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Method for the Prediction of Some Time Series Using Small Sets of Experimental Samples

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Abstract

The paper cares with the tactic of prediction of your time series supported the concepts of system identification. The distinctive property of the tactic is that the use of small sets of experimental samples of knowledge . The latter create some basis for building so-called learning subsets, which are wont to construct particular prediction models. Values of variables predicted by different particular models allow calculating the specified variables by employing a batch voting technique. the tactic are often used for short-term prediction of knowledge values at future time instants supported the analysis of a quick history of the method into account . It are often useful in cases of processing very large arrays of knowledge samples, when the researcher has got to confirm his (her) attention to only alittle a part of the samples received at the last instants of your time , in sight of the limited memory of the pc or in cases when very slow processes are analyzed. A special place within the paper is given to the instance during which the computational aspects of the proposed method are considered intimately.

Introduction

Time series may be a conventional tool for the analysis of processes of various kindssamples of using statistic are of great variety. They're utilized in the estimation of the daily closing value of the Dow Jones Industrial Average, in math statistics, signal processing, pattern recognition, mathematical finance, meteorology, engineering control, and largely in any domain of engineering and engineering which involves investigations of time-varying parameters that describe states of the analyzed object. Typically, the researcher receives data sets within the sort of the sequence of samples of parameters describing states of the analyzed objects, (call them experimental samples), on the idea of which math models are built reflecting parameter relationships.

The developed models are applied to the answer of varied problems of your time series analysis. Among the mentioned problems, the prediction of parameter values within the future instants of your time using the history of changes of the parameter values obtained from the experimental samples at the previous time instants is one among the central problems, the answer of which researchers are engaged for several years. on the mentioned prediction problem, it's obvious that the set of experimental samples should be a fairly complete to span as great range of states of the analyzed object as possible. Unfortunately, in many cases it's an open question whether or not a given set of experimental samples is sufficient to satisfy this requirement. it's intuitively agreed that if we solve the matter of your time series prediction using statistical methods, the amount of experimental samples should be a minimum of several tens or more to determine certain regularities of parameter changes On occasion, the researcher deals with the prediction problem having alittle number of experimental samples (say, 7–10 or a touch more). for instance, such a situation may happen at the analysis of slow processes, or when the sampling of your time series is extremely time- and memory-consuming.

Examples from various spheres of act confirm the sensible relevance of the matter studied during this paper. In we will find an example of the matter which deals with the prediction of the amount of bacteria of varied types within the Rybinsk reservoir in Russia. Fourteen variables were chosen for the studies, which, consistent with experts, were most strongly correlated with the number of bacteria within the reservoir, and among them were: the amount of cyanobacteria, the concentration of zooplankton, the biomass of diamond algae, the density of sapphire bacteria, and a few others. For collecting experimental data, researchers took a period of ten years. this is often an example of a slow process, which is characteristic of ecological systems. Despite the very fact that the quantity of knowledge within the samples was relatively small, the amount of samples was limited because the studied processes were too stretched in time.

The study of demographic processes are often viewed as another typical example of a task during which observations could also be limited to a comparatively small interval, since it allows us to make predictive models that take under consideration new trends in population migration and changes in several regions of the planet . consistent with the United Nations , the changes within the population of the world and population of various countries occurs unevenly over the years. for instance, a rise within the population of the world per billion people occurred from 1959 to 1974, from 1974 to 1987, and from 1987 to 1999. However, in each of those periods, the dynamics of population changes in several countries was completely different. Therefore, if we attempt to construct models of population changes, supported the info for the amount , say, from 1959 to 1974, then for a few countries such models are going to be completely useless for predicting population changes in current years. Obviously, to get plausible forecasts, it's necessary to believe data from the foremost recent years.

In any case, once we affect severely limited sets of experimental data, there's no possibility to collect reach statistics of changes in parameter values. Therefore, under these conditions, it's difficult to expect that the created math models can give good prediction accuracy within the long-term perspective. Taking in mind the above considerations, at the guts of the proposed method, which is named the Local Extrapolation Method (LEM), we put ideas almost like those utilized in the idea of system identification and adaptive learning. the tactic is devoted to the prediction of your time series parameters within the short-term perspective using small sets of experimental samples.

To gain a far better understanding of the precise features of the tactic, brief review should be made from some existing approaches. one among them is moving averagebecause it is named which encompasses family of methods which form function.

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