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The Algorithm for Selection of Symptom Complex of Ischemic Heart Diseases Based on Flexible Search

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ABSTRACT

In the case of preliminary data processing, particularly, in identifying symbols, the determination and categorization of informative symbols or sets of symbols that classify objects is an important issue. Although, there have been a number of methods and algorithms proposed to solve these problems, many more ones are to be solved in this direction. This is due to the fact that most of the proposed approaches are strongly dependent on the nature of the subject of the study, the number of symbols, the type of values that can take symbols, the size of the training sample, and so forth. In addition, there are certain requirements for the above. Besides these, each method or algorithm depends to a large extent on the correctness of the information selection criterion and choosing the appropriate decisive rule that determines the quality of the selected choice. In this regard, the efficiency and reliability of many methods and algorithms are not stable.
The flexible search-based algorithm proposed below is in some sense universal, since symbols can take different types of values, and the proposed informative criterion for selecting a set of symbols is based on minimizing classification errors. In addition, the probability vector used in character selection prevents objects from irrelevant displacement of their important characters out of the selection.
Using this algorithm, the diagnostic data of patients with stenocardia, acute myocardial infarction and cardiac arrhythmia, which are part of ischemic heart disease, were first processed. In this case, the problem of selecting and classifying disease complexes was studied according to the clinical signs and symptoms of patients. Results of the study are presented.

Keywords: preliminary data processing, criteria for informativeness, character selection, classification error coefficient, flexible random search.

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INTRODUCTION

According to the World Health Organization, 56 percent of all deaths occur due to diseases of the cardiovascular system. In European countries, cardiovascular disease causes 4.3 million (48%) deaths per year.
According to the State Statistics Committee, 62.1% of deaths in the Republic of Uzbekistan in January-June 2019 were caused exactly by diseases of the blood circulatory system [1]. One of the most common diseases of the cardiovascular system is ischemic heart disease (IHD). In addition, IHD is the cause of 40% of deaths from cardiovascular disease [2].
According to experts, "the effectiveness of treatment and the outcome of the disease depends on timely diagnosis, immediate hospitalization, early use of drugs in connection with the state of the cardiovascular system and clinical manifestations of the disease. The patient must stay in bed for at least 24 hours, since a passive state reduces the need for oxygen in the myocardium, prevents the expansion of the damaged area, prevents the development of various complications, accelerates the reparative (scarring) process in the damaged myocardium. On the second day, passive movement in place is allowed. If there are no complications, you can sit on the 3rd day." [3].
It can be seen from the above that with this type of disease, proper diagnosis and rapid decision-making are considered as one of the most important tasks. This demonstrates the need for extensive introduction of advanced math equipment and information and communication technologies in the industry.
In general, in solving many practical problems, it is important to build a model of the research process (mathematical, physical, technological, etc.), as well as to form an initial database of research objects and determine the characteristics that classify objects.
The positive and reliable solution to these issues will be closely related to the quality of training material presented by the specialists in the field. This is due to the fact that all scientific research is carried out on the basis of the properties and characteristics of the selected research objects.
The results of the analysis show that for the most part objects and processes have a complex structure, and the construction of mathematical models representing them is too complex or impossible at all. In such cases, it is necessary to process the provided data, that is, to process it first. For example, let's say we are given a set of objects. If you can select objects from this set that accurately represent the properties of this set, you do not need to examine all these objects. It is these selected objects that make up the educational selection. All information on research selection objects is provided by specialists in this field.

Each object is characterized by a unique set of "symbols," which are quantitative, qualitative and/or functional conditions, representing different properties of the object.
Image recognition theory and practice play an important role in the initial processing of data, which is based on the choice of training at the research site.
To improve the reliability and effectiveness of research, it is important to determine the excellence of training sample. You can give a number of works in this direction, for example, analysis and integration of training sample data [4-8], normalization of training sample objects by parameters [9-14], creation of a reference table based on training sample [15-21], selection of a set of informative symbols that classify objects [22-27], determination of the level of importance of objects of classes, symbols and classes in the space of informative symbols [25-27], classification [28-33].
In general, an analysis of existing scientific developments and advances in primary data processing shows that none of them can be strictly considered as a single preference value. The reason is that the ability to achieve the expected result by applying it directly to practical issues is not sufficient. Since many of them require certain requirements for the subject of the study, the number of its features, allowed characteristic values, the size of the training sample, and so on. In addition, each method or approach will depend on an informative character selection criterion and a decisive rule that determines the quality of the selected selection. Therefore, the effectiveness and reliability of many methods and approaches will not be stable. However, their implementation will also depend on the available technical means. Based on such considerations, it can be said that the choice of a particular method depends on the particular problem and the practical possibilities available.
To solve some of the problems mentioned in the article, the following scientific studies are planned:
- selection of a set of information characteristics that classify the research objects;
- Improve the efficiency and reliability of classification compared to the original situation;
- detection and analysis of misclassified objects;
- Pre-processing of patient diagnostic data (history, physical, laboratory and instrumental examination) provided by specialists in IHD sphere;
- selection of symptomatic complexes of the disease based on clinical signs or symptoms in patients;
- Classification of patients with IHD into "stenocardia", "acute myocardial infarction" and "arrhythmic form" categories.

MATHEMATIC CLASSIFICATION OF THE MATTER

Let's suppose the selection study objects are expressed as follows:

$$X = \bigcup_{p=1}^{r} X_p, X_p \cap X_q = \emptyset, p \neq q, \quad p,q = \overline{1,r},$$
$$X_p = \{x_{pi}: i = \overline{1,m_p}\}, \qquad (1)$$

here x_{pi} – p – class object, r - number of classes in training sample, m_p and p – number of class objects.
Let every x_{pi} object be classified by N number of symbols, i.e. $x_{pi} = (x_{pi}^1, x_{pi}^2, \dots, x_{pi}^N)$. Well then, $\exists\, D\ (\dim(D) = N)$ exist, $\forall x_{pi} \in D$. In this case D expresses space of symbols.

For solving the task of selecting of informative symbols' complex (ISC) of given selection method objects $x_{11}, x_{12}, \dots, x_{1m_1}, x_{21}, x_{22}, \dots, x_{2m_2}, \dots, x_{r1}, x_{r2}, \dots, x_{rm_r}$ the following auxiliary N measured λ vectors' complex is defined:

$$\Lambda = \{\lambda = (\lambda^1, \lambda^2, \dots, \lambda^N): \lambda^j \in \{0,1\}, j = \overline{1,N}\}. \qquad (2)$$

The main task of auxiliary vector λ is the definition of ISC which is important for analyzing and classifying task with the help of $D|_\lambda = \{(\lambda^1 x_{pi}^1, \lambda^2 x_{pi}^2, \dots, \lambda^N x_{pi}^N), (p = \overline{1,r}, i = \overline{1,m_p})\}$. Here, symbols corresponding to components of λ vector indicate that the partitioned portion is in ISC space, and symbols corresponding to components equal to zero are not present in ISC partitioning.

Description 1

The given $\lambda = (\lambda^1, \lambda^2, \dots, \lambda^N)$ vector has the length ℓ, if $\sum_{j=1}^{N} \lambda^j = \ell$.
We will indicate by Λ^ℓ symbol the complex of vectors λ having ℓ length. Then the following will be to the point:

$$\Lambda = \bigcup_{\ell=1}^{N} \Lambda^\ell, \Lambda^\ell \cap \Lambda^\eta = \emptyset, \quad \ell \neq \eta, \quad \ell, \eta = \overline{1,N},$$
$$\Lambda^\ell = \{\lambda: \textstyle\sum_{j=1}^{N} \lambda^j = \ell, \quad \lambda^j \in \{0,1\}, j = \overline{1,N}\}. \qquad (3)$$

Here the number of vectors λ in Λ^ℓ and Λ complexes accordingly will be as follows:

$$|\Lambda^\ell| = C_N^\ell = \frac{N!}{\ell!(N-\ell)!} \qquad (4)$$
$$|\Lambda| = \sum_{\ell=1}^{N} C_N^\ell = 2^N - 1. \qquad (5)$$

Description 2

If $\lambda \in \Lambda^\ell$ is applicable, then λ vector will be named as ℓ informative vector.

Description 3

If $D|_{\Lambda^\ell} = \{(\lambda^1 x_{pi}^1, \lambda^2 x_{pi}^2, \dots, \lambda^N x_{pi}^N), (p = \overline{1,r}, i = \overline{1,m_p}): \lambda \in \Lambda^\ell\}$ is applicable, then $D|_{\Lambda^\ell}$ will be named as space of ℓ informative symbols.
In the case of symbol recognition, it is important how the objects of the educational example behave when they move from one character space to another character space. This feature is manifested in solving the classification problem. When solving a classification problem in a new character space, some objects may lose their classes and move to another class, i.e.

$$\exists x \in X, \lambda \in \Lambda^\ell, \mu \in \Lambda^\eta, \ \ell \neq \eta \quad \text{учун} \quad x|_\lambda \in X_p, x|_\mu \in X_q, p \neq q. \ (6)$$

We will indicate by $\theta(\ell)|_\lambda$ the coefficient of error in classification of ℓ informative in relation to λ vector and by $\varkappa(\ell)|_\lambda$ the number of incorrectly classified objects. The connection between the coefficient of errors in classifying and the number of incorrectly classified objects is defined as follows

$$\theta(\ell)|_\lambda = \frac{\varkappa(\ell)|_\lambda}{M}, \qquad (7)$$

here $M = \sum_{p=1}^{r} m_p$ – is general number of objects in selective method.
Note. If it is important that objects of one class (es) do not move to another class, or conversely, objects of another class

do not fall erroneously into this class (es), then when determining the error rate in the classification, the importance of classes must be taken into account.

Let's imagine, that the degree of importance of not moving erroneously to another class of class object X_p is - α_p and conversely, degree of importance of not moving erroneously of another class object to this class is - β_p . Well then, the number of incorrectly classified objects for the class X_p according to the degree of importance can be defined as follows

$\varkappa(\ell)|_\lambda(X_p) = \alpha_p \cdot t_p^{out}|_\lambda + \beta_p \cdot t_p^{in}|_\lambda$,

here t_p^{out} and t_p^{in} are accordingly the number of joined together and erroneously came out from class X_p.

In this case informative symbols ℓ are defined in space (7) as follows:

$$\theta(\ell)|_\lambda = \frac{\varkappa(\ell)|_\lambda + \alpha_p \cdot t_p^{out}|_\lambda + \beta_p \cdot t_p^{in}|_\lambda - (t_p^{out}|_\lambda + t_p^{in}|_\lambda)}{M}. \qquad (8)$$

Description 4

For the space of informative symbols $D|_{\Lambda^\ell}$ $\lambda \in \Lambda^\ell$ vector is named as optimal, if $\forall \mu \in \Lambda^\ell$ is applicable in $\theta(\ell)|_\lambda \leq \theta(\ell)|_\mu$.

Description 5

If $\theta(\ell) = \min_{\lambda \in \Lambda^\ell} \theta(\ell)|_\lambda$ is, then the coefficient of error rate in classification in the space of informative symbols $D|_{\Lambda^\ell}$ is equal to $\theta(\ell)$.

To calculate $\theta(\ell)$ and $\varkappa(\ell)$ $(\ell = \overline{1,N})$, it is necessary to define the function of proximity (similarity) between objects and which of the previously defined classes the control object belongs to, that is, if we speak the language of defining symbols, then a decisive rule will be necessary. We define the proximity function and the crucial rule for study objects as follows [5].

Let's imagine, that objects (vectors) $\forall x = (x_1, x_2, \ldots, x_N), y = (y_1, y_2, \ldots, y_N) \in D$ and $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_N, \varepsilon$ – positive numbers are given. With the help of $\nabla(x,y)$ we will indicate the number of inequations not satisfying the following rules

$$|x_1 - y_1| \leq \varepsilon_1, |x_2 - y_2| \leq \varepsilon_2, \ldots, |x_N - y_N| \leq \varepsilon_N \qquad (9)$$

Then, the proximity function will be as follows

$$\rho(x,y) = \begin{cases} 1, if\ \nabla(x,y) \leq \varepsilon \\ 0, if\ \nabla(x,y) > \varepsilon. \end{cases} \qquad (10)$$

In general, the proximity function for the given $\lambda \in \Lambda^\ell$ vector is defined as follows

$$\rho(x,y)|_\lambda = \begin{cases} 1, if\ \nabla(x,y)|_\lambda \leq \varepsilon|_\ell \\ 0, if\ \nabla(x,y)|_\lambda > \varepsilon|_\ell \end{cases} \qquad (10')$$

here $\nabla(x,y)|_\lambda$ – the number of nonexecutable inequations corresponding to the vector λ in (9), $\varepsilon|_\ell$ - positive number, space of informative symbols is given according to its size.

$$\Re(x)|_\lambda = \begin{cases} p, if\ \Gamma_p|_\lambda - \Gamma_q|_\lambda \geq \delta, q \neq p, q = \overline{1,r} \\ 0, in\ all\ other\ cases \end{cases} \qquad (11)$$

here $\Gamma_q|_\lambda = \sum_{y \in X_q} \rho(x,y)|_\lambda$, δ – is given before any positive number.

Defined by (11) function $\Re(x)|_\lambda$ being the crucial rule, its value expresses belonging to some class of object x in relation to the vector λ.

As it seen, $\varkappa(\ell)|_\lambda$ value is defined with the help of (11).

Using the above concepts, we can express the main purpose of the research work in the form of a mathematical statement as follows:

Mathematical task

Definition of optimal vector $\lambda \in \Lambda^\ell$ and $\varkappa(\ell)|_\lambda$, satisfying the rule $\theta(\ell) \leq \theta(N)$ for $\ell \ll N$.

Let's enter the vector of probability $p_\nu = (p_\nu^1, p_\nu^2, \ldots, p_\nu^N)$ for selection of symbols of selective method objects, here p_ν^j – is the probability of choosing the symbol j; ν – p_ν is the order of probability vector.

Let's imagine, that in $\lambda \in \Lambda^N$ and $\nu = 1$ for $p_\nu = (p_\nu^1, p_\nu^2, \ldots, p_\nu^N)$ let it be $p_\nu^j = \frac{1}{N}; j = \overline{1,N}$. It's known, that if $\mu \in \Lambda^k$ is, it will be $\lambda - \mu \in \Lambda^{N-k}$.

By the way of defined formulas the values of $\varkappa(N-k)|_{\lambda-\mu}$, $\theta(N-k)|_{\lambda-\mu}$ and $\theta(k)|_\mu$ are calculated.

We will check the following rule for all $\mu \in \Lambda^k$ vectors

$$\theta(N-k)|_{\lambda-\mu} \leq \theta(N)|_\lambda. \qquad (12)$$

Probabilities corresponding to each μ vector, satisfying the rule (12) are divided equally to probabilities of symbols corresponding to vector $\lambda - \mu$, i.e. $p_{\nu+1}(\mu) = p_\nu + \frac{(p_\nu, \mu)}{N-k} * p_\nu|_{\lambda-\mu} - p_\nu|_\mu$. As a result, the probability of some symbols participating in the next choice increases, and the probability of some symbols participating is reduced.

$$p_{\nu+1} = \frac{1}{T}\sum_\mu p_{\nu+1}(\mu), \qquad (13)$$

here T – is the number of μ vectors satisfying the rule (12).

If (14) is realized, then $\exists(!)\eta = (\eta^1, \eta^2, \ldots, \eta^N) \in \Lambda^k$ is for $\eta^j = \begin{cases} 1,\ j \in \{j_{N-k+1}, j_{N-k+2}, \ldots, j_N\} \\ 0, \quad otherwise \end{cases}$.

Let's imagine, that (15) is applicable for components of probability vectors, in that case $\xi = \max_{\mu \in \Lambda^{*k}} \theta(k)|_\mu$ must be found. Here $\Lambda^{*k} = \{\mu \in \Lambda^k | \mu^{j_{k+l+1}} = \mu^{j_{k+l+2}} = \ldots = \mu^{j_N} = 1\}$.

If for probability vector $p_{\nu+1} = (p_{\nu+1}^1, p_{\nu+1}^2, \ldots, p_{\nu+1}^N)$ the rule (14) is applicable, in this case symbols corresponding to vector $\eta \in \Lambda^k$, otherwise to vector $\xi \in \Lambda^k$ are took out from the space of informative symbols.

So, accordingly will be $\Lambda^N \xrightarrow{\eta \in \Lambda^k} \Lambda^{N-k}$ or $\Lambda^N \xrightarrow{\xi \in \Lambda^k} \Lambda^{N-k}$, i.e. it is moved from space of N sized symbols to the size $N-k$.

This process is repeated till the space of informative symbols is equal to the size ℓ. As a result of repetitions, if $k \geq N - \ell$ is observed, then it is taken as $k = N - \ell$.

The result of $\lambda \in \Lambda^\ell$ is defined by way of (11) accordingly to the optimal vector.

When practical tasks are solved, it is reasonable that for k - $k \ll \ell$ rule is applicable, and usually it is recommended to $k = 3 \div 5$.

Here we will provide selection of vectors $\mu \in \Lambda^k$.

It is known, that in complex $\mu \in \Lambda^k$ the number of informative vectors k is equal to $\frac{N!}{k!(N-k)!}$.

The strict sequence of selection of these vectors for performance improvement can be defined as follows.

For μ vectors, conditionally, let's calculate as $\mu_1 = \left\{\underbrace{0,0,\dots,0}_{N-k},\underbrace{1,1,\dots,1}_{k}\right\}$ and $\mu_{\frac{N!}{k!(N-k)!}} = \left\{\underbrace{1,1,\dots,1}_{k}\underbrace{0,0,\dots,0}_{N-k},\right\}$. In this case the sequence of the given vectors can be defined as follows.

For this purpose, in general, having known the vector placed at l – place, it is enough to define the vector at $l+1$ - place. Generally, according to vector components $\mu_l = (\mu_l^1, \mu_l^2, \dots, \mu_l^N)$ staying at l –place, the following situations can take place:

1-situation. Components having value equal to 1 are placed in sequence, i.e. between two voluntary components having value equal to 1, there doesn't exist component equal to 0;

2-situation. Components with 1 or 0 value are voluntary, i.e. they are placed in confusion.

Firstly, at 1-situation we will consider how the following vector looks like.

It is found component equal to 1 beginning from low index by the index of vector components $\mu_l = (\mu_l^1, \mu_l^2, \dots, \mu_l^N)$ and the given component changes place with one next component, i.e. if found component index is j, then it changes place with that at $j-1$. Al the other components with value equal to 1 are moved right to $N-k$, i.e.

$$\mu_l^1 = 0, \dots, \mu_l^j = 0, \mu_l^{j+1} = 1, \mu_l^{j+2} = 1, \dots, \mu_l^{j+k} = 1, \mu_l^{j+k+1} = 0, \dots, \mu_l^N = 0 \Longrightarrow$$
$$\mu_{l+1}^1 = 0, \dots, \mu_{l+1}^{j-1} = 0, \quad \mu_{l+1}^j = 1, \mu_{l+1}^{j+1} = 0, \dots, \mu_{l+1}^{N-k+2} = 0, \mu_{l+1}^{N-k+1} = 1, \dots, \mu_{l+1}^N = 1$$

Now let's look through the situation-2. In this case, as compared to situation-1, we will start the process with the biggest index (N) of components. First of all, the biggest index satisfying the rule $\mu_l^j = 0, \mu_l^{j+1} = 1$ is defined and their places are changed, i.e. beginning from $\mu_l^j = 1, \mu_l^{j+1} = 0$ and $j+2$, all the components with value equal to 1 once more placed beginning with the index N, i.e.,

$$\mu_l^1 = *, \ \dots, \mu_l^j = 0, \mu_l^{j+1} = 1, \ \dots, \mu_l^{j+q} = 1, \mu_l^{j+q+1} = 0, \dots, \mu_l^N = 0 \Longrightarrow$$
$$\mu_{l+1}^1 = *, \dots, \mu_{l+1}^{j-1} = *, \ \mu_{l+1}^j = 1, \mu_{l+1}^{j+1} = 0, \ \dots, \mu_{l+1}^{N-q} = 0, \mu_l^{N-q+1} = 1, \ \dots, \mu_l^N = 1.$$

Suggested method of algorithm

1-step. Preliminaries: X – selection method; X_p ($p = \overline{1,r}$) – classes; r –number of classes; k, ℓ, N.

2-step. For $\lambda \in \Lambda^N$ $\varkappa(N)$ and $\delta = \theta(N)|_\lambda$ are calculated; incorrectly classified objects are fixed.

3-step. $i = k$

4-step. At $\nu = 1$ for $p_\nu = (p_\nu^1, p_\nu^2, \dots, p_\nu^N)$ $p_\nu^j = \frac{1}{N}; j = \overline{1,N}$ values are understood.

5-step. For all $\mu \in \Lambda^i$ vectors $\theta(N-i)|_{\lambda-\mu}$ and $\theta(i)|_\mu$ calculated.

6-step. For all μ vectors: if $\theta(N-i)|_{\lambda-\mu} \le \delta$ is applicable, it is understood as $p_{\nu+1}(\mu) = p_\nu + \frac{(p_\nu,\mu)}{N-i} * p_\nu|_{\lambda-\mu} - p_\nu|_\mu$.

7-step. $p_{\nu+1} = \frac{1}{T}\sum_\mu p_{\nu+1}(\mu)$ is calculated, here T - $p_{\nu+1}(\mu)$ is number of vectors. For $p_\nu = (p_\nu^1, p_\nu^2, \dots, p_\nu^N)$ vector (14) and (15) situations are checked and accordingly $\Lambda^N \xrightarrow{\eta \in \Lambda^i} \Lambda^{N-i}$ or $\Lambda^N \xrightarrow{\xi \in \Lambda^i} \Lambda^{N-i}$ are realized.

8-step. New value is understood as $N = N - i$ and $\lambda = (1,1,\dots,1) \in \Lambda^N$.

9-step. If $i \le N - \ell$, the it is returned to 3-step.

10-step. If $i \ge N - \ell$, then it is taken as $i = N - \ell$ and it is returned to 5-step.

11-step. Issuing parameters: λ optimal vector.

Selection of symptom complexes of ischemic heart disease

Using the proposed algorithm, we consider the selection and classification (diagnosis) of symptomatic disease complexes based on the diagnostic data of patients with IHD, i.e. clinical signs or symptoms (history, physical, laboratory and instrumental examination) in patients. Here, clinical signs or symptoms belong to different types that have quantitative significance and qualitative indicators.

Sample data provided by IHD specialists are shown in Table 1.

Table 1

N/o	Classes	Number of patients (objects)	Number of clinical symptoms	Classification of classes
1	X_1	140	62	stenocardia
2	X_2	120	62	acute myocardial infarction
3	X_3	40	62	arhythmia

As a result of applying the proposed algorithm to the task, the reliability of diagnostics not only decreased, but also the number of symptom complexes increased from 62 to 10. For the case where $\ell = 10$, 7 sets of informative symbols with the same result were identified. The selected symptom complexes are listed in Table 2.

Table 2

N/o	Chosen symptom complexes (ISC)
1.	$x_1, x_7, x_{16}, x_{22}, x_{27}, x_{36}, x_{41}, x_{51}, x_{57}, x_{62}$
2.	$x_1, x_7, x_{22}, x_{27}, x_{36}, x_{41}, x_{44}, x_{51}, x_{57}, x_{62}$
3.	$x_1, x_7, x_{22}, x_{27}, x_{36}, x_{41}, x_{47}, x_{51}, x_{57}, x_{62}$
4.	$x_1, x_7, x_{10}, x_{22}, x_{27}, x_{36}, x_{41}, x_{51}, x_{57}, x_{62}$
5.	$x_1, x_7, x_{22}, x_{27}, x_{34}, x_{36}, x_{41}, x_{51}, x_{57}, x_{62}$
6.	$x_1, x_2, x_7, x_{22}, x_{27}, x_{36}, x_{41}, x_{51}, x_{57}, x_{62}$
7.	$x_7, x_{22}, x_{27}, x_{34}, x_{36}, x_{41}, x_{47}, x_{51}, x_{57}, x_{62}$

CONCLUSION

In this study, the problem of selecting a set of informative symbols, which is one of the main problems of initial data processing, was solved using a flexible random search. For the proposed algorithm, it does not matter what type of values the object symbols take. In this algorithm, the classification error factor and the probability vector of the characteristics of the selected objects were taken as informative criteria for ISC selection, all of which are aimed at reducing the classification error. In addition, the probability vector used in character selection prevents object from irrelevant displacement of their important characters out of the selection.

Preliminary processing of diagnostic data of patients with ischemic heart disease, acute myocardial infarction and arrhythmia using a program developed on the basis of the proposed algorithm, in particular, made it possible to select a complex of disease symptoms and classification based on clinical symptoms in patients.

Based on patient classification results using selected symptom complexes, it was found that reference table objects found their classes for 100%.

The results were positively evaluated by experts in this field.

CONFLICT OF INTEREST

None

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