Electricity consumption clustering using smart meter data

Electricity smart meter consumption data is enabling utilities to analyze consumption information at unprecedented granularity. Much focus has been directed towards consumption clustering for diversifying tariffs; through modern clustering methods, cluster analyses have been performed. However, the clusters developed exhibit a large variation with resulting shadow clusters, making it impossible to truly identify the individual clusters. Using clearly defined dwelling types, this paper will present methods to improve clustering by harvesting inherent structure from the smart meter data. This paper clusters domestic electricity consumption using smart meter data from the Danish city of Esbjerg. Methods from time series analysis and wavelets are applied to enable the K-Means clustering method to account for autocorrelation in data and thereby improve the clustering performance. The results show the importance of data knowledge and we identify sub-clusters of consumption within the dwelling types and enable K-Means to produce satisfactory clustering by accounting for a temporal component. Furthermore our study shows that careful preprocessing of the data to account for intrinsic structure enables better clustering performance by the K-Means method.
Structured Literature Review of Electricity Consumption Classification Using Smart Meter Data

Smart meters for measuring electricity consumption are fast becoming prevalent in households. The meters measure consumption on a very fine scale, usually on a 15 min basis, and the data give unprecedented granularity of consumption patterns at household level. A multitude of papers have emerged utilizing smart meter data for deepening our knowledge of consumption patterns. This paper applies a modification of Okoli's method for conducting structured literature reviews to generate an overview of research in electricity customer classification using smart meter data. The process assessed 2099 papers before identifying 34 significant papers, and highlights three key points: prominent methods, datasets and application. Three important findings are outlined. First, only a few papers contemplate future applications of the classification, rendering papers relevant only in a classification setting. Second, the encountered classification methods do not consider correlation or time series analysis when classifying. The identified papers fail to thoroughly analyze the statistical properties of the data, investigations that could potentially improve classification performance. Third, the description of the data utilized is of varying quality, with only 50% acknowledging missing values impact on the final sample size. A data description score for assessing the quality in data description has been developed and applied to all papers reviewed.

General information
State: Published
Organisations: Department of Management Engineering, Systems Analysis
Authors: Tureczek, A. M. (Intern), Nielsen, P. S. (Intern)
Number of pages: 19
Publication date: 2017
Main Research Area: Technical/natural sciences

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Structured Literature Review of Electricity Consumption Classification Using Smart Meter Data

General information
State: Published
Organisations: Department of Management Engineering, Systems Analysis
Authors: Tureczek, A. M. (Intern)
Publication date: 2017
Event: Poster session presented at CITIES consortium meeting 2017, Aarhus, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
poster_cities_consortium_2017_rhus.pdf
Publication: Research - peer-review › Poster – Annual report year: 2017

Danish Act on Processing of Personal Data, in a Smart Cities Research Perspective
The Danish act on processing of personal data influences what data can be processed for. Data has been collected with consent from the data subject for a specific purpose. Any other use of the data violates the purpose and requires new consent from each data subject. But the law does include some areas which are favorable for some position, science is one. This poster explains what the law says about processing data from a research point of view.

General information
State: Published
Organisations: Department of Management Engineering, Systems Analysis, DTU Climate Centre
Authors: Tureczek, A. M. (Intern)
Projects:

Analysis of high frequency (*smart meter*) energy consumption data

Department of Management Engineering
Period: 01/08/2015 → 31/07/2018
Number of participants: 3
Phd Student:
Tureczek, Alexander Martin (Intern)
Supervisor:
Madsen, Henrik (Intern)
Main Supervisor:
Nielsen, Per Sieverts (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Activities:

Classification of District Heat Heat Exchange Stations Using Smart Meter Data
Period: 13 Sep 2017
Alexander Martin Tureczek (Guest lecturer)
Department of Management Engineering
Systems Analysis
Degree of recognition: International
Documents:
4DH_AT_Orbit

Related event

3rd International Conference on Smart Energy Systems and 4th Generation District Heating
12/09/2017 → 13/09/2017
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Classification of electricity consumption using smart meter data
Period: 30 May 2017
Alexander Martin Tureczek (Speaker)
Department of Management Engineering
Systems Analysis
Degree of recognition: International
Documents:
Electricity Smart Meter Consumption Analytics_orbit

Related event

CITIES consortium meeting 2017: Centre for IT-Intelligent Energy System in Cities
Structured Literature Review of Electricity Consumption Classification Using Smart Meter Data

Period: 30 May 2017 → 31 May 2017
Alexander Martin Tureczek (Speaker)
Department of Management Engineering

Systems Analysis
Degree of recognition: International
Documents:
poster_cities_consortium_2017_århus

Related event

CITIES consortium meeting 2017: Centre for IT–Intelligent Energy System in Cities
30/05/2017 → 31/05/2017
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

State of the art in Energy Informatics – opportunities and barriers

Period: 6 Mar 2017
Alexander Martin Tureczek (Speaker)
Department of Management Engineering

Systems Analysis
Degree of recognition: Local
Documents:
Presentation Vejle 6_3_17 - Alex-Final

Related event

Scale UP Denmark Camp
06/03/2017 → 06/03/2017
Vejle, Denmark
Activity: Talks and presentations › Conference presentations

Smart Meter Data Analyse- klassificering af elforbrugere, et review

Period: 24 Jan 2017
Alexander Martin Tureczek (Speaker)
Department of Management Engineering

Systems Analysis
Degree of recognition: National
Documents:
symposium_i_anvendt_statistik_2017_orbit

Related event

Symposium i Anvendt Statistik 2017
23/01/2017 → 24/01/2017
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Danish Act on Processing of Personal Data, in a Smart Cities Research Perspective

Period: 24 May 2016 → 25 May 2016
Alexander Martin Tureczek (Speaker)
Department of Management Engineering
Systems Analysis
Degree of recognition: International
Documents:
poster_consortium

Related event

CITIES consortium 2016
24/05/2016 → 25/05/2016
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Version2 Conference and Exhibition
Period: 3 May 2016 → 4 May 2016
Alexander Martin Tureczek (Participant)
Department of Management Engineering
Systems Analysis
DTU Climate Centre
Centre for IT-Intelligent Energy Systems in Cities

Description
Data and security conference, 2 days about how data breaches occur, how to prevent it and the legal part of data protection.

Related event

Version2 Conference and Exhibition
03/05/2016 → 04/05/2016
København, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DEHA
Period: 9 Nov 2015
Alexander Martin Tureczek (Speaker)
Department of Management Engineering
Systems Analysis
DTU Climate Centre
Centre for IT-Intelligent Energy Systems in Cities

Description
Presentation about the danish Act on Processing of Personal Data and the possible changes in the foreseeable future. (In danish)
Documents:
Persondataloven_DTU_original

Related event

DEHA : Energy data, control and management
09/11/2015 → …
Roskilde, Denmark
Activity: Talks and presentations › Conference presentations

Hvordan håndterer du den kommende persondatabeskyttelse
Period: 29 Oct 2015
Alexander Martin Tureczek (Participant)
Department of Management Engineering
Systems Analysis

DTU Climate Centre

Centre for IT-Intelligent Energy Systems in Cities

**Description**
Gennemgang af ændringer i forhold til persondatabeskyttelse i forbindelse med ny EU forordning.

**Related event**

**Hvordan håndterer du den kommende persondatabeskyttelse**

29/10/2015 → 29/10/2015

Danmark

Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.