СЕКЦІЯ 13. ЗАСТОСУВАННЯ КОМП'ЮТЕРНИХ ТЕХНОЛОГІЙ ДЛЯ ВИРІШЕННЯ НАУКОВИХ І СОЦІАЛЬНИХ ПРОБЛЕМ У МЕДИЦИНІ

ON POSSIBILITY OF APPLICATION OF THE CELLULAR AUTOMATA METHOD WHEN CONSTRUCTING THE FUZZY MODELS FOR FORECASTING TIME SERIES

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Analysis of the time series, characterizing the incidence rate of certain skin infections in Ukraine over the past 60 years, using Fractal Analysis methods shows weak correspondence to the models constructed by known statistical methods. Adequate forecasting of the characteristics of the studied dynamic process, in this case, is possible only as a short-term one. The reason for the revealed discrepancy, according to the authors, is the hidden quasi-periodicity of the studied series.

Earlier, during the R/S-analysis, the authors determined the chaotic nature of this time series. One of the features of the system's chaotic behavior is the instability of the trajectories belonging to the attractor. The Lyapunov characteristic exponent is the quantitative measure of this instability. In accordance with the comparing method of the evolution points of the phase trajectory, the authors evaluated the maximal Lyapunov exponent $\lambda_p(x_1)$ for the trajectory $x_i = x(t_i), i = \overline{1,n}$ of the discrete time series $x_{t+1} = f(x_t)$ using the formula $\lambda_p(x_1) = \lim\limits_{n\to\infty} \frac{1}{n} \sum\limits_{i=1}^{n} \ln\left| f'(x_i) \right|$. It is corresponding to the definition of the $\lambda_p(x_1)$ value on condition that this limit exists. The computing showed that for the studied time series the value of $\lambda_p(x_1) \approx 1{,}18$, i.e. $\lambda_p(x) > 0$. This fact gave reason to believe that the trajectory of the time series of the analyzed dynamical system is chaotic.

In addition, in the course of the analysis of the H- and R/S- trajectories constructed for the studied time series, intervals with long-term memory were found. Therefore, the series has a long-term memory, not constant throughout the entire observation period T. However a numerical evaluation of the memory depth at intervals $T_i \left(i = \overline{1,s} \right)$ of the observation period is possible. Such an estimate was presented in the form of the fuzzy set $\{g, \mu(g)\}$, where g is a numerical evaluation of the memory depth, $\mu(g)$ is a corresponding value of the membership function.

Thus, the chaotic character of the investigated time series and the fuzzy model for the numerical evaluation of the memory depth of the studied process, constructed when analyzing the time series characteristics, make it possible to turn to use the Cellular Automata method to improve the quality of forecasts. It is assumed that this will provide an opportunity to move from short-term forecasts to medium-term ones.