

FORECASTING NETWORK TRAFFIC: A COMPARISON OF NEURAL NETWORKS AND LINEAR MODELS

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The object of the research is the time series characterizing the real traffic of both traditional telephone networks (POTS) and packet-switched IP-networks. The reliable forecasts of traffic generated by users (subscribers) allow planning the capacity of transmission channels, avoiding the overload and thereby sustaining the optimal level of quality of service.

A rapid development of packet-switched networks and the transformation of traditional telephone networks into multi-service systems offer new opportunities to a user (subscriber) and expand his/her scope of activities. Though, not only the architecture of telecommunications networks but also the statistical nature of traffic has been changed what implies a strong influence of such effects as long-range dependence and self-similarity.

Such a complicated non-linear method as neural networks is gaining more and more acceptance in the analysis of dynamic behaviour of IP-networks. However, the solution of the task of traffic forecasting is not trivial. It is important to keep in mind that a slowly decaying variance, long-range dependence and self-similarity of the traffic of IP-networks have a prominent influence only in the case of measurements in a very small scale – over the aggregation period varying from milliseconds to approximately 15 minutes. From the point of view of time series forecasting such a fine scale does not make a sense. Therefore, according to the ITU Recommendation E.492 the measurements of network traffic should be averaged over 15- minutes and/or one-hour intervals. In this case we can often speak about the possibility of applying the traditional methods of time series forecasting.

The main aim of the research is to produce the short-term forecasts of traffic loads by means of the mechanism of neural networks (a multilayer perceptron) and traditional linear models such as ARIMA models and exponential smoothing. In most cases the comparison of short-term forecasts produced by neural networks and linear models for different forecasting horizons did not reveal any statistically significant differences.

Therefore, in contradiction to popular belief, the use of such complicated and time-consuming methods as neural networks is not always appropriate. This issue requires further research with the aim of specifying the conditions under which the mechanism of neural networks has to be applied to forecasting the traffic of telecommunications networks.