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INFORMATION SYSTEM FOR OPERATIONAL ANALYSIS OF TIME SERIES

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This work is devoted to modern information technology of operational analysis of time series. The main purpose of data operational analysis is replenishment, data blurring, smoothing and forecasting of time series, obtaining conclusions about periodicity, cyclicity, character of the behavior of the observed process. Also attention is paid to the task of separating noise or observational errors from real data.

The developed information technology is based on the unique combination of several methods of smoothing and forecasting, both classical and completely new, not yet included in known statistical packages, but promising methods.

One of the tasks of operational analysis is the processing of time series, which includes trend analysis, research of various components of the series, eliminating noise (smoothing), restoration of missing data, normalization. At present, humanity is increasingly paying attention to the subtasks of operational analysis - prediction. To process and forecast your data, you need to complete the following steps:

1. Implement data smoothing methods (median smoothing, the method of moving average, smoothing with the help of Chebyshev's polynomials, smoothing of the B-spline and Doveches wavelets).

2. Perform a comparative analysis of these methods regarding the effectiveness and complexity of programming in a specific language of implementation. Implement a decisive rule for choosing the best anti-aliasing methods in automatic mode.

3. Realize the possibility of smoothing and replenishing incomplete and irregular data with the help of the 4th order polynomial gistplasin. Provide the possibility of storing data of an anthropogenic nature. Suggest a technique for data blurring.

4. Compare the first component as a trend line with linear and parabolic polynomial trends.

We note that in the time series we mean the set {f (i), i = 1, N of values, in general, an arbitrary function of one variable f (t), t> 0, at equidistant points i (i = 1, ..., N). In this case, the variable t does not necessarily make sense of the time. Many natural sciences have an idea about the possibility of describing natural processes using functions that consist of several terms:

$$f(t) = f(t) + fn(t) + fr(t) + e(t),\ t \in [0,T],$$

f (t) is a slow irregular component, often referred to as a tendency, often trying to describe it with algebraic polynomials of low order;

fn (t) - periodic or sum of periodic components; depending on the application area, they are called seasonal, day-time, etc. variations;

fr (t) - fast irregular small variations, which usually include everything that does not fit into the formal model, sometimes including random noises;

e (t) is a purely random component, described by a random process of a certain type.

In many individual (separate) cases, up to the present time, powerful theories have been created with a developed device of applications and computer realizations in the form of libraries and program packages. So, for functions of the form f (t) = f (t) + e (t), such a theory is the theory of approximation (for small e (t)) or the method of least squares of mathematical statistics (for large e (t)), for functions of the form f (t) = fn (t) Fourier's theory of harmonic series works well.

However, in many situations there are quite large difficulties of effective research functions. As an example is the case f (t) = f (t) + fn (t), where, in the absence of priority information about the frequencies of components of the periodic constituent, neither the theory of approximation nor the Fourier's

series theory works. In various specific applications, many heuristic techniques are invented, but generally they are poorly theoretically substantiated (grounded). Fig.1 shows the interface of the information system.

Fig.1. Forecasting and smoothing errors

The information system developed can be very useful for the analysis of data as technogenic nature, as well as any sphere of human life. Also, research results can be used to analyze time series of any nature, without limitation of number of observations and their regularity. That is, the circle of using technology is not limited, and therefore, the work has a great practical interest.

In the partial case, the results of the research may be important for the analysis of the monitoring data of the environment and for prediction of environmental disasters, to replenish the important data of technogenic nature, to identify the periodicity and trend of the observed process for the analysis of any sphere of human activity, for prediction of important indicators of social and budgetary spheres.

In this way, using this kind of information technology combining classical and non-classical methods of smoothing and forecasting provides an opportunity to make a deep analysis of the observed process and necessary conclusions. The most complete operational analysis of time series can be done with the help of information technology developed on the basis of software.

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