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**«METROLOGICAL SUPPORT OF INNOVATIVE TECHNOLOGIES»
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**«THE USE OF LOGICAL-LINGUISTIC APPARATUS TO DESCRIBE
THE FUNCTIONING OF MEDICAL SYSTEMS»**

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Problem statement

- Expert systems (ES) are increasingly included in the daily life of society. They became widespread in medicine.
- In the ES use fuzzy logic and logical-linguistic modeling.
- The advantage of logical-linguistic models is their universality.
- The use of a fuzzy logic apparatus for recognizing cough sound signals is considered.
- The use of a fuzzy logic apparatus to support decision making in the diagnosis of eye diseases is considered.

- A general description and a typical structure of a logical-linguistic model are given. The formal system \mathbf{S}_f of a logical-linguistic model, like any other formal system, is defined by a four, $\mathbf{S}_f = \langle \mathbf{T}, \Phi, \mathbf{A}, \Theta \rangle$, where \mathbf{T} are the terms (alphabet) of the formal system, that is, the set of basic (not further disjoint) elements used in this system for the construction of formulas; Φ is the syntax of the formal system, that is, the rules for constructing the correct formulas in a given system; \mathbf{A} - axioms, that is, correctly constructed formulas that reflect statements and statements that are considered a priori true in this system; Θ - the rules for deriving new formulas, which, with the initially given system of axioms, generate all possible correct formulas in \mathbf{S}_f .
- Based on a general description, a methodology is proposed for using fuzzy logic to classify sound signals using coughing as an example. The description of cough phases is given. Evaluation criteria are defined. A base of inference rules has been developed.
- A modification of the general model based on fuzzy logic for the diagnosis of eye diseases is considered. Used statistics related to the field of eye diseases. A fuzzy variable is formalized by the set $(\mathbf{T}, \mathbf{S}, \mathbf{P})$, where \mathbf{T} - age-related diseases, \mathbf{S} - primary symptoms, \mathbf{P} - possible causes of the underlying disease, in this case, eye disease is considered.

Conclusions

- The percentage of recognition of cough in a long record of the patient is 92.5%.
- A mathematical apparatus based on fuzzy logic and a direct chain of reasoning is developed. Using fuzzy logic, a decision support model was synthesized to diagnose the disease belonging to the class of eye diseases.

- The formal system of the logical-linguistic model is described. Expert systems based on fuzzy logic allow optimal combination of various approaches to their solution. The results were tested as part of the defense of the Ph.D. thesis (December, 2002).
- The problem of recognizing sound signals by coughing patients has been solved. A description of the fuzzy and linguistic variables. As linguistic variables for fuzzy logic, mathematical criteria are analyzed and selected. Aggregation of criteria was carried out according to the fuzzy conclusion of Mamdani. Models, algorithms, and software solutions were tested in a medical institution, PhD thesis defended (October, 2019)
- The diagnosis of eye diseases has been solved. The diagnosis is based on the operations of logical conjunction and disjunction. Knowledge base models in the form of fuzzy rules have been developed. For the interaction between input and output parameters and the implementation of decision support, a fuzzy knowledge base is used. Testing was carried out as part of a presentation at scientific and methodological conferences, a master's thesis was defended (June, 2018)

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