

Advances in Rough and Soft Clustering: Meta-Clustering, Dynamic Clustering, Data-Stream Clustering

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Abstract

Clustering is one of the most versatile data mining techniques. Since it is an unsupervised learning technique, it can be part of the initial pattern analysis, but can also be used at different stages of a knowledge discovery process. This talk begins with the discussion on how the available raw data with limited input from domain expert can begin the knowledge discovery process in a number of application domains ranging from retail, mobile/social networks, financial, web usage, and a number of engineering applications. The versatility of clustering is further demonstrated by showing its usage for improving the quality of other data mining techniques. For example, grouping similar patterns can improve the quality of prediction techniques. The clustering can also be used to summarize results of other data mining techniques such as evolutionary optimization. We will also discuss how clustering can provide an alternative or supplementary classification or association mining technique.

We will see why the initial crisp clustering algorithms are not able to model the clustering in real-world applications. The fuzzy and rough are shown to provide better alternatives for some of the real-world applications. Fuzzy clustering provides a degree of membership to the clusters, but does not provide obvious boundaries between clusters. Rough clustering can provide a happy medium between the fuzzy and crisp clustering. Rough clustering can also complement fuzzy clustering to provide descriptive memberships and identifiable rough boundaries of clusters. The talk describes how one can derive well delineated rough clusters from a fuzzy clustering scheme.

The clustering technology continues to evolve to respond to new challenges. For example, dynamic, incremental, and decremental clustering algorithms have been developed to address continuous accumulation of data. These techniques reorganize the clustering schemes by adding new clusters, deleting obsolete clusters, and merge clusters that start converging. The discussion will also include the need for efficient handling of high velocity data-streams. Finally, we will discuss an emerging area of meta-clustering that uses hierarchical, network, and temporal relationships between objects for parallel clustering processes that feed knowledge to each other creating semantically enhanced meta-clustering schemes.

About The Presenter

Pawan Lingras is a graduate of IIT Bombay with graduate studies from University of Regina. He is currently a Professor and Director of Computing and Data Analytics at Saint Marys University, Halifax. He is also internationally active having served as a visiting professor at Munich University of Applied Sciences, IIT Gandhinagar, as a research supervisor at Institut Superieur de Gestion de Tunis, as a Scholar-in-Residence, and as a Shastri Indo-Canadian scholar. He has delivered more than 35 invited talks at various institutions around the world. He has authored more than 200 research papers in various international journals and conferences. He has also co-authored three textbooks, and co-edited two books and eight volumes of research papers. His academic collaborations/co-authors include academics from Canada, Chile, China, Germany, India, Poland, Tunisia, U.K. and USA. His areas of interests include artificial intelligence, information retrieval, data mining, web intelligence, and intelligent transportation systems. He has served as the general co-chair, program co- chair, review committee chair, program committee member, and reviewer for various international conferences on artificial intelligence and data mining. He is also on editorial boards of a number of international journals. His research has been supported by Natural Science and Engineering Research Council (NSERC) of Canada for twenty-five years, as well as other fundings agencies including NRC-IRAP and MITACS. He is also serving on the NSERC's Computer Science peer review committee. He has been awarded an Alumni association excellence in teaching award, Student union's faculty of science teaching award, and President's award for excellence in research at Saint Mary's University.

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