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Autor pracy

Ph.D. abstract

**„The system that generates the heat demand forecasts for the Warsaw District Heating Network”**

This thesis presents theoretical background and practical implementation of the system which generates the heat demand forecasts for the Warsaw District Heating Network. The algorithms that evaluate the forecasts have been developed based on machine learning models where the input data are the measurements of heat consumption by the end users and the weather data. The dataset contains the one hour resolution measured values from 16 000 substations. This thesis presents the methods for time series forecasts and the metrics allowing the evaluation of the prediction models. The process of constructing the machine learning based system has been described and it consists of three main stages: problem definition, modelling and model implementation. This thesis presents each system layer and its key algorithms allowing the efficient data workflow, that is: data validation, missing data replacement, estimation of heat demand for the whole grid or its areas as well as model training and evaluation. The final forecast model has a form of the artificial neural network with 4 hidden layers and autoregressive input, whereas the forecast consists of the forecast value and the confidence intervals. The models quality has been evaluated individually for three distinctive seasons of the year, i.e. heating, summer and transient season. The thesis proves that it is possible to precisely forecast heat demand for each analyzed season. The analysis of the outcomes from the implementation in the Warsaw District Heating Network demonstrates the efficiency and effectiveness of the solution.

**Keywords:** district heating networks, heat demand forecast, artificial neural networks

A handwritten signature in black ink, reading "Teresa Kurek", is written over a horizontal dotted line. A long, thin horizontal line is drawn above the signature.

Signature