UDC 681.4

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THEORETICAL FOUNDATIONS OF HARDWARE IMPLEMENTATION OF MULTIPLY NEURAL-LIKE GROWING NETWORKS

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Анотація. *У роботі розглядаються теоретичні основи апаратної реалізації нейроподібних зростаючих мереж. На основі наведених теорем і тверджень визначені базові відносини повних векторів, заданих об'єднанням відносин їх підвекторів. У результаті визначаються операції побудови і функціонування нейроподібних мереж. Показано збільшення відносної швидкості обробки інформації при збільшенні її об'єму.*
Ключові слова: *нейроподібні зростаючі мережі, повний вектор, підвектори, теорія відносин векторів.*

Аннотация. *В работе рассматриваются теоретические основы аппаратной реализации нейроподобных растущих сетей. На основе приведенных теорем и утверждений определены базовые отношения полных векторов, заданных объединением отношений их подвекторов. В результате определяются операции построения и функционирования нейроподобной сети. Показано увеличение относительной скорости обработки информации при увеличении ее объема.*
Ключевые слова: *нейроподобные растущие сети, полный вектор, подвекторы, теория отношений векторов.*

Abstract. *The theoretical foundations of the hardware implementation of neural-like growing networks are regarded in the paper. On the base of the given theorems and statements the most crucial relations of the full vectors given union relations of their sub-vectors are determined. As a consequence, the operations of construction and functioning of the neural-like network are determined.*
The increase of the relative speed of the information processing under the increase of its volume is shown.
Keywords: *neural-like growing networks, the full vector, subvector, vectors theory relation.*

1. Introduction

The development of new intellectual technologies is closely related to the disclosure of the properties of the human cognitive system. Unlike computers, with classic architecture, a person determines the next action in accordance with the internal motivation, the current situation and goals, most of them aimed at the knowledge of the world. Researchers in the field of massively parallel, neurocomputing and artificial intelligence focus their efforts on the search for the best hardware and software solutions. At the same time they have to deal with a number of architectural issues. For example, how to ensure the synchronization of a large number of processors, how to ensure the identification and accumulation of knowledge, what structure should have a memory for establishing links between description the situation, knowledge and methods of solving problems, how to be processed and put into storage structure a new information order that the system can be trained, increasing the level of its intellect. The most radical solution to this problem is to develop a fundamentally new “thinking” architectures of intelligent computers with developed artificial intelligence in which the programming of applications comes down to education and knowledge of the external world into the internal structure of these computers. One of these architectures is an active, associative neural structure – neural-like growing network implemented in hardware.

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2. Multidimensional neural-like growing networks

A. Neural-like growing networks

Neural-like growing networks (n-GN) are formally defined as $\boldsymbol{S} = \left(\boldsymbol{R}, \boldsymbol{A}, \boldsymbol{D}, \boldsymbol{P}, \boldsymbol{M}, \boldsymbol{N}\right)$.

Here $\boldsymbol{R}=\{r_i\}$, $i = \overline{1,n}$, $\boldsymbol{A}=\{a_i\}$, $i = \overline{1,k}$, $\boldsymbol{D}=\{d_i\}$, $i = \overline{1,e}$, $\boldsymbol{P}=\{P_i\}$, $i = \overline{1,k}$ $\boldsymbol{N} = h$, where P is the excitation threshold of node a; $P = f(m) > P^\circ$ (P° is the minimum allowed excitation threshold) given that the set of arcs $\boldsymbol{D}$ entering the node a_i, is assigned the set of weights $\boldsymbol{M}=\{m_i\}$, $i = \overline{1,w}$, where m_i, may take both positive and negative values [1–6].

Neural-like growing networks are a dynamic structure that changes depending on the value and the time the information gets to the receptors, as well as on the previous state of the network. The information about the objects is presented as the ensembles of excited nodes and the connections between them. Memorization of objects and situations descriptions is accompanied by the addition of new nodes and arcs to m_i the network when a group of receptors and neural-like elements enter into a state of excitement.

B. Basic Operations of building n-GN

In the complex structures of multiply neuro-like GN interconnection between network elements are most conveniently expressed in terms of relations. Consideration of any information network is not merely a numeration elements entering into its composition, but also the determination of possible kinds connections and interactions between them. For this purpose, a formalized apparatus of the theory relationship is usually applied. To describe the linkages between the two elements (x, y), $x \in \boldsymbol{X}$, $y \in \boldsymbol{Y}$, applies the concept of binary relations $\boldsymbol{R}(x,y)$, which is represented as a set of ordered pairs (x, y) of elements $x \in \boldsymbol{X}$, $y \in \boldsymbol{Y}$, defined on the set $\boldsymbol{R}$ [7, 8].

In theory, multiply neural-like growing networks are considered binary relations, which are given a set of vertices or neural elements $\left\{\vec{a}_1, \vec{a}_2, ..., \vec{a}_n\right\}$, where $\vec{a}_i$. Boolean vector of finite dimension, $\left\{\vec{a}_i, \vec{a}_k\right\}$, a plurality of pairs of these elements. A pair $\vec{a}_i, \vec{a}_k$ in the subset, $\boldsymbol{R}$ only when the vector $\vec{a}_i$ is in relation to $\boldsymbol{R}$ with the element $\vec{a}_k$.

Consider the basic properties of pairs of vectors, based on the conjunction operation applied by the components of the vectors, i.e. $\vec{a}_i \times \vec{a}_k = \left(a_{(1)} \wedge b_{(1)}, a_{(2)} \wedge b_{(2)}, ..., a_{(n)} \wedge b_{(n)}\right)$, here $\times$ – operation “vector” conjunction, ^ – a conjunction.

The basic properties of conjunctive pairs of vectors, such as the following:

1. $\vec{a} \times \vec{c} = \vec{a}$, 2. $\vec{a} \times \vec{c} \neq \vec{a}$, 3. $\vec{a} \times \vec{c} = \vec{c}$,
4. $\vec{a} \times \vec{c} \neq \vec{c}$, 5. $\vec{a} \times \vec{c} = 0$, 6. $\vec{a} \times \vec{c} \neq 0$.

Combinations of the basic properties of pairs of vectors give eight mutually exclusive relationships:

$$\vec{a}\ \boldsymbol{R1}\,\vec{c} \equiv (\vec{a} \times \vec{c} = \vec{a}) \cap (\vec{a} \times \vec{c} = \vec{c}) \cap (\vec{a} \times \vec{c} \neq 0);$$
$$\vec{a}\ \boldsymbol{R2}\,\vec{c} \equiv (\vec{a} \times \vec{c} \neq \vec{a}) \cap (\vec{a} \times \vec{c} \neq \vec{c}) \cap (\vec{a} \times \vec{c} = 0);$$
$$\vec{a}\ \boldsymbol{R3}\,\vec{c} \equiv (\vec{a} \times \vec{c} \neq \vec{a}) \cap (\vec{a} \times \vec{c} \neq \vec{c}) \cap (\vec{a} \times \vec{c} \neq 0);$$
$$\vec{a}\ \boldsymbol{R4}\,\vec{c} \equiv (\vec{a} \times \vec{c} \neq \vec{a}) \cap (\vec{a} \times \vec{c} = \vec{c}) \cap (\vec{a} \times \vec{c} \neq 0);$$

$$\vec{a}\,\boldsymbol{R5}\,\vec{c} \equiv (\vec{a}\times\vec{c} = \vec{a}) \cap (\vec{a}\times\vec{c} \neq \vec{c}) \cap (\vec{a}\times\vec{c} \neq 0);$$
$$\vec{a}\,\boldsymbol{R6}\,\vec{c} \equiv (\vec{a}\times\vec{c} = \vec{a}) \cap (\vec{a}\times\vec{c} \neq \vec{c}) \cap (\vec{a}\times\vec{c} = 0);$$
$$\vec{a}\,\boldsymbol{R7}\,\vec{c} \equiv (\vec{a}\times\vec{c} \neq \vec{a}) \cap (\vec{a}\times\vec{c} = \vec{c}) \cap (\vec{a}\times\vec{c} = 0);$$
$$\vec{a}\,\boldsymbol{R8}\,\vec{c} \equiv (\vec{a}\times\vec{c} = \vec{a}) \cap (\vec{a}\times\vec{c} = \vec{c}) \cap (\vec{a}\times\vec{c} = 0);$$
here $\cap$ – logical AND.

Obviously, the relationship ***R6***, ***R7***, ***R8*** is trivial, because in each of them, one or both vectors are zero. Based on the analysis of the basic properties of vector pairs formulate the following statements:

Statement 1. On the set of pairs of vectors $\vec{a}, \vec{a}' \in \boldsymbol{A}$, you can define five major, mutually exclusive relationship ***R1***, ***R2***, ***R3***, ***R4***, ***R5***.

$$\vec{a}\,R1\,\vec{a}' \equiv \forall \vec{a}_i, \vec{a}_{i+1} \in A: (\vec{a}_i \times \vec{a}_{i+1} = \vec{a}_i) \cap (\vec{a}_i \times \vec{a}_{i+1} = \vec{a}_{i+1}) \cap (\vec{a}_i \times \vec{a}_{i+1} \neq 0);$$

$$\vec{a}\,R2\,\vec{a}' \equiv \forall \vec{a}_i, \vec{a}_{i+1} \in A: (\vec{a}_i \times \vec{a}_{i+1} \neq \vec{a}_i) \cap (\vec{a}_i \times \vec{a}_{i+1} \neq \vec{a}_{i+1}) \cap (\vec{a}_i \times \vec{a}_{i+1} = 0);$$

$$\vec{a}\,R3\,\vec{a}' \equiv \forall \vec{a}_i, \vec{a}_{i+1} \in A: (\vec{a}_i \times \vec{a}_{i+1} \neq \vec{a}_i) \cap (\vec{a}_i \times \vec{a}_{i+1} \neq \vec{a}_{i+1}) \cap (\vec{a}_i \times \vec{a}_{i+1} \neq 0);$$

$$\vec{a}\,R4\,\vec{a}' \equiv \forall \vec{a}_i, \vec{a}_{i+1} \in A: (\vec{a}_i \times \vec{a}_{i+1} \neq \vec{a}_i) \cap (\vec{a}_i \times \vec{a}_{i+1} = \vec{a}_{i+1}) \cap (\vec{a}_i \times \vec{a}_{i+1} \neq 0);$$

$$\vec{a}\,R5\,\vec{a}' \equiv \forall \vec{a}_i, \vec{a}_{i+1} \in A: (\vec{a}_i \times \vec{a}_{i+1} = \vec{a}_i) \cap (\vec{a}_i \times \vec{a}_{i+1} \neq \vec{a}_{i+1}) \cap (\vec{a}_i \times \vec{a}_{i+1} \neq 0).$$

Here $\vec{a}_i \times \vec{a}_{i+1}$ – the conjunction of vectors $\vec{a}_i$ и $\vec{a}_{i+1}$, $\cap$ – logical AND.

Obviously, the relationship ***R6***, ***R7***, ***R8*** is trivial, because in each of them, one or both vectors are zero. On the basis of assertions 1 are determined by the following basic operations for constructing n-GN.

If a pair of vectors $(\vec{a}^1, \vec{a}^k)$ is located in relation to ***R1***, ***R2***, ***R3***, ***R4***, ***R5***, respectively, the operation $\boldsymbol{Qj^1}$, $\boldsymbol{Qj^2}$, $\boldsymbol{Qj^3}$, $\boldsymbol{Qj^4}$, or $\boldsymbol{Qj^5}$, is performed, which consist in the construction of vectors the pair $\left(\vec{a}^1, \vec{a}^k\right)$ on of three vectors $\left(\vec{a}^1, \vec{a}^k, \vec{a}^{k+1}\right)$ and are defined as follows:

$$Q^1(\vec{a}, \vec{a}') = (\vec{a}^1, \vec{a}^k, \vec{a}^{k+1}), \quad \vec{a}^1 := \vec{a}^1, \ \vec{a}^k := 0, \ \vec{a}^{k+1} := 0;$$

$$Q^2(\vec{a}, \vec{a}') = (\vec{a}^1, \vec{a}^k, \vec{a}^{k+1}), \ \vec{a}^1 := \vec{a}^1, \ \vec{a}^k := \vec{a}^k, \ \vec{a}^{k+1} := 0;$$

$$Q^3(\vec{a}, \vec{a}') = (\vec{a}^1, \vec{a}^k, \vec{a}^{k+1}), \ \vec{a}^1 := (\overline{\vec{a}^1 \times \vec{a}^k} \times \vec{a}^1) \cup \vec{c}, \ \vec{a}^k := (\overline{\vec{a}^1 \times \vec{a}^k} \times \vec{a}^k) \cup \vec{c}, \ \vec{a}^{k+1} := \vec{a}^1 \times \vec{a}^k;$$

$$Q^4(\vec{a}, \vec{a}') = (\vec{a}^1, \vec{a}^k, \vec{a}^{k+1}), \ \vec{a}^k := \vec{a}^k, \ \vec{a}^1 := (\overline{\vec{a}^1 \times \vec{a}^k} \times \vec{a}^1) \cup \vec{c}, \ \vec{a}^{k+1} := 0;$$

$$Q^5(\vec{a}, \vec{a}') = (\vec{a}^1, \vec{a}^k, \vec{a}^{k+1}), \ \vec{a}^1 := \vec{a}^1, \ \vec{a}^k := (\overline{\vec{a}^1 \times \vec{a}^k} \times \vec{a}^k) \cup \vec{c}, \ \vec{a}^{k+1}_{ri} := 0;$$

here $\cup$ – disjunction vectors, applied to the components of the vectors.

C. The basic attitude of complete vectors consisting of a combination relations sub-vectors

The input vector neural-like growing network of representing a description of the concepts or situations outside world usually has a greater dimension. For example, an image size of 640x480 pixels in the network represented by the vector 307200 bytes in size. Therefore, for the hardware implementation of n-PC input (complete), the vector must be divided into subvector.

Determination 1. Full vector is a vector consisting of subvectors.

If each vector $\vec{a}_i$ of the set $\boldsymbol{A}=\left\{\vec{a}_1,\vec{a}_2,\ldots,\vec{a}_n\right\}$ determined by the aggregate by a subvectors $\vec{a}_i^{\,j}$, i.e., $\vec{a}_i=(\vec{a}_i^{\,1},\vec{a}_i^{\,2},\ldots,\vec{a}_i^{\,j})$, denote: $\boldsymbol{a}$ a plurality of sub-vectors by (full) vectors $\vec{a}_i\in\boldsymbol{A}$; by $\vec{a}_r$ – a subset of subvectors, which are given a binary relation **r**.

Statement 2. On the set of pairs of subvectors $\vec{a}^{\,j},\ \vec{a}^{\,j+1}\in\boldsymbol{a}$ can be identified eight mutually exclusive relationship ***r1, r2, r3, r4, r5, r6, r7, r8.***

$$\vec{a}\ r1\ \vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq 0),$$

here $\vec{a}^{\,j}\times\vec{a}^{\,j+1}$ – the conjunction of vectors $\vec{a}^{\,j+1}$ и $\vec{a}^{\,j+1}$, $\cap$ – logical AND;

$$\vec{a}\,r2\,\vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=0);$$

$$\vec{a}\,r3\,\vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq 0);$$

$$\vec{a}\,r4\,\vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq 0);$$

$$\vec{a}\,r5\,\vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq 0);$$

$$\vec{a}\,r6\,\vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=0);$$

$$\vec{a}\,r7\,\vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}\neq\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=0);$$

$$\vec{a}\,r8\,\vec{c}\equiv\forall\,\vec{a}^{\,j},\vec{a}^{\,j+1}\in A\!:\ (\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=\vec{a}^{\,j+1})\cap(\vec{a}^{\,j}\times\vec{a}^{\,j+1}=0).$$

In this case, all eight relations used, since a full vector will be zero only in the case of the vanishing of all its subvectors.

Formulate statements that define the relationship on the set of vectors of full relations subvector that make them. These statements are obviously follows from the definition of equality (inequality) vectors:

Determination 2. The full vectors are equal if equal all their corresponding subvectors in particular equal to their respective components (bits), i.e.

$$\vec{a}=\vec{b}\ \Leftrightarrow\ \forall_j\!:\ \vec{a}^{\,j}=\vec{b}^{\,j}\ \Leftrightarrow\ \forall_{j,s}:\ \vec{a}^{\,j}_{(s)}=\vec{b}^{\,j}_{(s)}\,.$$

Determination 3. The full vectors are not equal if there is at least one pair of corresponding unequal subvectors, in particular, subvectors not match at least in one a discharge, i.e.

$$\vec{a}\neq\vec{b}\ \Leftrightarrow\exists_g\!:\vec{a}^{\,g}\neq\vec{b}^{\,g}\ \Leftrightarrow\ \exists_{g,k}:\ \vec{a}^{\,g}_{(s)}\neq\vec{b}^{\,g}_{(s)}.$$

Statement 3. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R1*** if and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r1***, i.e.

$$\vec{a}\ R1\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j\ r1\ \vec{b}^j \cdot$$

Statement 4. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R2*** if and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r2***, i.e.

$$\vec{a}\ R2\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j r2\ \vec{b}^j \cdot$$

Statement 5. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R3*** if and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r3***, i.e.

$$\vec{a}\ R3\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j r3\ \vec{b}^j \cdot$$

Statement 6. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R4*** if and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r4***, i.e.

$$\vec{a}\ R4\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j\ r4\ \vec{b}^j \cdot$$

Statement 7. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R5*** *if* and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r5***, i.e.

$$\vec{a}\ R5\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j\ r5\ \vec{b}^j \cdot$$

Statement 8. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R6*** if and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r6***, i.e.

$$\vec{a}\ R6\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j\ r6\ \vec{b}^j \cdot$$

Statement 9. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R7*** if and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r7***, i.e.

$$\vec{a}\ R7\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j\ r7\ \vec{b}^j \cdot$$

Statement 10. In accordance with the definition 2 full vectors $\vec{a}$ and $\vec{b}$ are in relation to ***R8*** if and only if all subvectors $\vec{a}^{\,j}$, $\vec{b}^{\,j}$ are in the relation ***r8***, i.e.

$$\vec{a}\ R8\ \vec{b} \Leftrightarrow \forall_j : \vec{a}^j\ r8\ \vec{b}^j \cdot$$

In the case where the subvectors $\vec{a}^{\,j} \in \alpha$ full vectors $\vec{a}^{\,j} \in A$ represent different combinations of relations ***r1***, ***r2***, ***r3***, ***r4***, ***r5***, ***r6***, ***r7***, ***r8***, the ratio of the full of the vectors $\vec{a}^{\,j} \in A$ is not so obvious and require evidence.

Theorem 1. Let on the set of subvectors *a* vectors $\vec{a}_i \in A$ given binary relation ***R=r1*** $\cup$ ***r2***, and $a_{r1} \neq \varnothing$ and $a_{r2} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R3***, i.e, to

$$\forall \vec{a}, \vec{a}' \in A : \vec{a}\ \ R3\ \ \vec{a}' \cdot$$

Substantiation. Since $a_{r1} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g}, \vec{a}_2^{\,g}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatment ***R1***, where $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} \neq 0$, and since $a_{r2} \neq \varnothing$, then at least one pair of subvectors $\vec{a}_1^{\,k}, \vec{a}_2^{\,k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatment ***R2***, and where $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq \vec{a}_1^{\,k}$, $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq \vec{a}_2^{\,k}$. This means, by the above definition of 3 that $\vec{a}_1 \times \vec{a}_2 \neq \vec{a}_1$, $\vec{a}_1 \times \vec{a}_2 \neq \vec{a}_2$, $\vec{a}_1 \times \vec{a}_2 \neq 0$, i.e. $\vec{a}_1\ R3\ \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$, as required.

Theorem 2. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R=r1*** $\cup$ ***r3***, and $a_{r1} \neq \varnothing$ and $a_{r3} \neq \varnothing$. Then, on the set of vectors **A** is given by a binary relation ***R3***, i.e, to

$$\forall\, \vec{a}, \vec{a}' \in A : \vec{a}\ R3\ \vec{a}'.$$

Substantiation. Since $a_{r1} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g}, \vec{a}_2^{\,g}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatment ***R1***, where $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} \neq 0$, and since $a_{r3} \neq \varnothing$, then at least one pair of subvectors $\vec{a}_1^{\,k}, \vec{a}_2^{\,k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatment ***R3***, and where $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq \vec{a}_1^{\,k}$, $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq \vec{a}_2^{\,k}$, $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq 0$. This means, by the above definition of 3 that $\vec{a}_1 \times \vec{a}_2 \neq \vec{a}_1$, $\vec{a}_1 \times \vec{a}_2 \neq \vec{a}_2$, $\vec{a}_1 \times \vec{a}_2 \neq 0$, i.e. $\vec{a}_1\ R3\ \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$, as required. Similarly possible formulate the following assertion.

Statement 11. The relationship of ***R3*** on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ defined by the union of relationship is ***(r2***$\cup$***r3) or (r4***$\cup$***r3)***, ***or (r5***$\cup$***r3)***, ***or (r6***$\cup$***r3)***, ***or (r7***$\cup$***r3)***, ***or (r8***$\cup$***r3)*** on subvector $\vec{a}^{\,j} \in a$, here conjunctive properties relationship ***r3*** absorb properties relationship ***r2***, ***r4***, ***r5***, ***r6***, ***r7*** and ***r8.***

Also it can be shown that the relationship of ***R3*** on the set of full vectors $\vec{a}_1, \vec{a}_2 \in A$ given association relationship ***(r4***$\cup$ ***r5) or (r4***$\cup$ ***r6)***, ***or (r5***$\cup$ ***r7), or (r2***$\cup$ ***r5)***, ***or (r2***$\cup$ ***r4)*** on the subvector $\vec{a}^{\,j} \in a$.

Theorem 2. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R=r2*** $\cup$ ***r6,*** and $a_{r2} \neq \varnothing$ and $a_{r6} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R2,*** i.e., to

$$\forall\, \vec{a}, \vec{a}' \in A : \vec{a}\ R2\ \vec{a}'.$$

Substantiation. Since $a_{r2} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g}, \vec{a}_2^{\,g}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatment ***R2***, where, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} \neq \vec{a}_1^{\,g}$, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} \neq \vec{a}_2^{\,g}$, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} \neq 0$ and since $a_{r6} \neq \varnothing$, then at least one pair of subvectors $\vec{a}_1^{\,k}, \vec{a}_2^{\,k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatment ***R6***, and where $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} = \vec{a}_1^{\,k}$, $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq \vec{a}_1^{\,k}$ and $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq 0$. This means, by the above definition 3, that $\vec{a}_1 \times \vec{a}_2 \neq \vec{a}_1$, $\vec{a}_1 \times \vec{a}_2 \neq \vec{a}_2$, $\vec{a}_1 \times \vec{a}_2 \neq 0$, i.e. $\vec{a}_1\ R2\ \vec{a}_2$ for $\vec{a}_1, \vec{a}_2 \in A$, as required.

Similarly possible formulate the following assertion.

Statement 12. The relationship of ***R2*** on the set of complete vectors $\vec{a}_1,\ \vec{a}_2 \in A$ defined by the union of relationship is ***(r2∪r7)*** *or* ***(r6∪r7)***, on subvector $\vec{a}_i \in a$.

Theorem 4. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R= r1 ∪r4,*** and $a_{r1} \neq \varnothing$ and $a_{r4} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R4***, i.e.

$$\forall \vec{a}, \vec{a}' \in A : \vec{a}\ R4\ \vec{a}'.$$

Substantiation. Since $a_{r1} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g},\ \vec{a}_2^{\,g}$ of vectors $\vec{a}_1,\ \vec{a}_2 \in A$ fair treatment ***R1***, where, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} = \vec{a}_1^{\,g}$, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} = \vec{a}_2^{\,g}$, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} \neq 0$ and since $a_{r4} \neq \varnothing$, then at least one pair of subvectors $\vec{a}_1^{\,k},\ \vec{a}_2^{\,k}$ of vectors $\vec{a}_1,\ \vec{a}_2 \in A$ fair treatment ***R4***, and where, $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq \vec{a}_1^{\,k}$, $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} = \vec{a}_1^{\,k}$ and $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq 0$.

This means, by the above definition 3, that $\vec{a}_1 \times \vec{a}_2 \neq \vec{a}_1$, $\vec{a}_1 \times \vec{a}_2 = \vec{a}_2$, $\vec{a}_1 \times \vec{a}_2 \neq 0$, i.e. $\vec{a}_1\ R4\ \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$, as required.

Similarly possible formulate the following assertion.

Statement 13. The relationship of ***R4*** on the set of complete vectors $\vec{a}_1,\ \vec{a}_2 \in A$ defined by the union of relationship is ***(r1∪r7)*** or ***(r4∪r7)***, on subvector $\vec{a}^{\,j} \in \boldsymbol{a}$.

Theorem 5. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R=r1 ∪r5***, and $a_{r1} \neq \varnothing$ and $a_{r5} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R5***, i.e. $\forall \vec{a},\ \vec{a}' \in A : \vec{a}\, R5\, \vec{a}'$.

Substantiation. Since $a_{r1} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g},\ \vec{a}_2^{\,g}$ of vectors $\vec{a}_1,\ \vec{a}_2 \in A$ fair treatment ***R1***, where $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} = \vec{a}_1^{\,g}$, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} = \vec{a}_2^{\,g}$, $\vec{a}_1^{\,g} \times \vec{a}_2^{\,g} \neq 0$, and since $a_{r5} \neq \varnothing$, then at least one pair of subvectors $\vec{a}_1^{\,k},\ \vec{a}_2^{\,k}$ of vectors $\vec{a}_1,\ \vec{a}_2 \in A$ fair treatment ***R5,*** and where $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} = \vec{a}_1^{\,k}$, $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq \vec{a}_2^{\,k}$ and $\vec{a}_1^{\,k} \times \vec{a}_2^{\,k} \neq 0$. This means, by the above definition 3, that i.e. $\vec{a}_1\ R5\ \vec{a}_2$ for $\forall \vec{a}_1,\ \vec{a}_2 \in A$, as required.

Similarly possible formulate the following assertion.

Statement 14. The relationship of ***R5*** on the set of complete vectors $\vec{a}_1,\ \vec{a}_2 \in A$ defined by the union of relationship is ***(r1∪r6)*** or ***(r5∪r6)***, on subvector $\vec{a}^{\,j} \in \boldsymbol{a}$.

Theorem 6. Let on the set of subvectors a vectors $\vec{a}_i \in A$ given binary relation ***R=r1 ∪r2∪r3***, and $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$ and $a_{r3} \neq \varnothing$. Then, on the set of vectors A is given by a binary relation R3, i.e. $\forall \vec{a},\ \vec{a}' \in A : \vec{a}\, R3\, \vec{a}'$.

Substantiation. Since $a_{r1} \neq \varnothing$ and $a_{r2} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g}$, $\vec{a}_2^{\,g}$ and $\vec{a}_1^{\,k}$, $\vec{a}_2^{\,k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatments ***r1*** and ***r2***, as well as the relationship ***r'=(r1*** $\cup$***r2)*** in accordance with theorem 1 given the relationship ***r3*** and as $a_{r3} \neq \varnothing$, then at least for one pair of corresponding subvectors $\vec{a}_1^{\,n}$, $\vec{a}_2^{\,n}$ to the fair treatment ***r3,*** and the definition 1 of the ratio of ***r''=(r3***$\cup$ ***r3)*** sets ***r3***, then on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ ratio ***R=r'***$\cup$ ***r''=(r1*** $\cup$***r2)*** $\cup$***r3*** coincides with ***r3,*** i.e. $\vec{a}_1\ R3\ \vec{a}_2$ for $\vec{a}_1, \vec{a}_2 \in A$, as required.

Theorem 7. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R=r1*** $\cup$***r2***$\cup$***r4***, and $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$ and $a_{r4} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R3***, *i.e.* $\forall \vec{a}, \vec{a}^{\,'} \in A : \vec{a}\, R3\, \vec{a}^{\,'}$.

Substantiation. Since $a_{r1} \neq \varnothing$ and $a_{r2} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g}$, $\vec{a}_2^{\,g}$ and $\vec{a}_1^{\,k}$, $\vec{a}_2^{\,k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatments ***r1*** and ***r2,*** as well as the relationship ***r'=(r1*** $\cup$ ***r2)*** in accordance with theorem 1 given the relationship ***r3*** and as $a_{r4} \neq \varnothing$, then at least for one pair of corresponding subvectors $\vec{a}_1^{\,n}$, $\vec{a}_2^{\,n}$ to the fair treatment ***r4,*** and the definition 13 of the ratio of ***r''=(r3***$\cup$ ***r4)*** sets ***r3,*** then on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ ratio ***R=r'***$\cup$***r''=(r1*** $\cup$***r2)*** $\cup$***r4*** coincides with ***r3,*** i.e. $\vec{a}_1\ R3\ \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$**,** as required.

Similarly possible formulate the following assertion.

Statement 17. The relationship of ***R3*** on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ defined by the union of relationship is ***(r1***$\cup$ ***r2***$\cup$ ***r5),*** or **...,** ***(r2***$\cup$ ***r3***$\cup$ ***r4),*** or **...,** ***(r5***$\cup$ ***r6***$\cup$ ***r7)*** on subvector $\vec{a}^{\,j} \in a$**.**

Theorem 8. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R=r1*** $\cup$***r2***$\cup$***r3***$\cup$ ***r4***, and $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$ and $a_{r4} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R3***, i.e. $\forall \vec{a}, \vec{a}^{\,'} \in A : \vec{a}\ R3\ \vec{a}^{\,'}$.

Substantiation. Since $a_{r1} \neq \varnothing$**,** $a_{r2} \neq \varnothing$, and $a_{r3} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{\,g}$, $\vec{a}_2^{\,g}$, $\vec{a}_1^{\,n}$, $\vec{a}_2^{\,n}$ and $\vec{a}_1^{\,k}$, $\vec{a}_2^{\,k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatments ***r1, r2*** and ***r3,*** as well as the relationship ***r'=(r1*** $\cup$***r2***$\cup$***r3)*** in accordance with theorem 5 given the relationship ***r3*** and as $a_{r4} \neq \varnothing$, then at least for one pair of corresponding subvectors $\vec{a}_1^{\,n}$, $\vec{a}_2^{\,n}$ to the fair treatment ***r4,*** and the definition 13 of the ratio of ***r''=(r3***$\cup$***r4)*** sets ***r3,*** then on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ ratio ***R=r'***$\cup$***r''=(r1*** $\cup$***r2***$\cup$***r3) (***$\cup$***r3***$\cup$***r4)*** coincides with ***R3***, i.e. $\vec{a}_1\ R3\ \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$, as required.

Similarly possible formulate the following assertion.

Statement 18. The relationship of ***R3*** on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ defined by the union of relationship is ***(r1∪r2∪r3∪r5),..., (r5∪r6∪r7∪r8)*** on subvector $\vec{a}^{j} \in a$.

Theorem 9. Let on the set of subvectors a vectors $\vec{a}_i \in A$ given binary relation ***R=r1 ∪r2∪r3∪ r4∪r5***, and $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$, $a_{r4} \neq \varnothing$ and $a_{r5} \neq \varnothing$. Then, on the set of vectors A is given by a binary relation R3, i.e. $\forall \vec{a}, \vec{a}' \in A : \vec{a}\, R3\, \vec{a}'$.

Substantiation. Since $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$ and $a_{r4} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{g}$, $\vec{a}_2^{g}$, $\vec{a}_1^{n}$, $\vec{a}_2^{n}$, $\vec{a}_1^{m}$, $\vec{a}_2^{m}$ and $\vec{a}_1^{k}$, $\vec{a}_2^{k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatments ***r1, r2, r3*** and ***r4,*** as well as the relationship ***r'=(r1 ∪r2∪r3∪r4)*** in accordance with theorem 7 given the relationship ***r3*** and as $a_{r5} \neq \varnothing$, then at least for one pair of corresponding subvectors $\vec{a}_1^{n}$, $\vec{a}_2^{n}$ to the fair treatment ***r5***, and the definition 13 of the ratio of ***r''=(r3∪r5)*** sets ***r3***, then on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ ratio ***R=r'∪r''= (r1 ∪r2∪r3)∪(r4∪r5)*** coincides with ***R3***, i.e. $\vec{a}_1\, R3\, \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$, as required.

Similarly possible formulate the following assertion.

Statement 19. The relationship of ***R3*** on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ defined by the union of relationship is ***(r1∪ r2∪ r3∪ r5∪ r6), . . . , (r4∪ r5∪ r6∪ r7∪ r8),*** on subvector $\vec{a}^{j} \in a$ **.**

Theorem 10. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R=r1 ∪r2∪ r3∪r4∪r5∪r6***, and $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$, $a_{r4} \neq \varnothing$, $a_{r5} \neq \varnothing$ and $a_{r6} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R3***, i.e. $\forall \vec{a}, \vec{a}' \in A : \vec{a}\, R3\, \vec{a}'$.

Substantiation. Since $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$, $a_{r4} \neq \varnothing$ and $a_{r5} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}_1^{g}$, $\vec{a}_2^{g}$, $\vec{a}_1^{n}$, $\vec{a}_2^{n}$, $\vec{a}_1^{m}$, $\vec{a}_2^{m}$ $\vec{a}_1^{s}$, $\vec{a}_2^{s}$, and $\vec{a}_1^{k}$, $\vec{a}_2^{k}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatments ***r1***, ***r2***, ***r3***, ***r4*** and ***r5,*** as well as the relationship ***r'=(r1 ∪r2∪r3∪ r4∪r5)*** in accordance with theorem 9 given the relationship ***r3*** and as $a_{r6} \neq \varnothing$, then at least for one pair of corresponding subvectors $\vec{a}_1^{n}$, $\vec{a}_2^{n}$ to the fair treatment ***r6,*** and the definition 13 of the ratio of ***r''=(r3∪r6)*** sets ***r3***, then on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ ratio ***R=r'∪r''= r1 ∪r2∪r3∪r4∪r5 ∪r6*** coincides with ***R3***, i.e. $\vec{a}_1\, R3\, \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$, as required.

Similarly possible formulate the following assertion.

Statement 20. The relationship of ***R3*** on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ defined by the union of relationship is ***(r1∪r2∪r3∪r4∪r5∪r7), ..., (r3 ∪r4∪r5∪r6∪r7∪r8)*** on subvector $\vec{a}^{j} \in a$ **.**

Theorem 11. Let on the set of subvectors ***a*** vectors $\vec{a}_i \in A$ given binary relation ***R=r1 ∪r2∪ r3∪ r4∪ r5∪ r6∪ r7***, and $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$, $a_{r4} \neq \varnothing$, $a_{r5} \neq \varnothing$, $a_{r6} \neq \varnothing$ and

$a_{r7} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R3,*** i.e. $\forall \vec{a}, \vec{a}' \in A : \vec{a}\ R3\ \vec{a}'$.

Substantiation. Since $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$, $a_{r4} \neq \varnothing$, $a_{r5} \neq \varnothing$ and $a_{r6} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}^{g}_{1}$, $\vec{a}^{g}_{2}$, $\vec{a}^{n}_{1}$, $\vec{a}^{n}_{2}$, $\vec{a}^{m}_{1}$, $\vec{a}^{m}_{2}$, $\vec{a}^{s}_{1}$, $\vec{a}^{s}_{2}$ $\vec{a}^{d}_{1}$, $\vec{a}^{d}_{2}$ and $\vec{a}^{k}_{1}$, $\vec{a}^{k}_{2}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatments ***r1****,* ***r2****,* ***r3****,* ***r4****,* ***r5*** and ***r6****,* as well as the relationship ***r'=(r1 ∪ r2∪ r3∪ r4∪ r5∪ r6)*** in accordance with theorem 10 given the relationship r3 and as $a_{r7} \neq \varnothing$,then at least for one pair of corresponding subvectors $\vec{a}^{n}_{1}$, $\vec{a}^{n}_{2}$ to the fair treatment ***r7****,* and the definition 13 of the ratio of ***r''=(r3∪ r7)*** sets ***r3****,* then on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ ratio ***R=r'∪r''=r1 ∪r2∪r3∪r4∪r5 ∪r6 ∪r7*** coincides with ***R3****,* i.e. $\vec{a}_1\ R3\ \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$, as required.

Similarly possible formulate the following assertion.

Statement 21. The relationship of ***R3*** on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ defined by the union of relationship is ***(r1∪r2∪r3∪r4∪r5∪r6∪r8), ... ,(r1∪r2 ∪r3∪r4∪r5∪r7∪r8)*** on subvector $\vec{a}^{j} \in \boldsymbol{a}$.

Theorem 12. Let on the set of subvectors ***a*** vectors $\vec{a}^{j} \in A$ given binary relation ***R=r1 ∪r2∪ r3∪r4∪r5∪r6∪r7,∪r8*** and $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$, $a_{r4} \neq \varnothing$, $a_{r5} \neq \varnothing$, $a_{r6} \neq \varnothing$, $a_{r7} \neq \varnothing$ *and* $a_{r8} \neq \varnothing$. Then, on the set of vectors ***A*** is given by a binary relation ***R3,*** i.e. $\forall \vec{a}, \vec{a}' \in A : \vec{a}\ R3\ \vec{a}'$.

Substantiation. Since $a_{r1} \neq \varnothing$, $a_{r2} \neq \varnothing$, $a_{r3} \neq \varnothing$, $a_{r4} \neq \varnothing$, $a_{r5} \neq \varnothing$, $a_{r6} \neq \varnothing$, and $a_{r7} \neq \varnothing$, then at least one pair of respective subvectors $\vec{a}^{g}_{1}$, $\vec{a}^{g}_{2}$, $\vec{a}^{n}_{1}$, $\vec{a}^{n}_{2}$, $\vec{a}^{m}_{1}$, $\vec{a}^{m}_{2}$, $\vec{a}^{s}_{1}$, $\vec{a}^{s}_{2}$ $\vec{a}^{d}_{1}$, $\vec{a}^{d}_{2}$, $\vec{a}^{z}_{1}$, $\vec{a}^{z}_{2}$ and $\vec{a}^{k}_{1}$, $\vec{a}^{k}_{2}$ of vectors $\vec{a}_1, \vec{a}_2 \in A$ fair treatments ***r1, r2, r3, r4,r5, r6*** and ***r7,*** as well as the relationship ***r'=(r1 ∪r2∪r3∪r4∪r5∪r6∪r7)*** in accordance with theorem 11 given the relationship ***r3*** and as $a_{r8} \neq \varnothing$, then at least for one pair of corresponding sub-vectors $\vec{a}^{n}_{1}$, $\vec{a}^{n}_{2}$ to the fair treatment ***r7,*** and the definition 13 of the ratio of ***r''=(r3∪r7)*** sets ***r3****,* then on the set of complete vectors $\vec{a}_1, \vec{a}_2 \in A$ ratio ***R=r'∪r''=r1 ∪r2∪r3∪r4∪r5 ∪r6 ∪r7∪r8*** coincides with ***R3,*** i.e. $\vec{a}_1\ R3\ \vec{a}_2$ for $\forall \vec{a}_1, \vec{a}_2 \in A$**,** as required.

On the basis of theorems and assertions are defined basic attitude of full vectors, given union relationship subvectors. On fig. 1 shows the basic relationship of full of vectors $\vec{a}^{j} \in A$ by combining relations subvectors ***a.***

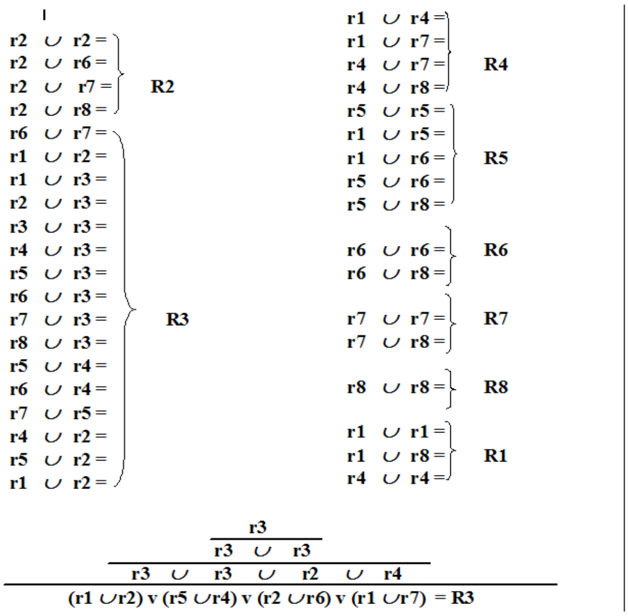

Fig. 1. Basic relationship of full of vectors by combining relations subvectors

C. Matrix representation multiply neural-like growing networks

According to the theory of graphs [7, 8], the conversion performed on the matrix correspond structural change graphs, and in application of the theory of multiply neural-like growing networks of relevant transformation of the structure of these networks.

In the theory of multiply neural-like growing networks with the help of matrices the topological structure of network is represented.

Due to the fact that the multiply neural-like growing networks are dynamic structures, which change (growing) as a result of receipt of new information on the receptor field, the matrix n-PC are also converted in the process of analysis and storage of information.

Line numbers of such matrix, are numbers of neural-like set elements $\boldsymbol{A} = \{a_i\}$, where $i \in \boldsymbol{I} = \{1, 2, 3, ..., k\}$.

Line matrix consists of a combination of the vectors $\boldsymbol{M}$ and $\boldsymbol{N}$, where $\boldsymbol{M}$ – the vector representing description of the object, the signs of which are arranged from left to right in accordance with the numbering of the receptors from the set $\boldsymbol{R} = \{r1, r2, ..., rn\}$, and $\boldsymbol{N}$ – vector which elements are numbered from left to right in the order of numbering of vertices of $\boldsymbol{A}$, i.e.

$$M = \{ n_i / i \in \overline{\overline{1,R}} \},\quad N = \{ k_i / i \in \overline{\overline{1,R}} \},\ \text{here}$$

$$n_i = \begin{cases} 0, \text{ if the sign of the object, corresponding } i \text{ the receptor missing,} \\ 1, \text{ if the sign of the object, corresponding } i \text{ the receptor there is;} \end{cases}$$

$$k_i = \begin{cases} 0, \text{ if the vector } \vec{a}_i \text{ corresponding } j \text{ line of the matrix, has no connection with the new vector,} \\ 1, \text{ if the vector } \vec{a}_i \text{ corresponding } j \text{ line of the matrix, has connection with the new vector.} \end{cases}$$

In order to form a matrix of n-GN it is installed connection coefficients $h_r \geq n_1$. Let the external information coming on receptor field, represented by a $\boldsymbol{Wr} = \{r_i^j\},\ i \in \boldsymbol{Ir},\ j \in \boldsymbol{Jr}$. For all pairs of vectors $\vec{a}, \vec{a}' \in \boldsymbol{Vr}$, where $\boldsymbol{Vr}$ is the set of row vectors of length k receptor area, introduce mutually exclusive relationship $\boldsymbol{Rr\ i}$, for the receptor zone.

$$\vec{a}\, R_r 1\, \vec{a}' \equiv \forall\, \vec{a}_i^{\,j}, \vec{a}_i^{\,j+1} \in A : (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} = \vec{a}_i^{\,j}) \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} = \vec{a}_i^{\,j+1} \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq 0),$$

here $\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1}$ – the conjunction of vectors $\vec{a}_i^{\,j}$ and $\vec{a}_i^{\,j+1}$, ∩ – a logical AND;

$$\vec{a}\, R_r 2\, \vec{a}' \neq \forall\, \vec{a}_i^{\,j}, \vec{a}_i^{\,j+1} \in A : (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq \vec{a}_i^{\,j}) \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq \vec{a}_i^{\,j+1}) \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} = 0);$$

$$\vec{a}\, R_r 3\, \vec{a}' \equiv \forall\, \vec{a}_i^{\,j}, \vec{a}_i^{\,j+1} \in A : (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq \vec{a}_i^{\,j}) \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq \vec{a}_i^{\,j+1}) \cup (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq 0);$$

$$\vec{a}\, R_r 4\, \vec{a}' \equiv \forall\, \vec{a}_i^{\,j}, \vec{a}_i^{\,j+1} \in A : (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq \vec{a}_i^{\,j}) \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} = \vec{a}_i^{\,j+1}) \cup (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq 0);$$

$$\vec{a}\, R_r 5\, \vec{a}' \equiv \forall\, \vec{a}_i^{\,j}, \vec{a}_i^{\,j+1} \in A : (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} = \vec{a}_i^{\,j}) \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq \vec{a}_i^{\,j+1}) \cap (\vec{a}_i^{\,j} \times \vec{a}_i^{\,j+1} \neq 0).$$

A. Let there a set of vectors there is $\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,2}, \vec{a}_{ri}^{\,3}, ..., \vec{a}_{ri}^{\,k}$.

B. Next is checks in which of the relations $\boldsymbol{R_r1}$, $\boldsymbol{R_r2}$, $\boldsymbol{R_r3}$, $\boldsymbol{R_r4}$, $\boldsymbol{R_r5}$ is a pair of vectors $\vec{a}, \vec{a}'$ of a sets of pairs of receptor areas $\left(\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,k}\right), \left(\vec{a}_{ri}^{\,2}, \vec{a}_{ri}^{\,k}\right), \left(\vec{a}_{ri}^{\,3}, \vec{a}_{ri}^{\,k}\right), ..., \left(\vec{a}_{ri}^{\,k\text{-}1}, \vec{a}_{ri}^{\,k}\right)$, where k ranges from 2 to $k + g$, here g - a number of new vectors.

If the couple of vectors $\left(\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,k}\right)$, is in respect of the $\boldsymbol{R_r1}$, $\boldsymbol{R_r2}$, $\boldsymbol{R_r3}$, $\boldsymbol{R_r4}$, $\boldsymbol{R_r5}$, then the operations are performed respectively $\boldsymbol{Q_{rj}^{\,1}}$, $\boldsymbol{Q_{rj}^{\,2}}$, $\boldsymbol{Q_{rj}^{\,3}}$, $\boldsymbol{Q_{rj}^{\,4}}$ or $\boldsymbol{Q_{rj}^{\,5}}$:

$$Q_{r1}^{1}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,k}, \vec{a}_{ri}^{\,k+1}),\ \vec{a}_{ri}^{\,1} := \vec{a}_{ri}^{\,1},\ \vec{a}_{ri}^{\,k} := 0,\ \vec{a}_{ri}^{\,k+1} := 0,\quad m_k^{\vec{a}_i^{\,1}} := b_k,\ m_k^{\vec{a}_i^{\,2}} := b_k,$$
$$P_{\vec{a}_i^{\,1}}^{0} = f(m_k^{\vec{a}_i^{\,1}}),\quad P_{\vec{a}_i^{\,2}}^{0} = f(m_k^{\vec{a}_i^{\,2}});$$

$$Q_{r1}^{2}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,k}, \vec{a}_{ri}^{\,k}),\ \vec{a}_{ri}^{\,1} := \vec{a}_{ri}^{\,1},\ \vec{a}_{ri}^{\,k} := \vec{a}_{ri}^{\,k},\ \vec{a}_{ri}^{\,k+1} := 0,\quad m_k^{\vec{a}_i^{\,1}} := b_k,$$
$$m_k^{\vec{a}_i^{\,2}} := b_k,\quad P_{\vec{a}_i^{\,1}}^{0} = f(m_k^{\vec{a}_i^{\,1}}),\quad P_{\vec{a}_i^{\,2}}^{0} = f(m_k^{\vec{a}_i^{\,2}});$$

$$Q_{r1}^{3}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,k}, \vec{a}_{ri}^{\,k+1}),\quad \vec{a}_{ri}^{\,1} := (\overline{\vec{a}_{ri}^{\,1} \times \vec{a}_{ri}^{\,k}} \times \vec{a}_{ri}^{\,1}) \cup c_{rj},\quad \vec{a}_{ri}^{\,k} := (\overline{\vec{a}_{ri}^{\,1} \times \vec{a}_{ri}^{\,k}} \times \vec{a}_{ri}^{\,k}) \cup c_{rj},$$
$$\vec{a}_{ri}^{\,k+1} := \vec{a}_{ri}^{\,1} \times \vec{a}_{ri}^{\,k},\ m_k^{\vec{a}_i^{\,1}} := b_k,\quad m_k^{\vec{a}_i^{\,k}} := b_k,\quad m_c^{\vec{a}_i^{\,1,k}} := f(P_{\vec{a}_i^{\,k+1}}^{0}),\ P_{\vec{a}_i^{\,k+1}}^{0} = f(m_k^{\vec{a}_i^{\,+1k}}),$$
$$P_{\vec{a}_i^{\,1}}^{0} = f(m_k^{\vec{a}_i^{\,1}}, m_c^{\vec{a}_i^{\,1}}),\quad P_{\vec{a}_i^{\,k}}^{0} = f(m_k^{\vec{a}_i^{\,k}}, m_c^{\vec{a}_i^{\,k}});$$

$$Q_{r1}^{4}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,k}, \vec{a}_{ri}^{\,k+1}),\quad \vec{a}_{ri}^{\,1} := (\overline{\vec{a}_{ri}^{\,1} \times \vec{a}_{ri}^{\,k}} \times \vec{a}_{ri}^{\,1}) \cup c_{rj},\quad \vec{a}_{ri}^{\,k} := \vec{a}_{ri}^{\,k},\quad \vec{a}_{ri}^{\,k+1} := 0,\ m_k^{\vec{a}_i^{\,1}} := b_k,$$
$$m_k^{\vec{a}_i^{\,k}} := b_k,\ m_c^{\vec{a}_i^{\,k}} := f(P_{\vec{a}_i^{\,k}}^{0}),\ P_{\vec{a}_i^{\,k}}^{0} = f(m_k^{\vec{a}_i^{\,k}}),\ P_{\vec{a}_i^{\,1}}^{0} = f(m_k^{\vec{a}_i^{\,1}}, m_c^{\vec{a}_i^{\,1}});$$

$$Q_{r1}^{5}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{\,1}, \vec{a}_{ri}^{\,k}, \vec{a}_{ri}^{\,k+1}),\quad \vec{a}_{ri}^{\,1} := \vec{a}_{ri}^{\,1},\quad \vec{a}_{ri}^{\,k} := (\overline{\vec{a}_{ri}^{\,1} \times \vec{a}_{ri}^{\,k}} \times \vec{a}_{ri}^{\,k}) \cup c_{rj},\ \vec{a}_{ri}^{\,k+1} := 0,\quad m_k^{\vec{a}_i^{\,1}} := b_k,$$
$$m_k^{\vec{a}_i^{\,k}} := b_k,\quad m_c^{\vec{a}_i^{\,k}} := f(P_{\vec{a}_i^{\,1}}^{0}),\ P_{\vec{a}_i^{\,1}}^{0} = f(m_k^{\vec{a}_i^{\,1}}),\quad P_{\vec{a}_i^{\,k}}^{0} = f(m_k^{\vec{a}_i^{\,k}}, m_c^{\vec{a}_i^{\,k}}).$$

Operations Q_{r1}, Q_{r1}^{2}, Q_{r1}^{3}, Q_{r1}^{4} or Q_{r1}^{5} are valid if the $h_r \geq n_1$, otherwise, if $\vec{a}_{ri}^{1} \neq \vec{a}_{ri}^{k}$, then

$$\vec{a}_{ri}^{1} := \vec{a}_{ri}^{1},\ \vec{a}_{ri}^{k} := \vec{a}_{ri}^{k},\ \vec{a}_{ri}^{k+1} := 0,\ m_k^{a_i^1} := b_k^{r_i^1},\ m_k^{a_i^1} := b_k^{r_i^1},\ P_{a_i^1}^{0} = f(m_k^{a_i^1}),\ P_{a_i^1}^{0} = f(m_k^{a_i^1}),$$

if $\vec{a}_{ri}^{1} = \vec{a}_{ri}^{k}$, then $\vec{a}_{ri}^{k} := 0,\ \vec{a}_{ri}^{k+1} := 0,\ m_k^{a_i^1} := b_k,\ P_{a_i^1}^{0} = f\left(m_k^{a_i^1}\right)$.

$$k = \begin{cases} 1, \text{ if the operation was performed } Q_{rj}^{1}, \\ 2, \text{ if the operation was performed } Q_{r1}^{2}, Q_{r1}^{4}, Q_{r1}^{5}, \\ 3, \text{ if the operation was performed } Q_{rj}^{3}. \end{cases}$$

If the couple of vectors $\left(\vec{a}_{ri}^{2}, \vec{a}_{ri}^{k}\right)$, is in respect of the ***R***R_r1, R_r2, R_r3, R_r4, R_r5, then the operations are performed respectively Q_{rj}^{1}, Q_{rj}^{2}, Q_{rj}^{3}, Q_{rj}^{4} or Q_{rj}^{5}:

$$Q_{r2}^{1}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{2}, \vec{a}_{ri}^{k}, \vec{a}_{ri}^{k+1}),\ \vec{a}_{ri}^{2} := \vec{a}_{ri}^{2},\ \vec{a}_{ri}^{k} := 0,\ \vec{a}_{ri}^{k+1} := 0,\ m_k^{\vec{a}_i^1} := b_k,$$
$$m_k^{\vec{a}_i^2} := b_k,\ P_{\vec{a}_i^1}^{0} = f(m_k^{\vec{a}_i^1}),\ P_{\vec{a}_i^2}^{0} = f(m_k^{\vec{a}_i^2});$$

$$Q_{r2}^{2}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{2}, \vec{a}_{ri}^{k}, \vec{a}_{ri}^{k}),\ \vec{a}_{ri}^{2} := \vec{a}_{ri}^{2},\ \vec{a}_{ri}^{k} := \vec{a}_{ri}^{k},\ \vec{a}_{ri}^{k+1} := 0,\ m_k^{\vec{a}_i^1} := b_k,\ m_k^{\vec{a}_i^2} := b_k,$$
$$P_{\vec{a}_i^1}^{0} = f(m_k^{\vec{a}_i^1}),\ P_{\vec{a}_i^2}^{0} = f(m_k^{\vec{a}_i^2});$$

$$Q_{r2}^{3}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{2}, \vec{a}_{ri}^{k}, \vec{a}_{ri}^{k+1}),\ \vec{a}_{ri}^{2} := (\overline{\vec{a}_{ri}^{2} \times \vec{a}_{ri}^{k}} \times \vec{a}_{ri}^{2}) \cup c_{rj},\ \vec{a}_{ri}^{k} := (\overline{\vec{a}_{ri}^{2} \times \vec{a}_{ri}^{k}} \times \vec{a}_{ri}^{k}) \cup c_{rj},\ \vec{a}_{ri}^{k+1} := \vec{a}_{ri}^{2} \times \vec{a}_{ri}^{k},$$
$$m_k^{\vec{a}_i^1} := b_k,\ m_k^{\vec{a}_i^k} := b_k,\ m_c^{\vec{a}_i^k} := f(P_{\vec{a}_i^1}^{0}),\ P_{\vec{a}_i^1}^{0} = f(m_k^{\vec{a}_i^1}),\ P_{\vec{a}_i^k}^{0} = f(m_k^{\vec{a}_i^k}, m_c^{\vec{a}_i^k});$$

$$Q_{r2}^{4}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{2}, \vec{a}_{ri}^{k}, \vec{a}_{ri}^{k+1}),\ \vec{a}_{ri}^{2} := (\overline{\vec{a}_{ri}^{2} \times \vec{a}_{ri}^{k}} \times \vec{a}_{ri}^{2}) \cup c_{rj},\ \vec{a}_{ri}^{k} := \vec{a}_{ri}^{k},\ \vec{a}_{ri}^{k+1} := 0,\ m_k^{\vec{a}_i^1} := b_k,$$
$$m_k^{\vec{a}_i^k} := b_k,\ m_c^{\vec{a}_i^k} := f(P_{\vec{a}_i^k}^{0}),\ P_{\vec{a}_i^k}^{0} = f(m_k^{\vec{a}_i^k}),\ P_{\vec{a}_i^1}^{0} = f(m_k^{\vec{a}_i^1}, m_c^{\vec{a}_i^1});$$

$$Q_{r2}^{5}(\vec{a}, \vec{a}') = (\vec{a}_{ri}^{2}, \vec{a}_{ri}^{k}, \vec{a}_{ri}^{k+1}),\ \vec{a}_{ri}^{2} := \vec{a}_{ri}^{2},\ \vec{a}_{ri}^{k} := (\overline{\vec{a}_{ri}^{2} \times \vec{a}_{ri}^{k}} \times \vec{a}_{ri}^{k}) \cup c_{rj},\ \vec{a}_{ri}^{k+1} := 0,\ m_k^{\vec{a}_i^1} := b_k,\ m_k^{\vec{a}_i^k} := b_k,$$
$$m_c^{\vec{a}_i^{1,k}} := f(P_{\vec{a}_i^{k+1}}^{0}),\ P_{\vec{a}_i^{k+1}}^{0} = f(m_k^{\vec{a}_i^{+1k}}),\ P_{\vec{a}_i^1}^{0} = f(m_k^{\vec{a}_i^1}, m_c^{\vec{a}_i^1}),\ P_{\vec{a}_i^k}^{0} = f(m_k^{\vec{a}_i^k}, m_c^{\vec{a}_i^k}).$$

Here for Q_{r2}^{4}, Q_{r2}^{5}, $\vec{a}_{ri}^{k+1} :\neq 0$, if as a result of perform operations Q_{r1}^{4}, Q_{r1}^{5}, $\vec{a}_{ri}^{k+1} :\neq 0$ and if as a result of perform operations Q_{r1}^{3}, Q_{r1}^{4}, $\vec{a}_{ri}^{k+1} :\neq 0$.

The above operations are performed, if $h_r \geq n_1$, otherwise, if it is $\vec{a}_{ri}^{2} \neq \vec{a}_{ri}^{k}$, then $\vec{a}_{ri}^{2} := \vec{a}_{ri}^{2},\ \vec{a}_{ri}^{k} := \vec{a}_{ri}^{k},\ m_k^{a_i^2} := b_k,\ m_k^{a_i^k} := b_k,\ P_{a_i^1}^{0} = f(m_k^{a_i^1}),\ P_{a_i^2}^{0} = f(m_k^{a_i^2})$ and if $\vec{a}_{ri}^{2} = \vec{a}_{ri}^{k}$, то $\vec{a}_{ri}^{2} := \vec{a}_{ri}^{2},\ \vec{a}_{ri}^{k} := 0,\ m_k^{a_i^2} := b_k,\ P_{a_i^2}^{0} = f(m_k^{a_i^2})\cdot$

Further, if the couple of vectors $\left(\vec{a}_{ri}^{3} = \vec{a}_{ri}^{k}\right)$, is in respect of the R_r1, R_r2, R_r3, R_r4, R_r5, then the operations are performed respectively Q_{rj}^{1}, Q_{rj}^{2}, Q_{rj}^{3}, Q_{rj}^{4} orQ_{rj}^{5}: etc. while a plurality of pairs will not become exhausted $\left(\vec{a}_{ri}^{1}, \vec{a}_{ri}^{k}\right), \left(\vec{a}_{ri}^{2}, \vec{a}_{ri}^{k}\right), \left(\vec{a}_{ri}^{3}, \vec{a}_{ri}^{k}\right), \ldots, \left(\vec{a}_{ri}^{k-1}, \vec{a}_{ri}^{k}\right)$.

Thus, descriptions of concepts, objects, conditions or situations are formed in a matrix that contains information about these concepts, objects, conditions or situations and relationships between them, pointing to interdependence of their submission.

Fig. 2 depicts the determination of the ratio of two full vectors $\vec{a}_1, \vec{a}_2$ consisting of subvectors

$$\vec{a}_1^{\,1},\ \vec{a}_1^{\,2}, \vec{a}_1^{\,3}, \vec{a}_1^{\,4}, \vec{a}_1^{\,5}, \vec{a}_1^{\,6}, \vec{a}_1^{\,7}, \vec{a}_1^{\,8},$$

$$\vec{a}_2^{\,1},\ \vec{a}_2^{\,2}, \vec{a}_2^{\,3}, \vec{a}_2^{\,4}, \vec{a}_2^{\,5}, \vec{a}_2^{\,6}, \vec{a}_2^{\,7}, \vec{a}_2^{\,8}.$$

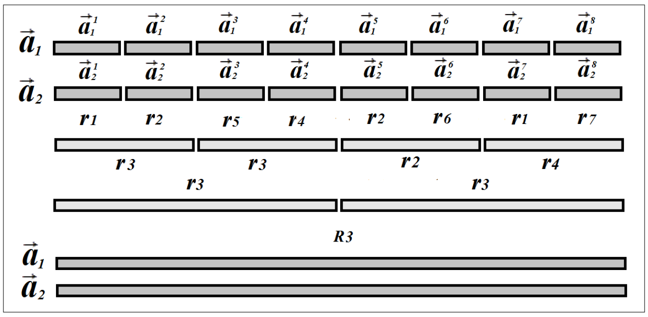

Fig. 2. Defining of vectors relationships $\vec{a}_1, \vec{a}_2$

Binary relationships between pairs of subvectors $\vec{a}_1^{\,j}$, $\vec{a}_2^{\,j}$ are determined simultaneously.

The first pair of subvectors is in relation ***r1.*** The second pair of subvectors is in relation ***r2.*** The third pair of subvectors is in relation ***r5***. The fourth pair of subvectors is in relation ***r4.***

The fifth pair of subvectors is in relation ***r2.*** The sixth pair of subvectors is in relation to ***r6.*** Seventh pair of subvectors is in relation ***r1.*** The eighth pair of subvectors is in relation to ***r7.***

All relationship of subvectors are determined parallel in one time interval. Then, in accordance with the ratio of the base vectors defined by combining their subvectors (Fig. 1) are determined in what respect are the full vectors $\vec{a}_1, \vec{a}_2$.

The first and second pair of subvectors is in the relation ***r3***. The third and fourth pair of subvectors is in the relation ***r3.***The fifth and sixth pair of subvectors is in the relation ***r2.*** The seventh and eighth pair of subvectors is in the relation ***r4***. The fifth and sixth, seventh and eighth pairs of subvectors are in the relation ***r3***. In general, full vectors are in the relation ***R3***. In accordance with a relation of ***R3*** are given operations for converting network.

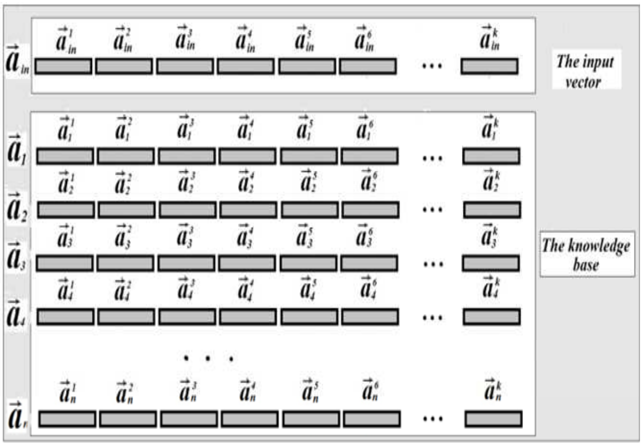

Fig. 3. Here shows the definition of the relationship of the input full vector with the full vectors of the knowledge base

In Fig. 3 shows the definition of the relationship of the input full vector with the full vectors of the knowledge base. The input vector describes the concepts, objects, conditions, situations, or images of the outside world. For example, the input vector describes the image of the human face, and the base knowledge contains descriptions of entities stored earlier. Relationship vectors are determined as described above. As a result, either the input vector is written into the knowledge base (in knowledge base there is no such image) or not written (such image is available in the knowledge base). Wherein the defining relationships of all vectors of the knowledge base with input vector is carried out simultaneously in a single time interval. Thus, with increasing of the knowledge base, execution time of operations remains unchanged. A relative speed of the information processing with increasing the knowledge base increases.

This property of n-GN at a hardware representation in matrix form (Fig. 4) allows increasing the volume of information processed freely (due to the modular structure) without loss of time of its processing (due to the massive parallelism of operations performing).

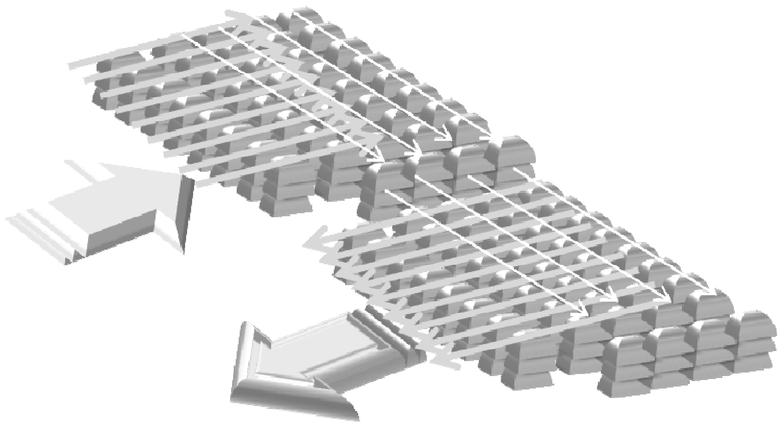

Fig. 4.This is hardware representation in matrix form

3. Conclusion

Matrix representation multiply neural-like growing networks in the form of a matrix allow us to solve the problem of hardware implementation of intelligent systems using these networks as a knowledge base. Due to the fact that n-GN is a dynamic structure that changes (grows) as a result of receipt of new information on the receptor field, their physical implementation is difficult due to the organization of dynamically changing connections between network elements.

In matrix representation, multiply n-GN, input information into the network is the process of redistribution of pointers (links) between existing and emerging elements of the matrix.

As a result of this process the object is included in class to which it belongs, or a new class of objects.

Forming the matrix associative links between descriptions of the objects on their common characteristics is set up automatically. Description of the object or class of objects localizes in certain parts of the network that can effectively perform different operations of associative search.

Minimization of the presentation of information in the matrix n-GN is carried out by compression of the information at every level, as well as due to the fact that the same combination of attributes of multiple objects represented by.

The relative speed of information processing in the n-GN with the increase in its volume increases.

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Стаття надійшла до редакції 26.10.2015