Non Intrusive Load Monitoring

Thesis Type
Master Thesis in Computer Science

Requirements
Good knowledge of Matlab
Good knowledge of Python
Good knowledge of signal processing

Description
Non-Intrusive Load Monitoring (NILM) is the process of estimating the energy consumed by individual appliances given just a whole-house power meter reading. In other words, it produces an (estimated) itemised energy bill from just a single, whole house power meter.

Goal of this thesis is to analyse the state of the art of NILM algorithms (with particular attention to nilm-tk) and study a dynamic learning technique to profile and then disaggregate all the single load contributions from a real collected data stream.

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Load Clustering Analysis

Thesis Type
Master Thesis in Computer Science

Requirements
Good knowledge of Matlab
Good knowledge of C/C++ or an equivalent advanced programming language
Good knowledge of signal processing

Description
Clustering is the process to gather different entities in specific groups driven by a similarities or common properties approach. This is quite useful in order to take average decisions on a limited amount of agents with respect to deal with the entire population of entities.
The goal of this thesis is twofold: the first goal is to compare various clustering algorithms and assess their pros and cons; second to apply the best methods on real thermal load profiles so to classified buildings along their energy performance.

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Swarm Intelligence for Optimal Power Flow

Thesis Type
Master Thesis in Computer Science

Requirements
Good knowledge of Matlab
Good knowledge of C/C++ or an equivalent advanced programming language
Good knowledge of signal processing

Description
The Optimal Power Flow (OPF) problem is concerned with finding a proper operating point for a power network while attempting to minimize some cost function and satisfy several network constraints. The OPF problem is in general NP-hard. This thesis aims to develop a swarm intelligence algorithms (as for example the Ant Colony Optimization methods) to solve the OPF in a sub-optimal way, but in a limited amount of time by means of a software solution high parallelized (several clients and servers to compute the optimal solution).

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Dynamic Learning Technique for Optimal Load Scheduling

Thesis Type
Master Thesis in Computer Science

Requirements
Good knowledge of Matlab
Good knowledge of C/C++ or an equivalent advanced programming language
Good knowledge of signal processing

Description
One of the major problem in energy distribution is to match with the production the demand for electricity. Production must follow strictly the demand of energy and the increased penetration of non programmable generation (solar and wind) increases the complexity to this problema. Demand Response is one of the proposed solution. This thesis aims to study a dynamic learning technique to find the best combination of resources among block of buildings so to optimize the among programmable and non programmable production, storages and demand of electricity.

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Short Term and Week ahead Load Forecasting

Thesis Type
Master Thesis in Computer Science

Requirements
Good knowledge of Matlab
Good knowledge of signal processing

Description
Load forecasting is the ability to predict the demand of energy for the next few hours or for the following day up to the whole week. Several methodologies have been analyzed in the literature. The majority of the algorithms have been applied to single users, while in this thesis the aim is to predict the aggregated load of block of buildings which is much more interesting for reliable operation of the power grid (which must serve not single users, but several users). The thesis aims to implement and validate the selected algorithms with simulated and potentially real data.

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Ant Colony Optimization applied to problems with uncertainties

**Thesis Type**
Master Thesis in Computer Science

**Requirements**
Good knowledge of Matlab

**Description**
Ant Colony Optimization algorithm are commonly used to solve hard combinatorial problem like the power flow optimization inside a microgrid. This kind of algorithm doesn’t take into account that some input data are provided with predictions models and so are affected with uncertainties. The thesis aims to study the integration of fuzzy logic to take into account these uncertainties. Other improvement different from the fuzzy logic can be studied and implemented.

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OpenADR

Thesis Type
Master Thesis in Computer Science

Requirements
Good knowledge of XML
Good knowledge of C/C++ or JAVA
Good knowledge of signal processing

Description
Demand Response (DR) programs help utilities maintain grid reliability and enable customers to realize significant value. Unfortunately, existing proprietary solutions add unnecessary cost and complexity. The OpenADR Alliance was created to standardize, automate and simplify DR to enable utilities to cost-effectively meet growing energy demand, and customers to control their energy future. The typical use is to send information and signals to cause electrical power-using devices to be turned off during periods of high demand. The goal of this thesis is to develop a client server application to emulate the functioning of an electrical grid managed through OpenADR standard.

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