THE USE OF THERAPEUTIC FEEDBACK IN THE INFORMATION-ANALYTICAL SYSTEMS OF MANAGEMENT OF THE PATIENT

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***Abstract*:** *the article discusses the use of the characteristics of biomedical signals characterizing the condition of the patient, obtained by spectral analysis. The structure of information-analytical system of support of acceptance diagnostic solutions, characterized by the use of therapeutic feedback and a control tuple that takes into account the risk of making therapeutic decisions. The proposed scope of application: clinical medicine and improvement of qualification of medical workers.*

Keywords: information-analytical systems of decision support, therapeutic feedback, a patient's condition, monitoring and control.

Currently, the examination and treatment of patients increasingly intelligent decision support system for diagnostic (DSSD) forming recommendations about the need for clinical examination and / or implementation of therapeutic effects through the application of direct and inverse decision rules [1, 2, 3].

In the treatment of various diseases the doctor always have to make the decision to conduct a certain therapeutic effect. From the point of view of control theory, the process according to [4] is a chain of duplicate tuples $TE_{t,\tau} = \{S_t, D_t(S_t, S^*_{t+\tau}, \tau), Risk(S_t \to S^*_{t+\tau})\}$ (where S_t is the state of the object at time *t*, $D_t(S_t, S^*_{t+\tau}, \tau)$ - the therapeutic effects of translating from state S_t to state $S^*_{t+\tau}$ for the time τ, $Risk(S_t \to S^*_{t+\tau})$ - value of risk of the object to transition from state S_t to state $S^*_{t+\tau}$). After application $D_t(S_t, S^*_{t+\tau}, \tau)$, the state of the object is identified as $S^*_{t+\tau}$. With proper therapeutic effect S_t $S^*_{t+\tau}$ are within permissible range of differences determined by the doctor depending on the nature of the disease, its occurrence and / or other characteristics of the object. Note, that the therapeutic effect $D_t(S_t, S^*_{t+\tau}, \tau)$ may be "waiting" (therapeutic inaction), for the purpose of tracking the natural object to transition from one state to another according to the concept of autonomous control [4].

Given the research status, problems and practices of medical-diagnostic process, the proposed information-analytical system of state management of the patient in the treatment process with the use of therapeutic feedback. presented in figure 1.

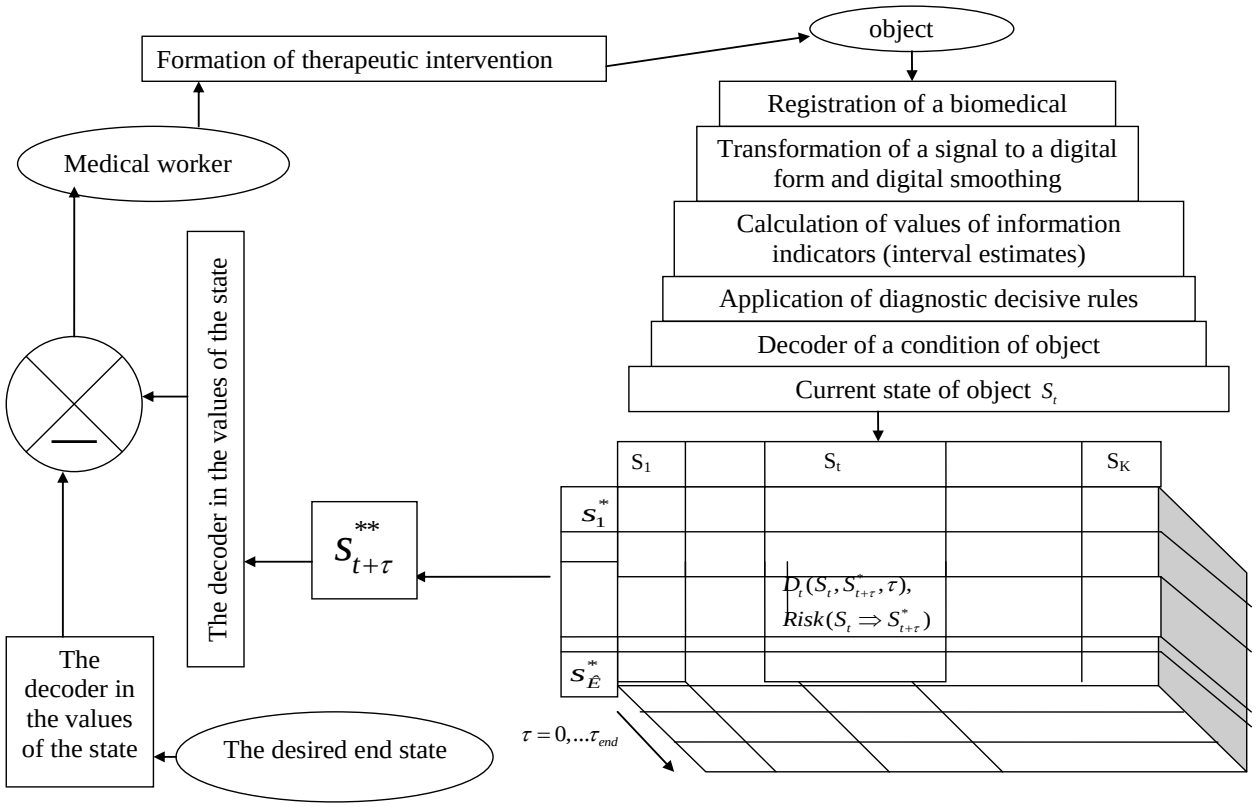

Fig. 1 - analytical control system of the patient using therapeutic feedback.

Method of implementation of therapeutic feedback with the use of DSSD is as follows. The task of translating the patient's condition from the current to the desired use by successive tuples $TE_{t,\tau}$. Status determined by the system of registration and processing of biomedical signals (ECG, EEG, etc.). At the training stage DSSD defined decision rules with an acceptable accuracy of determining the condition of the patient (in units «Decoder of a condition of object» and «Current state of object S_t»). Next, use a tuple $TE_{t,\tau}$ and, after comparing the newly emerged using a time τ state $S^*_{t+\tau}$, and the desired end state, a medical worker formed a certain therapeutic effect (in the module «Formation of therapeutic intervention»), to be applied to the patient.

The comparison is performed by identifying and analyzing differences in the interval estimates of indicators corresponding to certain States of the patient in «The decoder in the values of the state». Thus, the feedback mechanism of the therapeutic context enables the following: sustainable approach to the final state or uncontrollable the process of distancing from the adverse final state or the stagnation of a certain state (between the start and end).

As informative parameters characterizing the state of the organism at the current time it is proposed to use the characteristics of different biomedical signals:

- direct: frequency, power, real and imaginary parts of the expansions of biomedical signal identified using Fourier transform and algorithms of GMDH;

- latent: first the lows and highs at low frequencies, the global maxima across the entire spectrum, close to local highs lows (on adjacent frequencies), the functional dependence between the real and the imaginary parts of the spectra in the frequency ranges defined for the signal Fourier transform: *[fmin, fmax]* and *[fmax, 2fmax+ fmin],* where *fmin, fmax* -, respectively, the frequency of the first minimum at low frequencies and full range.

In real clinical conditions of a patient's care using the above mentioned system is recommended as a control or predictive element. Since, in this case, at the stage of learning DSSD knowledge engineer provides intensive and practical importance systematization States, therapeutic interventions and their relationship (in the form of decision rules), the proposed system may find application in educational process of raising the qualification level of medical personnel.

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