Analysis of modern computer diagnostic and measurement methods in medicine

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Abstract. The article deals with the aspectology of determining the classification of problems in the metrological apparatus of medical support. Attention is paid to the design and synthesis of the principles of diagnostics and direct measurements in medicine. The functional and semantic component of modern computer diagnostic methods is indicated, their synergistic effect is determined. The importance of promising measurement control methods - expert systems of new generations is substantiated. The author's consideration of the issue of solving specific problems through the methods of artificial intelligence and information technologies in mass spectroscopy is given.

1. Rationale
The ranked definition by the legal field and the functional predetermination in the field of standardization of any industry on the part of state institutions and supranational organizations annihilates the apparatus of technological content from the direct declaration of observance and provision of the principles of innovation, with providing neither encouraging nor recommendatory will.

This modal component is manifested in the field of health care, in particular, in the principles of integration or renovation of existing funds, aimed at the methodological role of partial or complete renewal of medical care. This influence is cross-cutting and dominant. It not only significantly determines the appearance of the technologies being developed, but also demonstrates a stable
connection of a direct type inherent in the cause-and-effect nature of relations between objects and subjects of various relations: problems and solutions, properties and influences, signs and principles.

Indeed, in general terms, the most priority component is identified, preceding the consideration of the principles of designing new, or improving existing systems in the applied sense.

That is, in fact, the issue of finding (determining) commensurate in a functional, fundamental, and interconnected construct is being monitored, which has an elementary, building, architectural base with new technological implementations. Undoubtedly, these questions are primarily characteristic of unlocking the potential of applied disciplines related to innovation as a field of knowledge about some aspects of the general topic under consideration. After all, the object of consideration in its name demonstrates a specified role and meta-goal of the “modern” that is formally exhaustive, not retrospective, but turned into a dynamically changing picture of the world. The combination of "modernity" and "technologies" allows us to reveal the aspectology of identifying problems of the functioning and development of existing specific mechanisms through the semantic-logical analysis of predicative content in the general theory of innovative management and individual mathematical disciplines [1,2].

This is achieved by identifying criteria of an objective nature for the above categories:

- What is a technology, what is the nature of its behavior (predictable, unpredictable, programmable, non-programmable, type (static, dynamic), applied (areal or technological) map.
- What is "modern": distinctive features of development (at a certain point from the acting reality) in the considered subject area.

2. Analysis of the aspectology of determining the classification criteria for the problems of existing diagnostics and measuring practice in medicine

The basis of the considered topic is the context, which is expressed in the form of a set of technologies or methodological bases for metrological support and measurement and diagnostic support of the medical industry. The presented criteria shall be based on identifying the distinctive characteristics of all interrelated contexts that mitigate the role of cross-entropy content: loss functions of the research area system analysis.

The criteria are determined both by a person, as an individual, in the form of direct or indirect use of support or through a declaration of the need for a certain function (for example, in organ transplantation or carrying out operations that are currently not performed in practice), and by a group of people (council, scientific team, population cross-section, econometric indicators of the efficiency of ambulance crews).

The revealed variety of criteria provides direct opportunities for the implementation of the encapsulation of the determination of the classification of problems - that is, groups of various parametric and nonparametric "signs" that impede or hinder the implementation of projects for the development of medical support in the current environment.

The connection between the criterion and the problem, in medical care, is provided by the multifactorial study, and the need for resolution. The problem is either a contradictory situation, which is certainly revealed due to opposite positions in the explanation of any phenomena, objects, processes, or it follows from the criteria requirements.

Typical patterns of the relationship between functional and fundamental requirements in medical hardware and software and hardware:

Approbation of deliberate activity partially or completely does not correspond to the target equipment map or technology map [3,4,5];

Previously developed, theoretically grounded and practically proven solution methods do not give the desired effect or cannot be used;

In practice, through fact-checking, certain patterns and stochastic processes are determined that do not fit into the framework of existing theoretical concepts (for example, the appearance of X-ray in systems operating according to other physical principles). One of the particular theories of systems
analysis in the context of an applied field (medical informatics) comes into logical contradiction with a more general theory or other areas of life within the general principles of evaluating the work of discrete systems.

There is currently no fully coherent classification of problem solving. However, based on the broad definition of problems presented above, there are two categories of problems: stabilization and development. Stabilization problems are those whose solution is aimed at preventing, eliminating or compensating for disturbances that disrupt the current operation of the measuring system.

Development problems are mediated with the affiliated action of already existing systemic solutions and require the implementation of other approaches to the design of information and measurement, diagnostic systems and mechanisms. Problem solving comes down to methods, tools, technologies.

The formation of ranked groups within the framework of finding the relevance in the application of specific technologies in medicine, determining their completeness, integrity, in matters of healthcare practice, in high-tech branches of knowledge, shall be expressed through verification and verification algorithms.

In our opinion, at the first stage, it is necessary to study the chronology of the emergence of the object of analysis (technology) by reducing it to the “hype cycle” curve (direct formalization of penetration, further adaptation and social impact of technologies in the specifications of industry development for a certain period). The last one can be used to describe the assessment of the interest of large companies and hospitals, which causes users to develop new technological solutions. It is believed that this kind of graphs and representations and the accompanying infographic component help professionals to separate the utopianism of the queuing system from reality [6].

A curve has been drawn based on the available graphs of the development of modern information and communication technologies and artificial intelligence over the past twenty-five years. In figure 1 information technologies are represented in green, direct or indirect replications (or the moments of the emergence of certain technologies of such a base in the medical field) are presented in yellow.

![Figure 1. Hype cycle of development.](image-url)
The description defines the circular coverage of the most expressive phenomena associated with computer technology in medicine. Cross-cutting trends provide a basis for analysis of plateaued tools, methods, principles and architectures.

The maturity cycle is built for each “perspective” based on its motivational context. It is considered as the only available primary screening method. Most often, studying the features of the emergence and implementation of life cycle stages it is possible to draw certain classification conclusions - minimizing the risks of choice (even without direct acquaintance with the technology stack) [7,8].

In fact, the graph is equivalent to the basic principles of curve tracing in automatic control theory, due to the fact that the following can be defined:

- the degree of attenuation;
- how much the controlled value deviates from the steady-state value during the regulation process.
- the error of the static plan, which, in turn, shows how much the task and the value established as a result of regulation differ
- regulation time (tp) - the time after which the deviation of the controlled parameter from the steady-state value does not exceed 5%.

3. Features of the design and synthesis of the principles of diagnostics and direct measurements in medicine

Proceeding from the chosen and justified trajectory approach to the analysis of modern means and to highlighting the problems of definitions, it is necessary to highlight the following, principles of structuring the methods of diagnostics and metrological innovations in a medical application [9,10].

First of all, the subject area of the design area shall be taken into account: preferential codification of all input and output values, the highest requirements for the "response" from the automated control, an attribute security system, the need for autonomous operation, the presence of a functional apparatus of protective content both from the external environment (technical parameters of the environment, for example, power supply), and from the side of people.

Secondly, there must be isomorphism in the principles of diagnosis: the abstract model shall be reduced to the result after the fact of work, and not during the action of the diagnostic function, or before it. Health care cannot be equivalent to industry-based expert systems mediated by empirical evidence. The essence of man and his biochemistry does not allow the use of the predicate model of analysis - without direct intervention or the fact of direct diagnosis (identities: measurement, verification, interrogation, dialogue, testing)

Considered analysis by building the general and particular listed properties is based on the analysis of the attainability of cascade models of development and support of the life cycle (expansion, identification of terms).

It is also recommended to use auxiliary reduction methods to reduce the size of the Petri net preserving its properties, and decomposition, dividing the original net into subnets. Methods for analyzing the properties of a network system are also based on the use of graphs (curves) of reachable (covering) markings, solving the equation of states of the network and calculating the linear invariance of positions and transitions in measurement control systems, queuing theory [11].

The functional component of the "maturity" of an optimal technology focused on priority human-machine interaction shall have a network character of the functional criteria of the general group, such as:

- limitedness - the number of marks in any position of the network of a measuring device or diagnostic tool cannot exceed the value of some K;
- safety is a special case of limitedness, K = 1;
- persistence - constancy of resource loading;
reachability - the possibility of a network transition from one given state (characterized by the distribution of labels) to another;
• liveliness - the ability to trigger any transition during the functioning of the modeled object.

The semantic component is determined by a non-strict set of parametric properties of the system that conflict with the solution of specific problems, problems of a patient or a medical institution. The indicated components are necessary for carrying out planimetric actions of optimization content, extraction of the economic effect: definition of factoring. The main additional feature of all sustainable promising technologies shall be a well-thought-out business model of their payback - a guarantee of investments and the presence of signs of the formation of a role-based renewal policy, since this issue is not analyzed by modern means of feasibility studies. It is Petri nets that can reduce modern systems to synergistic interaction, expressing the acceptor and expert component of authenticity control, validity and consideration of the attainability in the medical, and in general, in the technical component of the service sector [12].

But how to apply the current recommendations in the medical cluster for the provision and implementation of technologies on the example of promising technological bases that have not been sufficiently tested to accept the category of “achievable”? Let's consider this using the example of one technology used in physics: the principle of research and identification, which makes it possible to determine the concentration of various components in a specific material or substance due to complex isotopic, molecular analysis [13].

We will talk about mass spectrometric analysis, which underlies several diagnostic methods, indicated in figure 2. The adopted method is indicative. Its application map is extensive, and in general, demonstrative. As a basis, several designated properties are taken, which have a direct confirmed nature. Threshold categories are identified as "sensitive", i.e. they are directly indicated for analyzes and diagnostics of high accuracy (including in medical technologies). The rule of work has been studied and confirmed. There are approximated samples of the results of work in the chemical industry. The cycle itself is shown in principle in figure 2. In fact, they express the role of ant search algorithms in the context of the substance under study. However, the most important assessment criterion (as we noted earlier) is not a modern (promising, potential) technology demonstrates a specific action, but its commensurability with utility with the available means of a similar principle of obtaining ready-made results. The proposed model for the analysis of computer systems requires not only relevance or only commensurability, but a pronounced network model of interaction.

Mass Spectrometry – separates isotopes by mass differences.

Figure 2. Mass spectrometry cycle.
Is mass spectrometry a network model? Yes it is. Figure 2 indicates a specific path of a cybernetic experiment, identified with the processing of information from counterparties. Is the functional model related to the properties of Petri nets applicable? Yes it is due to the fact that it exhibits an ergodic effect due to the physical nature of the measurements. Is there a criterion for describing a solution to the problem? No there is not, since it is not supported by intelligence and expert judgement. The solution is the introduction of an artificial intelligence algorithm with support [8].

4. Findings
Thus, the paper considers the innovative role of the decomposition and denotation policy of determining the importance and necessity of specific technologies within the framework of the features of modern medical support.

What is it for? To confirm the stability of the reaction to the selected system (property from the theory of automated control that determines the completeness of the device being developed). And the determination of the position on the hype curve (in the permitted zone) acts as a factor in the analysis of the confirmation of the technology applicability. A specific degree of utility, as the main argument, is carried out only after the adoption of positive metrics according to the above selection methodology; from the primary ranking (“useful” model and “immature” system), to the definition of network distribution (a sign of the unity of technology and system controllability (also commensurate with the concept of role policy)). Controllability is extremely important, in view of the fact that information technologies can have latent algorithms, thereby threatening the life and health of the patient.

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