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Coordinator:
Aristotle University of Thessaloniki
Contact: Prof. Anastasios Tefas
tefas@csd.auth.gr

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machine learning system for energy data analysis & management

Machine Learning System for Energy Data Analysis and Management

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Motivation

Artificial Intelligence, in general, and Machine Learning, in specific, can change the energy management and consumption model. The analysis and exploitation of energy datasets using modern machine learning techniques can lead to models for the accurate prediction of the **energy load demand**, **energy production by the renewable energy sources**, as well as **personalised energy consumption management by individuals**. Machine Learning can be critical for optimising the energy saving and cost reduction process. The current operation of the Greek Energy Market is based on the Compulsory Consortium model, a techno-economic model of energy and reserve optimization. Regarding this, PPC uses load and RES forecasting software and services developed over the last decade. The existing Market model makes it impossible to interconnect the Greek Energy Market with the adjacent Markets. To ensure the PPC's effective and competitive participation in the forthcoming European Target Model, the following markets have been introduced: Day-Ahead Market and Intra-day Market.

What is the project about?

The aim of this project is to develop **innovative** and **state-of-the-art** software tools covering PPC's participation needs in the aforementioned markets, introduce innovation and expertise within the company, and provide PPC with a software solution that sets the company free from license restrictions and third-party software companies. At the same time, the provision of a personalized service to consumers, giving them integrated access to their energy data and allowing them to manage their consumption, broadens PPC's services portfolio with the integration of current trends in the energy sector. Development of innovative load and RES prediction algorithms will lead to the creation, for the first time in the Greek Energy Market, of an integrated management tool, which aspires to become a reference for all other participants in the market. In order to pursue all these objectives, deep neural networks and multi-target prediction techniques will be utilized.

The project investigates two main research paths for forecasting multiple future values of time series: a) deep neural networks, b) multi-target prediction. On one hand, deep neural networks have revolutionized machine learning during the past years achieving top results for unstructured data (images, video, audio, text). On the other hand, multi target prediction techniques allow the exploitation of algorithms – such as the extreme gradient boosting algorithm, which achieve top results in tasks with structured data involving multiple target variables, such as load forecasting. The project studies the application of the aforementioned techniques in time series of energy and weather data. In addition, the project studies graph mining techniques and methods for scaling up machine learning to data streams using graphics processing units and cloud computing.