THE LOAD FORECASTING APPLICATIONS FOR ENERGY SECTOR

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Abstract

Load forecasting is vitally important for the electric industry with in a deregulated economy. It has many applications including energy purchasing and generation, load switching, contract evaluation, and infrastructure development [1]. Time series methods are based on the assumption that the data have an internal structure, such as autocorrelation, trend, or seasonal variation. Time series forecasting methods detect and explore such a structure. Time series have been used for decades in such fields as economics, as well as electric load forecasting [2]. We present a short-term 5 days load forecasting applications for industrial plant with an electric arc furnace [3] in the City of Ravne, Slovenia. We present five different load-forecasting techniques: linear regression (off line) [4], ARIMA (off line), Winter's multiplicative (off line) and real time Data Mining [7] [8] [9]. At short-term load forecasting linear regression, for which we use two time series: energy and production at the electric arc furnace. Next, we divide the forecasting model in two parts: ARIMA with predictor "loads" at electric arc furnace and Winter's multiplicative without any predictor; in this case the electric arc furnace is off. IBM SPSS software was the tools at this section.

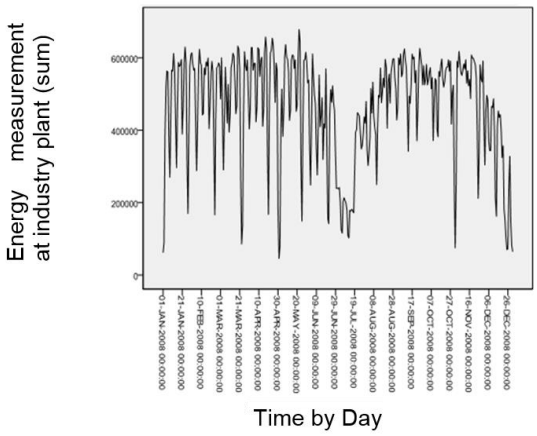

Figure 1: Energy measurements at plant Ravne.

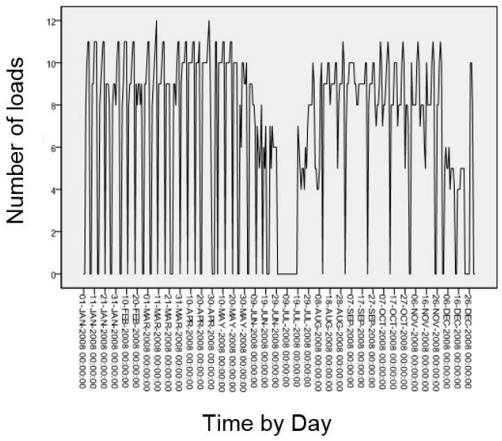

Figure 2: Number of loads at electric arc furnace.

Data Mining provides the means to make sense of tremendous volumes of data by automating the processes of categorising and clustering common elements, identifying trends and anomalies in the data, and predicting what will happen given those factors [7]. In this paper we discuss Data Mining at ARMA (Autoregressive and Moving Average Models) [9] and Data Mining at ART (Autoregressive Tree Models) [8]. For the development and improvements of forecasting we used the Microsoft technology: SQL server, Analysis Server and WEB server. We briefly discuss and compare predictions with and without any predictors. This means, model use only one time series, energy measurements at plant.

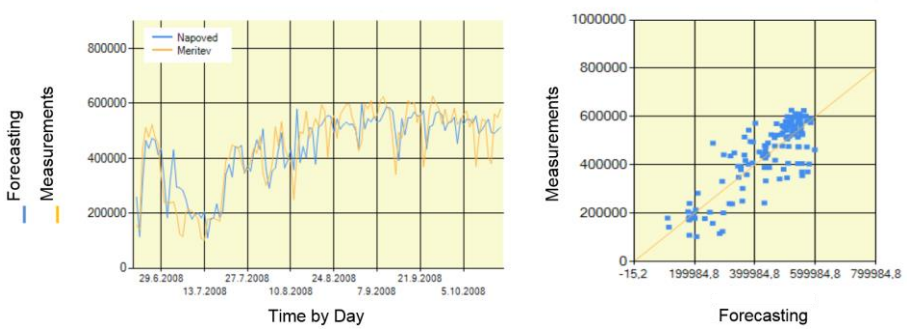

Figure 3: One day load forecasting and measurements - Data mining on WEB.

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In addition, we show Long-term load forecasting samples [5] of one-year predictions for two points at electrical transmission network in Slovenia. Software tools were IBM SPSS. We present two different load-forecasting techniques: ARIMA and seasonal models. Outliers can occur by forecasting, so we discuss some worst-case scenarios. We show forecasting quality factors for each forecasting model: CL (Confidence Intervals), MAPE (Mean Absolute Percentage Error) and time series value at forecasting time. At conclusion, we compare the results.

	Measurements	MAPE	Forecast	UCL	LCL
Jan 2009	33	-4 %	31,53	34,83	28,24
Feb 2009	29	7%	31,13	34,97	27,29
Mar 2009	32	-6 %	30,18	34,50	25,86
Apr 2009	30	-3,6 %	28,94	33,69	24,19
May 2009	29	-1 %	28,46	33,60	23,31
Jun 2009	27	10 %	29,74	35,25	24,23
Jul 2009	27	5 %	28,42	34,28	22,57
Aug 2009	24	16 %	28,73	34,91	22,55
Sep 2009	29	0 %	28,97	35,45	22,48
Oct 2009	28	7 %	30,40	37,18	23,61
Nov 2009	30	0,5 %	29,53	36,59	22,46

Figure 4: Long term - 12 months forecasting at node Krško.

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