set Theory over other intelligent approaches like fuzzy set theory is that it does not require degree of membership in dealing with vagueness. Fuzzy set theory addresses gradualness of knowledge in terms of membership whereas rough set theory addresses granularity of knowledge in terms of indiscernibility relation.

This paper discusses how decision rules for learning style are generated by using reduct and row reduction. In the proposed technique, row reduction method is used for eliminating duplicate rows and ambiguous rows. Then, reducts are generated on the basis of attribute selection. We have used Rough set extensively in our approach to generate rules on learning styles for the learner. By using the technique, an e-learning system could play significant role in providing student-centric learning and in improving student’s performance (Rana & Lal, 2014).

The paper presented the concept of rough set theory as well as its applications in the area of decision systems to predict the learner’s preferences to learn in e-learning environments. A method has been proposed to use rough set theory for extracting decision rules from such systems (Burney & Abbas, 2015). The paper is organised as follows: Section 2 reviews relevant literature including basic concepts from rough set theory such as information systems, indiscernibility, approximation sets, reduct. A discussion on learning style and RSES software tool is also presented. Section 3 briefly describes the proposed method of rule extraction from the tabular data sets. Section 4 verifies the reducts and rules formed by the proposed method through use of RSES software. Finally, Section 5 concludes the work and discusses future prospects in respect of the proposed method.

2. LITERATURE REVIEW

The rough set theory as a tool for analysis of voluminous data, which may be possibly incomplete and inconsistent, was introduced in 1982 by Zdzislaw Pawlak (Zhang, Li & Pan, 2012). It is a mathematical approach to handle and use imperfect knowledge for taking appropriate actions.

Rough set theory is used to discover relationships in data. The main objectives of rough set theory include data reduction, finding hidden data patterns, rule generation (Zbigniew, 2004) (Skowron, Bazan, Son & Wroblewski, 2005). Rough Set approach is useful in dealing with problems requiring dissimilarity analysis, maximizing of decision tables, and symbolic learning from examples (Pawlak, 1982).

The rough set based data analysis does not require exploratory or additional information about data. It deals with vagueness by defined a boundary region of a set rather than degree of membership as is done in fuzzy reasoning. If the boundary region of a set is empty then set is crisp otherwise set is rough.

The rough set theory concepts such as indiscernibility relation, information space, reduct, core are discussed (Pawlak, 1982). The reduct is the minimal subset of attributes that has the same classification of elements as the whole set of attributes.

In the article by (Adetunmbi, Falaki, Adewale & Alese, 2008), the author used rough set theory to develop decision table that contain minimal subset of attributes having same classification as the whole set of attributes. Rough set theory based rule generation method can generate minimal and non-redundant decision rules from inconsistent data (Gogaoi, Das, Borah & Bhattacharyya, 2011).

In the article by (Kerdprasop, Muenrat & Kerdprasop, 2008), the author proposed a technique based on rough set theory for rule induction that can facilitate the content management in CMS. The technique limits the rules that are relevant to the learner’s need.
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