Non Intrusive Appliance Load Monitoring System Based On A

Sustainable Energy Systems Planning, Integration and Management

This book gathers papers presented at the 9th International Conference on Computer Engineering and Networks (CENet2019), held in Changsha, China, on October 18-20, 2019. It examines innovations in the fields of computer engineering and networking and explores important, state-of-the-art developments in areas such as Information Security, Information Hiding and Cryptography, Cyber Security, and Intelligent Computing and Applications. The book also covers emerging topics in computer engineering and networking, along with their applications, discusses how to improve productivity by using the latest advanced technologies, and examines innovation in the fields of computer engineering and networking, particularly in intelligent computing and security.

Microgrids

This book provides state-of-the-art coverage of the principles, techniques, and management of issues in cyber security, including threat attacks, privacy, signature and encryption schemes. One of the most important topics addressed concerns lightweight solutions for public key encryption in resource-constrained environments; the book highlights the latest developments in this area. Authentication is another central issue in cyber security. In this book, we address this aspect and sub-aspects ranging from cryptographic approaches to practical design issues, such as CAPTCHA. Privacy is another main topic that is discussed in detail, from techniques for enhancing privacy to pseudonymous schemes. Addressing key issues in the emerging field of cyber security, this book effectively bridges the gap between computer security and threat attacks, and showcases promising applications involving cryptography and security.

Computational Intelligence and Optimization Methods for Control Engineering

This Special Issue presents the recent advances in sensor technologies for smart homes, including fiber Bragg grating (FBG) sensors for detecting the presence and number of occupants, the Internet of things for monitoring CO2 concentration, and designing a novel eye-tracking system for monitoring and controlling the vision of elderly and disabled persons. Such new explorations are pushing the boundary of sensing technologies and, thus, will have more profound implications for the future smart home. Advanced machine learning and data mining algorithms have been proposed to address sensor failure, appliance identification, and human activity recognition in a home environment. These results will enable a promising, sustainable deployment of sensing technologies. A novel multi-agent game simulation system is proposed for managing tasks between household members and between families, which demonstrates another dimension of future smart home application. This Special Issue concludes with a review on sensors for human activity recognition. This work paves the roadmap for deploying smart home systems in different socioeconomic contexts. The whole Special Issue has significantly helped to shape our understanding of the strength, implications, and barriers of deploying long-term, sustainable, smart sensors for smart homes.

Broadband Communications, Networks, and Systems

This six volume set LNCS 11063 – 11068 constitutes the thoroughly refereed conference proceedings of the 4th International Conference on Cloud Computing and Security, IICCS 2018, held in Haikou, China, in June 2018. The 386 full papers of these six volumes were carefully reviewed and selected from 1743 submissions. The papers cover ideas and achievements in the theory and practice of all areas of inventive systems which includes control, artificial intelligence, automation systems, computing systems, electrical and informative systems. The six volumes are arranged according to the subject areas as follows: cloud computing, cloud security, encryption, information hiding, IoT security, multimedia forensics, ecosystemic evolution feeded by smart systems.

Artificial Intelligence for Smart and Sustainable Energy Systems and Applications

This book presents research in artificial techniques using intelligence for energy transition, outlining several applications including production systems, energy production, energy distribution, energy management, renewable energy production, cyber security, industry 4.0 and internet of things etc. This book goes beyond standard application by placing a specific focus on the use of AI techniques to address the challenges related to the different applications and topics of energy transition. The contributions are classified according to the market and actor interactions (service providers, manufacturers, customers, integrators, utilities etc.), to the SG architecture model (physical layer, infrastructure layer, and business layer), to the digital twin of SG (business model, operational model, fault/transient model, and asset model), and to the application domain (demand side management, load monitoring, micro grids, energy consulting (residents, utilities), energy saving, dynamic pricing revenue management and smart meters, etc.).

Predicting the Future

Energy has been a crucial element for human beings and sustainable development. The issues of global warming and non-green energy have yet to be resolved. This book is a collection of twelve articles that provide strong evidence for the success of artificial intelligence deployment in energy research, particularly research devoted to non-intrusive load monitoring, network, and grid, as well as other emerging topics. The presented artificial intelligence algorithms may provide insight to how to apply similar approaches, subject to fine-tuning and customization, to other unexplored energy research. The ultimate goal is to fully apply artificial intelligence to the energy sector. This book may serve as a guide for professionals, researchers, and data scientists—namely, how to share opinions and exchange ideas so as to facilitate a better fusion of energy, academic, and industry research, and improve in the quality of people’s daily activities.

Safety and Reliability – Safe Societies in a Changing World
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Appliance Event Detection for Non-Intrusive Load Monitoring in Complex Environments

"This work presents a residential appliance disaggregation technique to help achieve the fundamental goal in Non-Intrusive Load Monitoring (NILM) problem i.e. simple breakdown of energy consumption based on the appliance type in a household. The appliances are modeled using Hidden Markov Model by utilizing both their active and reactive power consumption data. The data was recorded by attaching Power Standards Lab PQube measurement device to the appliances. Granularity of the power readings of the disaggregated appliance matches with that of the reading collected for individual device. The accuracy of the model is compared with other models developed using only active power consumption of the appliances. The results using the proposed method are more effective and are found to predict a better output sequence for the appliances compared to model using only active power for modeling loads" – Abstract, page iii.

Analysis and Techniques for Non-intrusive Appliance Load Monitoring

This book is a printed edition of the Special Issue "Ecosystemic Evolution Fedeed by Smart Systems" that was published in Future Internet

Low-complexity Low-rate Residential Non-intrusive Appliance Load Monitoring


International Conference on Information Technology and Communication Systems

The new multimedia standards (for example, MPEG-21) facilitate the seamless integration of multiple modalities into interoperable multimedia frameworks, transforming the way people work and interact with multimedia data. These key technologies and multimedia solutions interact and collaborate with each other in increasingly effective ways, contributing to the multimedia revolution and having a significant impact across a wide spectrum of consumer, business, healthcare, education and governmental domains. This book aims to provide a complete coverage of the areas outlined and to bring together the researchers from academic and industry as well as practitioners to share ideas, challenges and solutions relating to the multifaceted aspects of this field.

Decomposition Techniques for Non-intrusive Home Appliance Load Monitoring

Carbon dioxide emission reduction goals have intensified interest in researching new methods to improve our efficient use of electricity. It has been proven that providing consumers with appliance usage patterns can have significant energy savings. Non-intrusive appliance load monitoring (NILM) research aims to facilitate the large scale installation of mechanisms that provide such usage information. NILM is the process of using the whole home electricity signal to determine the energy consumption of appliances in the home without direct measurement. In this paper, we propose a fast and efficient non-parametric technique for disaggregating the whole home energy signal to determine individual appliance power consumption with high precision. We evaluate our proposed technique with the REDD dataset and show that it performs better than existing approaches in practice. We also propose modifications to known sparse coding techniques for energy disaggregation. Lastly, we evaluate the feasibility of employing Gaussian Process Regression for the purpose of NILM.

Encyclopedia of Information Science and Technology, Third Edition

The two-volume set LNCs 6593 and 6594 constitutes the refereed proceedings of the 10th International Conference on Adaptive and Natural Computing Algorithms, ICANNGA 2010, held in Ljubljana, Slovenia, in April 2010. The 83 revised full papers presented were carefully reviewed and selected from a total of 144 submissions. The second volume includes papers organized in topical sections on pattern recognition and learning, soft computing, systems theory, support vector machines, and bioinformatics.

Smart Device Recognition

Focusing on non-intrusive load monitoring techniques in the area of smart grids and smart buildings, this book provides a thorough introduction to related basic principles, while also proposing improvements. As the basis of demand-side energy management, the non-intrusive load monitoring techniques are highly promising in terms of their energy-saving and carbon emission reduction potential. The book is structured clearly and written concisely. It introduces each aspect of these techniques with a number of examples, helping readers to understand and use the corresponding results. It provides latest strengths on the non-intrusive load monitoring techniques for engineers and managers of relevant departments. It also offers extensive information and a source of inspiration for researchers and students, while outlining future research directions.

Applications of Evolutionary Computing

Energy-saving is a key element of Smart Grid. By encouraging consumers to moderate their energy demands, utilities can make more efficient use of their generation assets, and reduce total fuel consumption. For this purpose, we must provide homeowners with appliance energy consumption data, without requiring sensors on each appliance. This means that energy consumption from the house main feeder must be disaggregated into individual appliances. In this thesis, two novel methodologies for disaggregating household power consumption are evaluated. The first method is a multi-label classification, which is used to predict appliance participation in the power signal. The second method is a new signature-based sequence matching algorithm. Two sets of features have been used. In the time domain, a delay embedding of the observed power signal is constructed. The second feature set is a wavelet decomposition of the power signal, using Haar wavelet. We evaluate our techniques and features on two synthetic datasets, and two households from REDD.

Artificial Intelligence Techniques for a Scalable Energy Transition

Abstract: In order to reduce the electricity consumption in our homes, a first step is to make the user aware of it. Raising such awareness, however, demands to pinpoint users of specific appliances that unnecessarily consume electricity. A retrofittable and scalable way to provide appliance-specific consumption is provided by Non-Intrusive Load Monitoring methods. These methods use a single electricity meter to record the aggregated consumption of all appliances and disaggregate it into the consumption of each individual appliance using advanced algorithms usually utilizing machine-learning approaches. Since these approaches are often supervised, labelled ground-truth data need to be collected in advance. Labeling on-phasors of devices is already a tedious process, but, if further information about internal device states is required (e.g., intimacy of an HVAC), manual post-processing quickly becomes infeasible. We propose a novel data collection and labeling framework for Non-Intrusive Load Monitoring. The framework is comprised of the hardware and software required to record (and semi-automatically) label the data. The hardware setup includes a smart-meter device to record aggregated consumption data and multiple socket meters to record appliance level data. Labeling is performed in a semi-automatic post-processing step guided by a graphical user interface, which reduced the labeling effort by 72% compared to a manual approach. We evaluated our framework and present the FIREDS dataset. The dataset features uninterpreted, time synced aggregated, and individual device voltage and current waveforms with distinct state transition labels for a total of 101 days.

Future Technology Information

This book constitutes the refereed post-conference proceedings of the 10th International Conference on Broadband Communications, Networks, and Systems, Broadnets 2019, which took place in Xi’an, China, in October 2019. The 19 full papers presented were carefully reviewed and selected from 61
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submissions. The papers are thematically grouped as follows: Wireless Networks and Applications, Communication and Sensor Networks, Internet of Things, Pervasive Computing, Security and Privacy.

Advanced Technologies, Systems, and Applications VI

This book constitutes the refereed proceedings of the International Conference on the Applications of Evolutionary Computation, EvoApplications 2013, held in Vienna, Austria, in April 2013, colocated with the Evo* 2013 events EuroGP, EvoCOP, EvoBIO, and EvoMUSART. The 65 revised full papers presented were carefully reviewed and selected from 119 submissions. EvoApplications 2013 consisted of the following 12 tracks: EvoCOMNET (nature-inspired techniques for telecommunication networks and other parallel and distributed systems), EvoCOMPLEX (evolutionary algorithms and complex systems), EvoENERGY (evolutionary computation in energy applications), EvoFIN (evolutionary and natural computation in finance and economics), EvoGAMES (bio-inspired algorithms in games), EvoIASP (evolutionary computation in image analysis, signal processing, and pattern recognition), EvoINDUSTRY (nature-inspired techniques in industrial settings), EvoNUM (bio-inspired algorithms for continuous parameter optimization), EvoPAR (parallel implementation of evolutionary algorithms), EvoRisk (computational intelligence for risk management, security and defence applications), EvoOBOT (evolutionary computation in robotics), and EvoSTOC (evolutionary algorithms in stochastic and dynamic environments).

Recent Trends in Engineering and Technology (NCR&TET-2017)

Energy systems worldwide are undergoing major transformation as a consequence of the transition towards the widespread use of clean and sustainable energy sources. Basically, this involves massive changes in technical and organizational levels together with tremendous technological upgrades in different sectors ranging from energy generation and transmission systems down to distribution systems. These changes generate huge science and engineering challenges and demands for expert knowledge in the field to create solutions for a sustainable energy system that is economically, environmentally, and socially viable while meeting high security requirements. This book covers these promises and areas of research and development, and presents contributions in sustainable energy systems planning, integration, and management. Moreover, the book elaborates on a variety of topics, ranging from design and planning of small- to large-scale energy systems to the operation and control of energy networks in different sectors, namely electricity, heat, and transport.

Advances in Energy, Environment and Materials Science

After successful organization of the “National Seminar on Energy Science and Engineering, 2013 (NSESE-2013)” during November, 2013, Tripura Institute of Technology, Narsingpur, Tripura (West) has organized the second “National Conference on Recent Trends in Engineering and Technology, 2017 (NCR&TET-2017)” during March 17-18, 2017. The seminar aimed to provide an opportunity for academicians and researchers in India to discuss the divergent issues related to recent trends in engineering and technology covering all aspects on one platform so as to critically examine the ongoing/current research and derive directions for future research strategies and policy implications. As a mark of remembrance, a souvenir was published on this occasion. The conference has received enormous response in the form of technical papers and research contributions from various authors across the country. In total, 55 numbers of technical papers related to different engineering domain were accepted for oral presentation. Four invited papers from renowned faculty members of our country were also presented on the occasion. We are also happy to keep our commitment of publishing a conference proceeding with ISBN through a prestigious publisher having all accepted full length papers.

Sensor Technology for Smart Homes

Research on Smart Grids has recently focused on the energy monitoring issue, with the objective of maximizing the user consumption awareness in building contexts on the one hand, and providing utilities with a detailed description of customer habits on the other. In particular, Non-Intrusive Load Monitoring (NILM), the subject of this book, represents one of the hottest topics in Smart Grid applications. NILM refers to the techniques aimed at decomposing the consumption-aggregated data acquired at a single point of measurement into the diverse consumption profiles of appliances operating in the electrical system under study. This book provides a status report on the most promising NILM methods, with an overview of the publically available dataset on which the algorithm and experiments are based. All the proposed methods, those based on the Hidden Markov Model (HMM) and the Deep Neural Network (DNN), are the best performing and most interesting from the future improvement point of view. One method from each category has been selected and the performance improvements achieved are described. Comparisons are made between the two reference techniques, and pros and cons are considered. In addition, performance improvements can be achieved when the reactive power component is exploited in addition to the active power consumption trace.

Unsupervised Training Methods for Non-intrusive Appliance Load Monitoring from Smart Meter Data

“This work presents an appliance disaggregation technique to handle the fundamental goal of the Non-Intrusive Load Monitoring (NILM) problem i.e., a simple breakdown of the electrical power consumption into the diverse consumption profiles of appliances operating in the electrical system under study. This book provides a status report on the most promising NILM methods, with an overview of the publically available dataset on which the algorithm and experiments are based. All the proposed methods, those based on the Hidden Markov Model (HMM) and the Deep Neural Network (DNN), are the best performing and most interesting from the future improvement point of view. One method from each category has been selected and the performance improvements achieved are described. Comparisons are made between the two reference techniques, and pros and cons are considered. In addition, performance improvements can be achieved when the reactive power component is exploited in addition to the active power consumption trace.”

Advanced Data Acquisition and Intelligent Data Processing

DAQ and data processing is a basic part of all automated production systems, diagnostic systems, watching over quality of production, energy distribution, transport control or in various other areas. Demands on the speed, accuracy and reliability increase in general. It is possible to achieve not only using superior (but also more expensive) hardware, but also applying advanced data acquisition and intelligent data processing. It deals e.g. optimal data fusion of a number of sensors, new stochastic methods for accuracy increasing, new algorithms for acceleration of data processing, etc. These are the grounds for publishing this book. Advanced Data Acquisition and Intelligent Data Processing offers 15 up-to-date examples of different applications of advanced data acquisition and intelligent data processing used in monitoring, measuring and diagnostics systems. The book arose based on the most interesting papers from this area published at IDEAS2013 conference. However, the individual chapters include not only designed solution in wider context but also relevant theoretical parts, achieved results and possible future ways. Technical topics discussed in this book include: advanced methods of data acquisition in application that are not routine; measured data fusion using up-to-date advanced data processing; nonlinear dynamical systems identification; multidimensional image processing. Advanced Data Acquisition and Intelligent Data Processing is ideal for personnel of firms deals with advanced instrumentation, energy consumption monitoring, environment monitoring, non-destructive diagnostics robotics, etc., as well as academic staff and postgraduate students in electrical, control and computer engineering.

Hidden Markov Model Based Non-intrusive Load Monitoring Using Active and Reactive Power Consumption

The 2016 International Conference on Energy, Environment and Materials Science (EEMS 2016) took place on July 29-31, 2016 in Singapore. EEMS 2016 has been a meeting place for innovative academics and industrial experts in the field of energy and environment research. The primary goal of the conference is to promote research and developmental activities in energy and environment research and further to promote scientific information exchange among researchers, developers, engineers, students, and practitioners working all around the world. The conference will be organized every year making it an ideal platform for people to share views and experiences in energy, environment and materials science and related areas.

Advances in Cyber Security: Principles, Techniques, and Applications

The book is the first international reference on the field of smart device recognition and Ubiquitous Electric Internet of Things (UEIOT). It presents a range of state-of-the-art key methods and applications for smart device recognition. In future smart environments, obtaining energy consumption information for identifying every device is an effective approach to guarantee the energy efficiency of smart industrial systems. Such as, the Ubiquitous Electric Internet of Things (UEIOT) technology represents one of the most effective measures for electricity and energy management and has attracted considerable attention from scientists and engineers around the world. The realization of smart device recognition in the UEIOT framework has become the core and basis of UEIOT’s success. The device smart recognition can help governments and managers to distribute energy and power better, and help device manufacturers to improve their products regarding smart energy conservation. Accordingly, in the future smart industry, implementing smart device recognition is desired and very important. In the book, several methods, strategies, and experiments for achieving smart device recognition are presented in details. As the first monograph in the field of smart device recognition, the book can provide beneficial reference for students, engineers, scientists, and managers in the fields of power, energy, electromagnetic devices, smart cities, artificial intelligence, etc.

Analysis of Energy Disaggregation Techniques in Non-intrusive Appliance Load Monitoring

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Residential energy disaggregation is a process by which the power usage of a home is broken down into the consumption of individual appliances. There are a number of different methods to perform energy disaggregation, from simulation models to installing "smart-plugs" at every outlet where an appliance is connected to the wall. Non-Intrusive Load Monitoring (NILM) is one such disaggregation option. NILM is widely recognized as one of the most cost-effective methods for gathering disaggregated energy data while maintaining a high level of accuracy. Although the technology has existed for many years, the adoption rate of NILM, and other devices that disaggregate energy, has been minimal. This thesis provides details on the potential benefits, both for the customer and utility provider, associated with furthering the adoption of NILM devices and obtaining the disaggregated appliance level energy-use. A broad overview of potential benefits is presented; however, the primary goal of this thesis will be to investigate two benefits of NILM in detail: overall household energy reduction and targeted demand response. First, installation of a NILM device can provide electricity customers information that allows them to become more aware of their energy consumption, and thereby, more energy efficient. A study was conducted that looked at the electricity consumption of 174 homes that were using a passive NILM device in their home. This NILM device provided immediate feedback on the power consumption for a portion of the home's appliances via smart-phone application. The homes reduced their monthly energy consumption by an average of 2.6 - 3.1% after the NILM installation. This was validated by a number of analysis methods returning similar results. Aligned with this benefit comes a recommendation for an incentive structure that can reduce the price paid by the consumer and develop a higher adoption rate of NILM devices. Second, the wide-spread adoption of NILM devices can provide electric utilities information to reduce carbon intensity via targeted demand response. There is a significant opportunity for utilities to engage their customers based on the time of use of detailed appliances. Multiple metrics are presented in this thesis to quantify the deferrable load opportunity of specific appliances and individual households. Utility operational cost savings and greater customer incentives can be linked to the use of these metrics.

A Framework to Generate and Label Datasets for Non-intrusive Load Monitoring

The first proposed supervised approach is a low-complexity method that requires very short training period and is robust to labelling errors. The second, unsupervised approach relies on a database of appliance signatures that we designed using publicly available datasets.

Intelligent Systems and Applications

This volume presents some recent and principal developments related to computational intelligence and optimization methods in control. Theoretical aspects and practical applications of control engineering are covered by 14 self-contained contributions. Additional gems include the discussion of future directions and research perspectives designed to add to the reader's understanding of both the challenges faced in control engineering and the insights into the developing of new techniques. With the knowledge obtained, readers are encouraged to determine the appropriate control method for specific applications.

Computational Science and Its Applications – ICCSA 2020

The book Intelligent Systems and Applications - Proceedings of the 2020 Intelligent Systems Conference is a remarkable collection of chapters covering a wider range of topics in areas of intelligent systems and artificial intelligence and their applications to the real world. The Conference attracted a total of 545 submissions from many academic pioneering researchers, scientists, industrial engineers, students from all around the world. These submissions underwent a double-blind peer review process. Of those 545 submissions, 177 submissions have been selected to be included in these proceedings. As intelligent systems continue to replace and sometimes outperform human intelligence in decision-making processes, they have enabled a larger number of problems to be tackled more effectively. This branching out of computational intelligence in several directions and use of intelligent systems in everyday applications have created the need for such an international conference which serves as a venue to report on up-to-the-minute innovations and developments. This book collects both theory and application based chapters on all aspects of artificial intelligence, from classical to intelligent scope. We hope that readers find the volume interesting and valuable; it provides the state of the art intelligent methods and techniques for solving real world problems along with a vision of the future research.

Non-intrusive Load Monitoring

PAAMS, the International Conference on Practical Applications of Agents and Multi-Agent Systems is an evolution of the International Workshop on Practical Applications of Agents and Multi-Agent Systems. PAAMS is an international yearly tribute to present, to discuss, and to disseminate the latest developments and the most important outcomes related to real-world applications. It provides a unique opportunity to bring multi-disciplinary experts, academics and practitioners together to exchange their experience in the development of Agents and Multi-Agent Systems. This volume presents the papers that have been accepted for the 2017 in the special sessions: Agent-Based Social Simulation, Modelling and Big Data Analytics (ABM); Advances on Demand Response and Renewable Energy Sources in Agent Based Smart Grids (ADRES); Agents and Mobile Devices (AMB); Computer vision in Multi-Agent Robotics (BV); Persuasive Technologies (PT); Web and Social Media Mining (WASMM). The volume also includes the papers accepted for publication in the Doctoral Consortium (DCAI, DCAI-DECON, ISAMI, MIS4TEL, PAAMS, PACBB 2017 conferences).

Energy Disaggregation in Non-Intrusive Appliance Load Monitoring Using Hidden Markov Models

Smart home technologies promise to transform domestic comfort, convenience, security and leisure while also reducing energy use. But delivering on these potentially conflicting promises depends on how they are adopted and used in homes. This book starts by developing a new analytical framework for understanding smart homes and their users. Drawing on a range of new empirical research combining both quantitative and qualitative data, the book then explores how smart home technologies are perceived by potential users, how they can be used to link domestic energy use to common daily activities, how they may (or may not) be integrated into everyone's life by actual users, and how they serve to change the nature of control within households and the home. The book concludes by synthesizing a range of evidence-based insights, and posing a series of challenges for industry, policy, and research that need addressing if a smart home future is to be realized. Researchers will find this book provides useful insights into this fast-growing field.

Energy Disaggregation in Non-Intrusive Appliance Load Monitoring Using Hidden Markov Models Models

This book reports on advanced methods and theories in two related fields of research. Information Technology and Communication Systems. It provides professors, scientists, PhD students and engineers with a readily available guide to various approaches in Engineering Science. The book is divided into two major sections, the first of which covers Information Technology topics, including E-Learning, E-Government (egov), Data Mining, Text Mining, Ontologies, Semantic Similarity Databases, Multimedia Information Processing, and Applications. The second section addresses Communication Systems topics, including: Systems, Wireless and Network Computing, Security and Privacy, Modern Antennas, and Smart Grids. This book gathers contributions presented at the International Conference on Information Technology and Communication Systems (ITCS 2017) held at the National School of Applied Sciences of Moulaya, Hassan 1st University, Morocco on March 28-29, 2017. This event was organized with the objective of bringing together researchers, developers, and practitioners from academia and industry working in all areas of Information Technology and Communication Systems. It not only highlights new methods, but also promotes collaborations between different communities working on related topics.

Non-intrusive Appliance Load Monitoring System Based on a Modern KWh-meter

The seven volumes LNCS 12249-12255 constitute the refereed proceedings of the 20th International Conference on Computational Science and Its Applications, ICCSA 2020, held in Cagliari, Italy, in July 2020. Due to COVID-19 pandemic the conference was organized in an online event. Computational Science is the main pillar of most of the present research, industrial and commercial applications, and plays a unique role in exploiting ICT innovative technologies. The 466 full papers and 32 short papers presented were carefully reviewed and selected from 1450 submissions. Apart from the general track, ICCSA 2020 also include 52 workshops, in various areas of computational sciences, ranging from computational science technologies, to specific areas of computational sciences, such as software engineering, security, machine learning and artificial intelligence, blockchain technologies, and of applications in
Adaptive and Natural Computing Algorithms

Smart Homes and Their Users

This 10-volume compilation of authoritative, research-based articles contributed by thousands of researchers and experts from all over the world emphasizes modern issues and the presentation of potential opportunities, prospective solutions, and future directions in the field of information science and technology. – Provided by publisher.


Microgrids are a growing segment of the energy industry, representing a paradigm shift from centralized structures toward more localized, autonomous, dynamic, and bi-directional energy networks, especially in cities and communities. The ability to isolate from the larger grid makes microgrids resilient, while their capability of forming scalable energy clusters permits the delivery of services that make the grid more sustainable and competitive. Through an optimal design and management process, microgrids could also provide efficient, low-cost, clean energy and help to improve the operation and stability of regional energy systems. This book covers these promising and dynamic areas of research and development and gathers contributions on different aspects of microgrids in an aim to impart higher degrees of sustainability and resilience to energy systems.