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Influence of Raw Data Temporal Resolution by Using Clustering Approach on Electricity Load Profile

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Abstract: ***The interest is increasing in contemplative conduct of electricity users in both the housing and retail zon with the approach of high solution time-sequence capacity requrement data through best metering, drilling this data could be valuable from the computational aspect. One of the trendy facility is clustering, but build upon on the algorithm the solution of the data can have an relevant control on the resulting clusters. This paper shows how suited solution of power capacity portrait affects the quality of the gather process, the texture of cluster participation (profiles exhibiting similar behavior), and the ability of the clustering process. This work uses both raw data from ordinary expenditure data and counterfeit profiles. The rationale for this work is to growth the clustering of electricity load profiles to help categorize user types for charge pattern and switching, fault and fraud find requirement-side manage and power ability measures. The vital for benchmark drilling very large data agree is how small information needs to be used to get a stable conclusion while manage solitude and preservation.***

keywords: Classification algorithms, clustering algorithms, data mining, energy consumption, machine learning, power demand, smart grids.

I. INTRODUCTION

In the current structure of the electricity business, distribution and supply services have been unbundled in many dominions. As a consequence of unbundling, electricity supply to customers is now provided on a ambitious basis. In this incident, the electricity suppliers need to get accurate information on the current behaviour of the electricity customers, for the purpose of setting up effective commercial offers. Grouping the electrical load patterns on the basis of information on their activity codes has proven to be ineffective, since very different load patterns would result in the same group. The propagation of smart meters in many countries will enable the creation of time series of power demand in both residential and commercial assumption. Most meters will be capable of generating data with high temporal resolution, but customers and network operators have different requirements, prospect, and priorities for using this data. This paper addresses the question of how much information is sufficient. Data mining and pattern recognition techniques have been applied to power demand time series [1].

The application of these tech-niques can be useful for many purposes such as detecting fail-ures and fraudulent usage or grouping users that present similar consumption patterns [2], [3].

A. Problem statement

With the coming of high-resolution time-series power used data through advanced metering, mining this data could be costly from the computational viewpoint. The popular techniques is clustering, but depend on the algorithm the resolution of the data can have an essential impact on the resulting clusters.

B. Objectives

To save the cost according to the computing point of view.

improve the clustering of electricity load profiles to help distinguish user types for cost design and switching, fault and fraud detection, trade-side management, and energy efficiency measures.

II. LITERATURE SURVEY

G. Chicco, “Overview and performance assessment of the clustering methods for electrical load pattern grouping,” *Energy*, vol. 42, no. 1, pp. 68–80, 2012.

Relieving distribution-line overload is an important measure for boosting the reliability of electric power systems. Increasing capacity and load shifting are the current commonly used methods for relieving distribution-line overload. The present study proposes the use of a new method for relieving distribution-line overload considering the demand response. First, based on the

demand elasticity matrix, a control strategy for the electricity price-load-overload degree is formed. This strategy revises the load-level curve and effectively reduces the power-system overload risk. Under electricity price responses, situations of overload are still present, but by using a response strategy based on stimulus demand, this strategy regards the minimum economic loss from overload as the target function for interruptible load cutoff. The influence of different load-interrupt schemes on the degree of relief is discussed. Finally, the study employs data from a specific domestic demonstration area to verify the feasibility of the proposed method. The results reveal that by maximally reducing the line overload risk via demand-response means, the safe operation of distribution lines is ensured.

Flath,D. Nicolay, T. Conte, C. van Dinther, and L. Filipova-Neumann, "Cluster analysis of smart metering data—An implementation in practice," *Business Inf. Syst. Eng.*, vol. 4, no. 1, pp. 31–39, 2012.

With the rollout of smart metering infrastructure at scale, demand-response (DR) programs may now be tailored based on users' consumption patterns as mined from sensed data. For issuing DR events it is key to understand the intertemporal consumption dynamics as to appropriately segment the user population. We propose to infer occupancy states from consumption time series data using a Hidden Markov Model frame work. Occupancy is characterized in this model by i) magnitude, ii) duration, and iii) variability. We show that users may be grouped according to their consumption patterns into groups that exhibit qualitatively different dynamics that may be exploited for program enrollment purposes. We investigate empirically the information that residential energy consumers 'temporal energy demand patterns characterized by these three dimensions may convey about their demographic, household, and appliance stock characteristics. Our analysis shows that temporal patterns in the user's consumption data can predict with good accuracy certain user characteristics. We use this framework to argue that there is a large degree of individual predictability in user consumption at a population level.

T. Fu, "A review on time series data mining," *Eng. Appl. Artif. Intell*, vol. 24, no. 1, pp. 164–181, 2011.

Today, wide important advances in clustering time series have been obtained in the field of data mining. A large part of these successes are due to the novel achieves in dimensionality reduction and distance measurements of time series data. However, addressing the problem of time series clustering through conventional approach has not solved the issue completely, especially when the class label of time series are vague. In this paper, a two-level fuzzy clustering strategy is employed in order to achieve the objective. In the first level, upon dimensionality reduction by a symbolic representation, time series data are clustered in a high-level phase using the longest common subsequence as similarity measurement. Then, by utilizing an efficient method, prototypes are made based on constructed clusters and passed to the next level to be reused as initial centroids. Afterwards, a fuzzy clustering approach is utilized to justify the clusters precisely. We will present the benefits of the proposed system by implementing a real application: Credit card Transactions Clustering.

G. Chicco, R. Napoli, and F. Piglione, "Comparisons among clustering techniques for electricity customer classification," *IEEE Trans. Power Syst.*, vol. 21, no. 2, pp. 933–940, May 2006.

An attempt was made to cluster the load profiles of a sample (n ≈ 380) of New Zealand households. An extensive range of approaches was evaluated, including the approach of clustering on "features" of the data rather than the raw data. A semi-automatic search of the problem space (cluster base, distance measure, cluster/partitioning method and k) resulted in a k = 3-cluster solution with acceptable quality indices and face validity. Although a particular combination of base, distance metric and clustering method was found to work well in this case, it is the practice of searching the problem space, rather than a particular solution, that is discussed and advocated.

S. Verdu, M. Garcia, C. Senabre, A. Marin, and F. Franco, "Classification, filtering, and identification of electrical customer load patterns through the use of self-organizing maps," *IEEE Trans. Power Syst.*, vol. 21, no. 4, pp. 1672–1682, Nov. 2006.

Self-organizing maps (SOM) are excellent tools to extract and visualize information from large scale systems. In this paper, these maps are used to analyze data from an electric power system in a group of buildings. An experiment has been proposed to study the electric owner consumption in these buildings according to the electricity Tari in order to achieve energy and economic savings. The input space of the SOM is mainly composed of a set of electric, meteorological and time period variables. Component planes and hit maps have been used for visualization. It has been proven that hit maps produce a close approximation to the real energy consumption.

Figueiredo, F. Rodrigues, Z. Vale, and J. Gouveia, "An electric energy consumer characterization framework based on data mining techniques," *IEEE Trans. Power Syst.*, vol. 20, no. 2, pp. 596–602, May 2005.

This paper presents an electricity consumer characterization framework based on a knowledge discovery in databases (KDD) procedure, supported by data mining (DM) techniques, applied on the different stages of the process. The core of this framework is

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a data mining model based on a combination of unsupervised and supervised learning techniques. Two main modules compose this framework: the load profiling module and the classification module. The load profiling module creates a set of consumer classes using a clustering operation and the representative load profiles for each class. The classification module uses this knowledge to build a classification model able to assign different consumers to the existing classes. The quality of this framework is illustrated with a case study concerning a real database of LV consumers from the Portuguese distribution company.

Chen, M. Kang, J. Hwang, and C. Huang, "Synthesis of power system load profiles by class load study," *Int. J. Elect. Power Energ Syst.*, vol. 22, no. 5, pp. 325–330, 2000.

The clustering of electricity customers might have an effective meaning if, and only if, it is verified by domain experts. Most of the previous studies on customer clustering, however, do not consider real applications, but only the structure of clusters. Therefore, there is no guarantee that the clustering results are applicable to real domains. In other words, the results might not coincide with those of domain experts. In this paper, we focus on formulating clusters that are applicable to real applications based on domain expert knowledge. More specifically, we try to define a distance between customers that generates clusters that are applicable to demand response applications. First, the *k*-sliding distance, which is a new distance between two electricity customers, is proposed for customer clustering. The effect of *k*-sliding distance is verified by expert knowledge. Second, a genetic programming framework is proposed to automatically determine a more improved distance measure. The distance measure generated by our framework can be considered as a reflection of the clustering principles of domain experts. The results of the genetic programming demonstrate the possibility of deriving clustering principles.

G. Chicco, "Challenges for smart distribution systems: Data representation and optimization objectives," in *Proc. 12th OPTIM*, 2010, pp. 1236–1244.

This paper deals with the evolution of distribution networks towards the smart grid paradigm, with a two fold focus. The first focus is on discussing the role of information technologies and specific aspects of data representation for generation, demand and storage patterns gathered from the field. The second focus refers to highlighting the formulation of specific objective functions for distribution system optimization incorporating new issues emerging from today's trend towards exploiting decentralized resources..

Yu, J. K. Lee, J. Ko, and S. Kim, "A method for classification of electricity demands using load profile data," in *Proc. 4th ICIS*, 2005, pp. 164–168.

With the electricity market liberalisation in Indonesia, the electricity companies will have the right to develop tariff rates independently. Thus, precise knowledge of load profile classifications of customers will become essential fordesigning a variety of tariff options, in which the tariff rates are in line with efficient revenue generation and will encourage optimum take up of the available electricity supplies, by various types of customers. Since the early days of the liberalisation of the Electricity Supply Industries (ESI) considerable efforts have been made to investigate methodologies to form optimal tariffs based on customer classes, derived from various clustering and classification techniques. Clustering techniques are analytical processes which are used to develop groups (classes) of customers based on their behaviour and to derive representative sets of load profiles and help build models for daily load shapes.Whereas classification techniques are processes that start by analysing load demand data (LDD) from various customers and then identify the groups that these customers' LDD fall into. In this paper we will review some of the popular clustering algorithms, explain the difference between each method.

III. PROPOSED SYSTEM

A. System Architecture

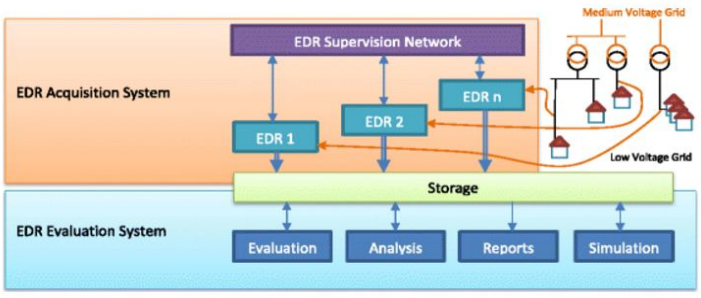

Fig -1: System Architecture

B. Advantages

Detect Fraud & Fault in Electricity Bill Handling large amount of raw data
Speeding up the computational procedures.

IV. CONCLUSION

Implement the clustering of electricity load profiles to help distinguish user types for tariff design and switching, fault and fraud detection, demand-side management, and energy efficiency measures. This work analyses the impact of the temporal resolution when clustering electricity load profiles.

V. ACKNOWLEDGEMENT

A project of this magnitude has been a journey with various ups and downs. It was the support from Guide, Colleagues and family, which has helped me in the successful accomplishment of this project.

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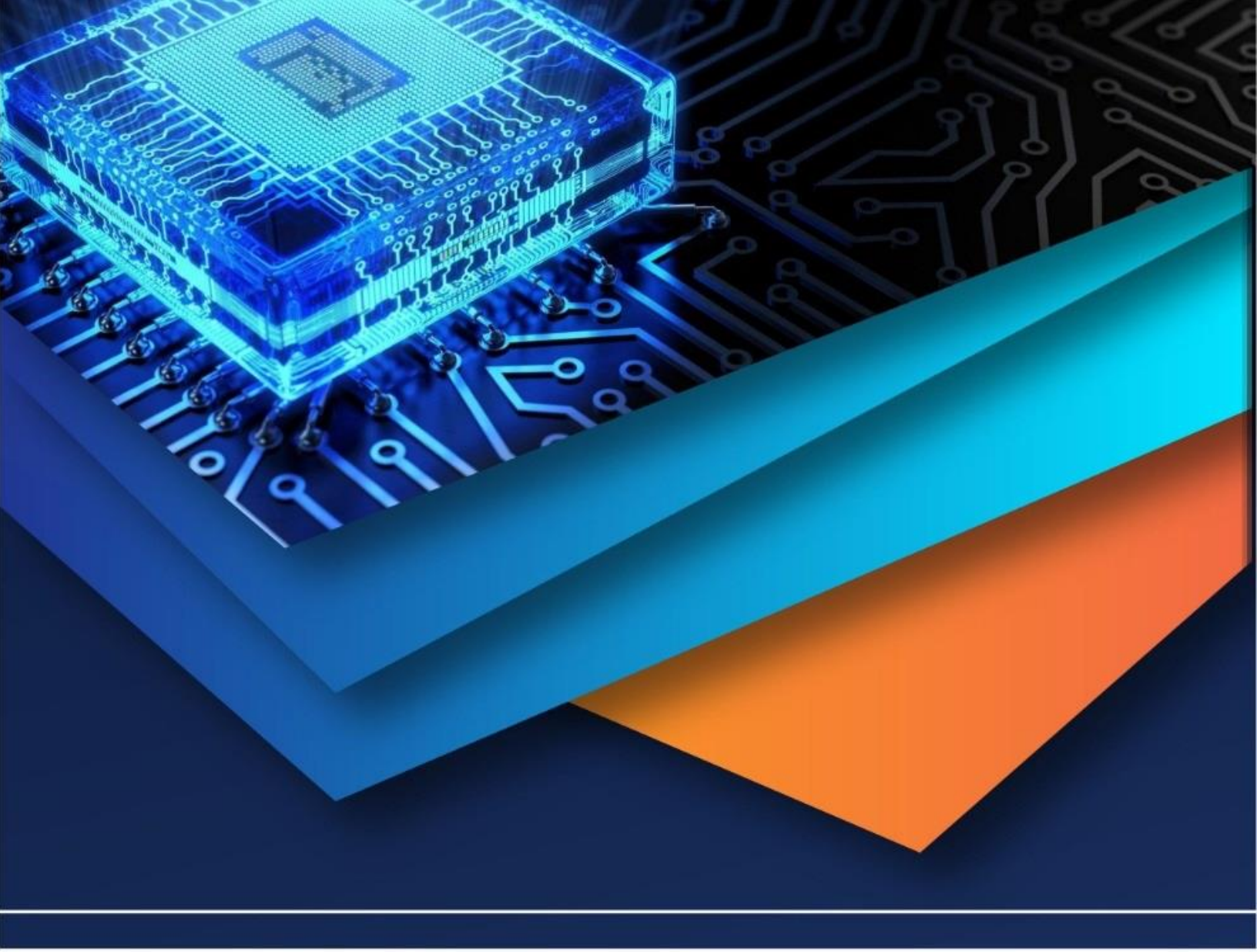

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