A Procedure for Testing the Adequacy of Information-Logical Models of Radio-Tail Sources and Objects in the Expert Recognition System

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Abstract: **The paper presents the techniques and mathematical apparatus for testing the adequacy of information-logical models of radio-tail sources and objects to real objects under observation.**

Key words: **recognition, radio-tail objects and sources, effectiveness, information-logical model, trustworthiness, adequacy, squared χ criterion.**

INTRODUCTION

The recognition effectiveness of radio-tail sources and objects (RTO) in the expert recognition systems (ERS), functioning under conditions of the complicated dynamic medium, the parametric uncertainty, incompleteness and indistinctness of th information can be essentially increased by creation of trustworthy and adequate information-logical models (ILM) of RTO under observation.

MAIN PART

ILMs, created on basis of the formally logical approach, are formed by experts at the stage of designing ERS. ILMs are an a priori described scenario for functioning of each recognizable RTO. Some vector of signal-trajectory signs of the observable object to be obtained under such an approach and processed will allow defining a type (class) of the object and its current state. [1, 2]

However, along with this, there become actual the problem of establishment of the fact of the ILM trustworthiness and accuracy, that is of the developed models adequacy to real RTO. Besides, extremely important is the possibility of the operative updating of the ILM structure and composition, taking into account changes in the external medium while carrying out tests needed for the statistical data accumulation.

The trustworthiness of developed models is defined by:

- the correspondence of the used ILM to logical or physical processes and phenomena described by this model;
- an accuracy and completeness of the initial data, on whose basis the process of simulation is carried out;
- the limited number of ILM variations (corrections) to be obtained at changes of the external medium in the course of statistical testing.

For the quantitative estimation of a degree of the ILM adequacy to its original (the real object), it is the rule to use the ε-adequacy criterion that means meeting the following condition

$|W_{\iota(X)}-W_{\iota}^{M}(X)| = \varepsilon_{\iota} \le \varepsilon^*$

where $W_i(x)$ and $W_i^M(x)$ are the sum-totals of experimental data (echos) of the object and its model, respectively; i=1,2,...,n is the number of experiments (tests); ε* is the given accuracy.

This testing is usually carried out by the statistical squared χ criterion of goodness of fit. [3]

In order to establish the fact and a degree of adequacy of ILM to a real object, it was proposed to use the probability of meeting the ε-adequacy:

$\gamma = P[|W_{\iota(X)}-W_{\iota}^{M}(X)| \le \varepsilon^*]$.

Under this approach, to be tested is the hypothesis of that the ILM under estimation is adequate to a real object with the given probability of the ε-adequacy (e.g., γ = 0.9). There are considered the design analytical expressions and the developed techniques for testing the adequacy of ILM to a real object, which includes:

– a choice of the criterion of adequacy and assignment of a level of accuracy for the ε^* model;

– assignment of the probability γ of meeting the adequacy condition;

– definition of the number of ILM tests by given values of γ and ε^*;

– the statistical testing of the adequacy condition for each step of recognition and ILM as a whole.

CONCLUSION

In the paper, there are given the mathematical apparatus and a techniques for defining the adequacy of ILM to real RTO, whose practical realization allows creating ILM with a given level of accuracy for each stage of recognition in complicated multi-level ERS.

LITERATURE

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