

Lecture by

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Title: Effectiveness of the clustering methods for the categorization of the electrical demand

Abstract:

Clustering algorithms are typically used for the categorization of the electrical demand. The application of the clustering algorithms is incorporated in a structured approach that includes a pre-clustering phase, the execution of the clustering algorithm, and a post-clustering phase. The pre-clustering phase contains various activities dedicated to the definition of the macro-categories of users, the choice of the representative days, the bad data detection and cleaning, and the choice of the features to be used for clustering, with the corresponding normalization aspects. The choice of the clustering algorithm is a key point that depends on the purpose of clustering (creating uniform groups, or identifying outliers). The post-clustering phase forms the final groups of users and the load profiles associated to these groups, while clustering validity assessment techniques can be applied to check the effectiveness of the clustering results.

The presentation provides a discussion on the main points of the whole structured approach indicated above. A specific focus is set on the role of the expert of the electricity domain in selecting appropriate features, choosing an effective method for clustering analysis, and interpreting the clustering results. A significant point is the different treatment needed for handling residential and non-residential users. For individual residential users, there is a strong dependence of the power curves of the residential demand on many unpredictable aspects linked to the consumers' lifestyle. Because of that, the use of classical metrics such as the Euclidean distance in the clustering algorithms could be ineffective. For non-residential users, the grouping based on the load curves is not connected with the categorization of the activities based on the type of activity. The use of clustering algorithms is then essential to obtain a categorization of the users based on the shape of the electrical demand patterns.



About the author

Gianfranco Chicco holds a PhD in Electrotechnics Engineering and is a Full Professor of Power and Energy Systems at Politecnico di Torino (POLITO) in Torino, Italy. He is a Fellow of the IEEE and the vice-Chair of the IEEE Italy Section. He received the title of "Doctor Honoris Causa" from the University Politehnica of Bucharest (Romania) and from the Technical University "Gheorghe Asachi" of Iasi (Romania) in 2017 and 2018, respectively. He participated in the various European Projects with POLITO and the Italian Consortium ENSIEL. He is the Editor-in-Chief of the journal Sustainable Energy, Grids and Networks (Elsevier), a Subject Editor of Energy (Elsevier), and an Editor of IEEE Open Access Journal of Power and Energy, IET Renewable Power Generation, and Energies (MDPI). He was the Chair of the International Conferences 55th UPEC (2020), 7th IEEE PES ISGT Europe (2017) and 6th WESC (2006) and is the Chair of the 20th IEEE EUROCON (2023). His research activities include Power System Analysis, Distribution System Analysis and Optimization, Electrical Load Management, Multi-Energy System Flexibility, Data Analytics, and Power Quality.