PSO-Based Fuzzy C-Means Algorithm and Fuzzy Rough Set Approaches for Rule Mining

Huimin Jiang *
Assistant Professor, School of Business, Macau University of Science and Technology, Macau, China

Farzad Sabetzadeh
Faculty of Business, City University of Macau, Macau, China

Yide Zhuang
School of Business, Macau University of Science and Technology, Macau, China

Abstract

Rough set is effective in managing discrete attributes for rule mining but the ability of dealing with the quantitative attributes with continuous values is limited. In addition, the continuous data usually involves fuzziness and defining optimal membership functions to fuzzify a continuous attribute is difficult. To overcome the limitations, in this paper, we propose particle swarm optimization (PSO)-based fuzzy c-means (FCM) algorithm and fuzzy rough set (FRS) approaches. The continuous attributes are fuzzified using PSO-based FCM algorithm in which the PSO is introduced to determine the optimal centers of fuzzy clusters. Then, instead of equivalent relation in rough set, a fuzzy similarity relation is used and an inductive learning method based on FRS is introduced to generate rules. To illustrate the proposed method, an example of rule mining to describe the relationship between degree, years of service and annual salary is used. The method is compared with the fuzzy concept learning system (FCLS) algorithm, Kohonen's self-organizing map (SOM)-based FRS, and FCM-based FRS approaches. The results of comparison show that the proposed approaches perform better than the other three approaches in terms of fitness values, the number of rules, as well as the percentages of coverage and accuracy.

Keywords

Rule mining, PSO, fuzzy c-means, fuzzy rough set, fuzzy similarity relationship.