Paper has been submitted to the 4th International Conference on
"Technical and Physical Problems of Power Engineering" (TPE-2008)
4-6 September 2008, University of Pitesti, Pitesti, Romania
www.ictpe.com

SHORT TERM LOAD FORECASTING BY NEURAL NETWORK IN MASHAD (IRAN) POWER SYSTEM

N.M. Tabatabaei [1] S.R. Mortezaeei [2] S. Alzakeriny [2] S. Ozen [3] A. Nayir [4]

1 Electrical Engineering Department, Azarbaijan University of Tarbiat Moallem, Tabriz, Iran
Electrical Engineering Department, Seraj Higher Education Institute, Tabriz, Iran
Engineering Department, Atrak Energy Co., Tehran, Iran, n.m.tabatabaei@gmail.com

2 Elect. Eng. Dept., Azarbaijan University of Tarbiat Moallem, Tabriz, Iran rmortezaeei@yahoo.com

3 Electrical Engineering Department, Akdeniz University, Antalya, Turkey, sukruozen@akdeniz.edu.tr

4 Electrical Engineering Department, Fatih University, Istanbul, Turkey, ahmetnayir@hotmail.com

Keywords: Short Term Load Forecasting, Weather-Electricity Demand Relation, Artificial Neural Network (ANN), Multi-Layer Perceptron (MLP)

Abstract- The paper illustrates supervised neural networks for the electric energy demand forecasting of an area with a prediction time of 24 h. The actual forecast is obtained using a two layered feed forward neural network, trained with the back propagation of momentum learning algorithm. In order to investigate the influence of climate variability on the electricity consumption, the neural network is trained using weather data (temperature, relative humidity, global solar radiation) along with historical load data available for a part of the electric grid of the town of Mashad (Iran). The model validation is performed by comparing model predictions with load data that were not used for the network's training. The results obtained bear out the suitability of the adopted methodology for the short term load forecasting (STLF) problem also at so small a spatial scale as the suburban one.

I. INTRODUCTION

Many studies have pointed out the overwhelming sensitivity of electricity consumption to weather variables, in particular focusing attention on the forecast limited to 24 hour ahead. The prediction of the system load over an interval ranging from 1 hour to 1 week is also known as short term load forecasting (STLF).

Recent research activities have also focused on the impacts of climatic changes both on supply (studies about the potential impact of climate change on renewable energy resources, such as wind power [1,2] and hydroelectric power [3]) and demand (studies about electricity demand and natural gas demand correlation with weather variability [4,5]) for energy.

Weather sensitivity has also been examined in order to correlate electricity consumptions to the increases in market saturation of air conditioning induced by long term climatic changes [6].

A very common approach in STLF problems is constituted of algorithms based on artificial neural networks (ANNs). Most of the suggested models for STLF use neural network architectures known as multi-layer perceptrons (MLPs) [7–13, 15].

Some of the proposed approaches present modular solutions in which different networks are suitably arranged to provide the forecast [12, 13].

In addition to MLPs for load forecasting, there are also other models based on unsupervised learning, using self organizing maps (SOMs) [14, 16-18]. The appeal of neural networks can be explained by the ability of the network to learn complex relationships between input and output patterns that would be difficult to model with conventional algorithms.

In particular, referring to STLF, the results of application method to Mashad (Iran) power system shows that ANNs are able to learn the properties of the electric load that would otherwise require deep and careful analysis to be discovered. In neural network models, past load and weather data generally represent the network inputs, and forecasted load values represent the outputs. The networks training is conducted by providing input-output pairs extracted from historical data.

II. THE MULTI-LAYER PERCEPTRON MODELS

MLPs are constituted of a set of interconnected basic processing units (neurons) organized in layers. Each neuron produces its output by taking a linear combination of the input signals and transforming it using a function called the activity function. The weights of this linear combination are those associated with the numeric connections (synaptic weights) linking the neuron with all of the neurons belonging to the upper layer.

The output of a neuron as a function of the input signals can thus be written