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Neural network models of time series of network traffic intensities

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Abstract

The paper presents the results of building neural network predictive models of the occupancy of the channel packet data. The problem is solved by the example of time series observations of the intensities at the commutator switch port. The above algorithm for constructing a neural network model based on the determination of the fractal dimension of the time series. The autoregressive model is constructed as a parallel model. The developed models are compared in accordance with the rated value of entered criteria for assessing the accuracy of the forecast.

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Keywords: neural network; network traffic; time series; correlation integral.

1. Introduction

The purpose of the research is to obtain valid conclusions on the approach to the construction of a mathematical model in the considered applied area. The relevance of the work is defined as follows. The existence of a large number of diverse services in one physical channel during the highest load hours can lead to an overload of commutation and routing devices on the network backbone which can lead to a massive failure of the range of services. To prevent situations leading to failure of the network backbone equipment and to optimize the use of network resources, the proper use of the broadband of the data-transmission circuit becomes the most important task. It is essential to use rational effective methods of traffic management and occupancy control, which would be

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based on the data provided, for example, by an instrument of forecasting traffic intensities on the previous values basis. There are different approaches to solve this problem[1,2]. The authors propose an unconventional approach to the solution by using the field data.

A commutator switch of the 2nd level organization focused on providing the main line services was taken as an example for a research. Traffic arriving at each port of the device, is a summarized traffic from groups of clients from a specified area. Figure 1 shows the schema of the study measurement. Statistics was prepared using Cacti software, SNMP-Interface statistic protocol. The information about the occupancy level of the network is more useful for practical purposes. The information about the packet count per unit time can be misleading. Therefore, as an observable variable the aggregated value x (t) – traffic intensity (bit) at the moment t is chosen. Duration time of data is 10080 points, or 7 days.

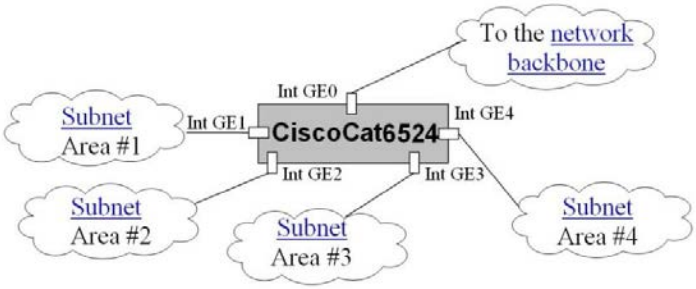

Fig.1. The schema of the study measurement

Figure 2 shows the intensities graph measured at the GE 0 port. Each point on the graph represents the number of data bit transmitted on the network backbone channel in a time interval of 1 minute.

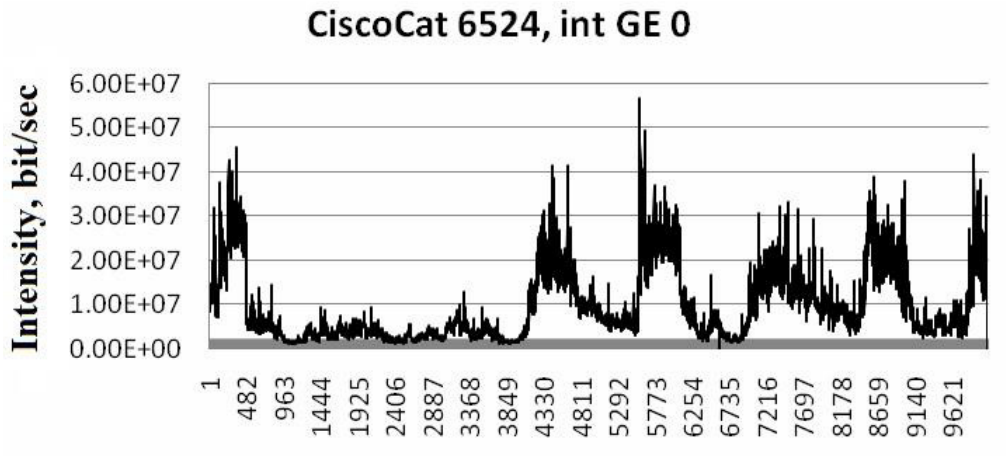

Fig.2. The traffic intensity graph at the GE 0 port

It is necessary according to the data from the observations $\{x(t)\}_{t=1}^{N}$, where N – amount of observation points, to solve the problem of identification of the timing series and to build the forecast for m anticipation steps.