Applications of Soft Computing in Distributed Systems

Arnold Szederjesi-Dragomir

Department of Computer Science, Faculty of Mathematics and Computer Science, Babeş-Bolyai University, Cluj-Napoca, Romania

`arnold@cs.ubbcluj.ro`

In our modern world more and more domains start using information technology to enhance observing, predicting and working capabilities. One of the most popular methods used in other fields as well is soft computing [1]. Soft Computing includes techniques as Classification (Supervised Learning), Cluster Analysis (Unsupervised Learning), Fuzzy Sets and Fuzzy Logic [3], Rough Sets and Rough Logic [2]. What we want to do is to combine Classification and Cluster Analysis with Fuzzy and Rough Sets to obtains algorithms that have better performance and can deal with a larger variety of data sets. When talking about distributed systems, especially about applying classification for resource management, the nature of the information is heterogeneous.

Fuzzy Sets and Rough Sets allow a new interpretation of sets, making them more flexible, thus suitable for a wider list of applications. While fuzzy sets extend the concept of membership, letting elements to be part of multiple sets to some degree; rough sets introduce approximations, separating elements by how certain is that the element belongs to a given set. They are usually used to detect/correct missing, vague or incomplete information, and for outlier detection too.

Supervised and Unsupervised Learning methods were already applied in other domains as biology, chemistry or physics. They are usually used to find related information, or interesting patterns in larger data sets. Machine learning in general is not only suitable for finding pattern s in large data, but it also has good performance in exchange for accuracy, but nowadays this accuracy is not a problem anymore.

The idea of combining these techniques is not new, it has been applied by [4]. They have successfully combined Fuzzy Sets and K-Means to obtain Fuzzy C-means, which, judging from the results, has better performance than its classic version. On the rough side there is also a book [5] which talks about combining rough sets with other data mining methods for analyzing imprecise data. There are also combinations with both rough and fuzzy sets.

As a consequence, we also want to try out combinations of this nature, not only because it has potential but also because their higher applicability, which will be needed in the field of distributed computing, because it provides large and diversified input.

References

[1] Zadeh, Lotfi A., "Fuzzy Logic, Neural Networks, and Soft Computing," Communications of the ACM, March 1994, Vol. 37 No. 3, pages 77-84.

[2] Pawlak, Zdzisaw. Rough Sets Basic Notions. Inst., Akad., 1981.

[3] Lotfi, A. Zadeh. Fuzzy sets. Inf Control 8(3):338353, 1965.

[4] Nayak, Janmenjoy, Bighnaraj Naik, and H. S. Behera. "Fuzzy C-means (FCM) clustering algorithm: a decade review from 2000 to 2014." In Computational intelligence in data mining-volume 2, pp. 133-149. Springer, New Delhi, 2015.

[5] Lin, Tung Yen, and Nick Cercone, eds. Rough sets and data mining: Analysis of imprecise data. Springer Science & Business Media, 2012.