UNIVERSITY OF BRESCIA

PhD Program
in
TECHNOLOGY FOR HEALTH

Machine Learning Techniques for Ensuring the Health of Citizens and the Environmental Sustainability of Buildings

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XXXVII Cycle

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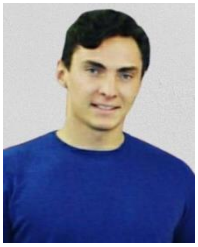

Background

I worked on a project for the economic optimization of the energy consumption of the heating system of the Repyovka Central District hospital during my Master's degree at Voronezh State Technical University. The set of energy-saving activities was created in order to determine the most efficient manner of conserving energy in the heating systems under consideration while maintaining the primary goal of energy supply reliability and safety. While working on this project, I became interested by the field of energy saving and chose to further my study in energy system optimization. With the goal of doing research in the field of system optimization and load forecasting using machine learning methods, I enrolled as a PhD student at University of Brescia.

Objectives

The aim of this project is to develop and test in a real working environment (by making use of the equipment and facilities of the eLUX laboratory of the University of Brescia) a set of models and tools which are able to provide reliable and accurate utilization profiles of buildings, by taking into account both the usage of energy assets and equipment, the behavior of end-users, and the care for the comfort and the health of occupants.

Methodologies

In project plans to use scientific-research methods of short-term load forecasting (STLF) which are divided in two main categories: statistical methods and artificial intelligence methods. In statistical methods, obtained equations show load-affecting factors relationship, while artificial intelligence methods are copying people's mode of thinking in order to get the information from the past experience and to forecast future load. The use of artificial intelligence methods has great advantages. This is the basic algorithm of a neural network, a fuzzy output system, genetic algorithms, a swarm of particles, chaos theory, and others. The foregoing methods of prediction and expert systems belong to artificial intelligence methods.

Expected Results and Impact

The aim of this project is to develop a set of models and tools able to provide reliable energy consumption profiles of buildings taking into account the behavior of end-users. Such models will be then adopted to generate short-term energy consumption profiles that could be used by energy managers to define adaptive optimal energy management schedules concerning the rate of utilization of buildings and of energy intensive equipment, by also taking care for the comfort and health of occupants. The analysis of the energy consumption of buildings, compared to the information of their utilization profiles (derived from the developed machine leaning models), could be also used to define targeted renovations actions. At the same time, the developed models could be used to monitor the presence and the energy behavior of users, and to provide them suggestions to a sustainable use of infrastructures.