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MODERN DIRECTIONS AND PERSPECTIVES OF USING MEDICAL INFORMATION SYSTEMS

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In this article, the main issues of the use of modern information computer technologies in the processing and statistical analysis of medical and biological data are presented to the students of the medical university in Microsoft Word text editor, Microsoft Excel spreadsheet, materials for performing practical work on medical informatics, environment and database management. system Microsoft Access data, Paint.Net graphic editor, global Internet, material for medical university students to perform practical work on the basics of statistics in the Microsoft Excel spreadsheet environment interns, graduate students, clinical residents, graduate students, students of advanced training courses and practicing doctors data for

Key words: basic definitions, method of perception, form of presentation, data, healthcare system, improving the quality of treatment, information processes in medicine, tasks of medical informatics, data grouping, data filtering.

For the first time computing devices in health care were used in the mid-50s in the United States, this was due to the advent of universal computers. The first medical information system project in the United States was the MEDINET project developed by General Electric. Informatization of domestic health care began with the Institute of Surgery named after A.V.Vishnevsky in the field of automation of diagnostics. The

development of information systems has been associated with changing health needs. Doctors faced the problem of processing information that comes to him through various information channels. This problem can only be solved by organizing information through the use of information technology.

The introduction of information technologies into the daily practice of health care will lead to fundamental changes in the organization of the work of its specialists. Each stage of the development of the health and medical system is associated with the emergence of new integrated fields of knowledge that include common scientific foundations: medical cybernetics, economics, health care, management and marketing, etc. Although the tasks solved by medical informatics 10-15 years ago were related to the scientific field, health care informatization, the introduction of digital medical equipment and devices, and the wide spread of telecommunication technologies have changed from computer systems to the use of computer systems today. brought support clinical processes in all areas. , in particular, to create electronic databases and image processing systems. Currently, medical information systems are used not only by academic staff, but also by practicing doctors. Many experts emphasize the importance of information technology in medical practice: "Providing high-quality medical care to patients is unimaginable without the support of informatics (computer), which plays an important role in providing and storing patient data and medical information in modern medicine. hard to do. knowledge, modeling of biological processes, biosignal processing, statistical analysis of images or clinical trials" [prof. W. Hillen].

As far back as 1960, the New York Times published an article in which a doctor at Tulane University made an interesting point about "medical records stored on film, or in some other computer-friendly way, that can completely supplant the written records of patients." In 1967, another article mentioned the following vision of the future - "every man, woman or child can have all their medical data electronically recorded in a huge memory system in Washington." There were discussions about the advantages of such a system. If, for example, a person has a heart attack, and he is in

another city. The article answers: “The appointed doctor will only need to call Washington, and seconds later, all the data of this patient will be in front of him.” Now, more than half a century later, we see how such systems have become a reality and have become widespread in various medical institutions around the world.

Despite its widespread use, the concept of information remains one of the most controversial concepts in science, and this term can have different meanings in different areas of human activity.

There are many definitions of information, and due to the breadth of this concept, there is no strict and sufficiently universal definition of information.

The following definitions are given in international and local standards:

• knowledge about things, facts, ideas, etc. that people can exchange in a specific context;

• knowledge of facts, events, objects, ideas and concepts that have a specific meaning in a specific context;

• information perceived by a person and (or) special devices as a reflection of the facts of the material or spiritual world in the process of communication.

Information must take some form of representation to exchange information.

Since the middle of the 20th century, the term “information” has become a general scientific concept, including the exchange of information between humans, human and automaton, automaton and automaton; signal exchange in the animal and plant world; transfer of characters from cell to cell, from organism to organism (for example, genetic information).

Information can be divided into types according to various criteria:

• according to the method of perception;

• according to the form of presentation;

• pre-arranged.

The subject of computer science is data: methods of their creation, storage, processing and transmission. Data is information in a formalized form (in digital form),

which allows for its collection, storage and further automation of processing on a computer.

Data - registered data; presenting facts, concepts or instructions in a form suitable for communication, interpretation or processing by human or automatic means.

In the field of informatics and information technologies:

• data is a reusable representation of information in a formalized, structured form suitable for transmission, communication, or processing.

• data - information systems and their users are engaged in the form of presentation of information.

Although information must take some form of representation in order to be exchanged, information is primarily an interpretation (meaning) of such a representation. Therefore, information in the strict sense is different from data, although the two terms are used interchangeably in informal contexts.

Information computer technologies (IT, also - information and communication technologies) - processes, information search, collection, storage, processing, presentation, distribution methods and methods of implementation of such processes and methods; techniques, methods and methods of using computer technologies in the performance of data collection, storage, processing, transfer and use functions; resources needed to collect, process, store and distribute information.

Informatics (French Informatique; English Computer Science) is the science of the methods and processes of collecting, storing, processing, transmitting, analyzing and evaluating information with the help of computer technologies, which allows them to be used in decision-making.

Computer science includes a number of disciplines related to information processing in computers and computer networks.

Medical informatics is a scientific science that studies the processes of receiving, transmitting, processing, storing, distributing, presenting information using computer technologies and information technologies in medicine and healthcare.

The object of study of medical informatics is information technology implemented in health care.

The leading department in the health care system is health care and system elements at the following levels of management and organization:

• state (or regional);

• territorial (province, city, district);

• the level of the medical institution (treatment-prophylactic institution, scientific-research institute, university, medicine and medical equipment supply services, etc.);

• individual / basic (or “doctor-patient” contact level).

Information exchange at each of these levels and between them is carried out in the form of information flow.

Information flows are information transfer processes to ensure the interdependence of all parts of a social system. Information flows in the medical-social environment are prescribed for:

• improvement of the organizational structure of the management of the healthcare system;

• optimization of processes in medicine in order to increase the quality of treatment and control the state of health;

• improvement of the documentation system;

• automating the processes of obtaining, collecting, storing, searching, transmitting and using information.

The subject of study of medical informatics is information processes related to biomedical, clinical and preventive problems.

The main goal of medical informatics is to optimize information processes in medicine through the use of computer technologies that increase the quality of public health care.

Tasks of medical informatics:

• study of information processes in medicine;

• development of new information technologies in medicine;

• solving scientific problems of creating and introducing computer technology in medicine.

To date, six areas of competence in the field of ICT have been defined:

• processing of medical documents and data;

• medical terms and classifications;

• healthcare information systems;

• data protection and protection;

• access to medical knowledge;

• medical signal processing.

In turn, data processing includes many operations, including the following:

- data collection - data collection in order to ensure their completeness for decision-making;

- data formalization - bringing the data from different sources into the same form;

- data filtering - rejection of "extra" information that is not necessary for decision-making;

- data sorting - data sorting according to a certain attribute;

- data grouping - combining data by a certain attribute in order to use them more conveniently;

- data archiving - organization of data storage in a convenient and convenient form, as a rule, in a more economical format;

- data protection - a set of measures aimed at preventing the loss, alteration or duplication of data;

- data transport - receiving and transmitting data between remote participants of the information process;

- data transformation - transferring data from one form (or structure) to another.

Medical informatics is also important because the volume of data is growing rapidly and systematic methods are needed to process and store it.

Modern directions and perspectives of using medical information systems.

Special medical software.

Practical medicine is increasingly automated. Software includes system and application programs. System software includes a network interface that provides access to data on the server. Application software is essentially computer programs.

Complex modern research in medicine cannot be imagined without computer technology. Such studies include computed tomography, tomography using the phenomenon of nuclear magnetic resonance, ultrasound, studies using isotopes. The amount of data obtained during such research is so large that a person without a computer cannot perceive and process it.

Expert systems.

Expert systems (ES, expert system) are computer programs that can perform analyzes based on certain initial data and can replace narrow experts in problem situations. The systems themselves are viewed as models of expert behavior and, like human experts, they use knowledge in their work. For ES, "knowledge" is presented in the form of knowledge bases that can be modified and supplemented.

Self-learning intelligent systems.

Self-learning intelligent systems (SIS) occupy a special place among expert medical systems. They are based on methods of automatic classification of situations from real practice or methods of learning by example. The most striking example of SIS is artificial neural networks.

Medical information systems.

Classification of medical information systems

The information system is the main link of health information. The classification of medical information systems is based on the hierarchical principle and corresponds to the multi-level structure of health care. Difference:

1. Medical information systems of the basic level, their main purpose is to provide the work of doctors of various specialties with computers; they allow to improve the

quality of preventive and laboratory-diagnostic work, especially in the conditions of public service with a shortage of time for qualified specialists.

2. Medical information systems at the level of medical institutions.

3. Medical information systems at the regional level.

4. State-level medical information systems.

Medical devices-computer systems.

An important type of specialized medical information systems are medical instrument computer systems (MPCS).

Typical representatives of MPCS are medical systems for monitoring the condition of patients, for example, during complex operations; computer analysis of tomography data, ultrasound diagnostics, radiography systems; systems for automated analysis of microbiological and virological research data, analysis of human cells and tissues.

Medical information technology includes the means of influencing the organism with external information factors, the description of ways and methods of their application, and the process of teaching practical skills. Accordingly, the further development of these technologies requires consideration and resolution of the following practical issues. First of all, the need for widespread introduction of proven tools and methods of information influence into clinical practice that meet the requirements such as safety and ease of use, high therapeutic efficiency of their use, is an urgent issue. The next urgent issue is to encourage and encourage the development and creation of new means and methods of influencing the human organism that are consistent with the principles and postulates of information medicine. Further development and improvement of this field of medicine is related to the optimization of biofeedback tools and methods under the influence of information corresponding to changes in the body.

Currently, one of the main ways to solve a number of medical, social and economic problems is to inform the work of medical workers. These problems include

the search for effective tools that help improve the three most important indicators of health care: the quality of treatment, the level of patient safety, and the cost-effectiveness of medical care. The main element of informatization is the use of modern clinical information systems equipped with decision support mechanisms in hospitals. However, these systems are not widely used.

Information-analytical system of the republican epidemiological register of patients with hematological diseases, information-analytical system for planning and control of centralized competitive procurement for accounting of medical and pharmaceutical personnel, monitoring and analysis of the level of medical care for the population. Medicines for healthcare organizations of the Republic of Belarus, a technology for full-scale registration of injuries in the Republic of Belarus, a republican information-analytical system for medical examination and rehabilitation of disabled people have been developed.

Classification of modern computers and their characteristics. Basic components of a computer. Medical peripheral devices.

There are various classifications of computers (computers).

Let's consider some of them.

According to the used element base, computers are conditionally divided into generations:

• 1st generation, 50s: computers on electronic vacuum tubes;

• 2nd generation, 60s: computers based on discrete semiconductor devices (transistors);

• 3rd generation, 70s: computers based on semiconductor integrated circuits with a low and medium degree of integration (hundreds - thousands of transistors on a single chip);

• 4th generation, 80s: computers based on large and ultra-large integrated circuits - microprocessors (tens of thousands - millions of transistors on a single chip);

• 5th generation, 90s. - to the present: computers with many dozens of microprocessors operating in parallel, allowing you to build efficient data processing systems.

In recent years, computers of the 6th generation with massive parallelism and neural structure have appeared - with a distributed network of a large number (tens of thousands) of simple microprocessors that model the architecture of neural biological systems.

According to the principle of operation, computers are divided into:

1. Analog - computers of continuous operation, work with information presented in a continuous (analog) form, i.e. in the form of a continuous series of values of any physical quantity: pressure, temperature, etc. (most often in the form of electrical voltage).

2. Digital - computers of discrete action, work with information presented in discrete or digital form.

3. Hybrid - computers of combined action, work with information presented in both digital and analog form; they combine the advantages of analog and digital computers. It is advisable to use them to solve the problems of managing complex high-speed technical complexes.

By appointment, they distinguish:

1. Universal (general purpose) - designed to solve a variety of problems: economic, mathematical, biomedical, information and others. They are widely used in public computing centers and other powerful computing systems.

2. Problem-oriented - serve to solve a narrower range of tasks associated, as a rule, with the management of individual objects; registration, accumulation and processing of relatively small amounts of data; performing calculations using relatively simple algorithms.

3. Specialized - used to solve a narrow range of tasks or to implement a strictly defined group of functions. Such a narrow orientation of computers makes it possible

to clearly specialize their structure, significantly reduce their complexity and cost while maintaining high performance and reliability of their operation.

In terms of size and functionality, there are:

1. Supercomputer. These include powerful multiprocessor computers with a speed of hundreds of millions - tens of billions of operations per second. Supercomputers are used to solve complex and large scientific problems (medicine, meteorology, hydrodynamics, etc.), in management, intelligence, as centralized information storage, etc.

2. Large computers. Large computers abroad are most often called mainframes (Mainframe). Until today, these computers remain the most powerful (not counting supercomputers) general-purpose computing systems that provide continuous round-the-clock operation. Mainframe computers are currently represented by the IBM system z-series Mainframes.

3. Small computers (minicomputers) are reliable, inexpensive and easy-to-use computers with slightly lower capabilities than mainframes. These computers include: in the countries of the former USSR - computers of the NAIRI family (“Nairi 4 ARM/ Nairi 4” and “Nairi 4/1”, etc.), an interactive computer complex (DVK3, DVK4, DVK4M, etc.); in the USA - PDP-11, etc. Currently, they are practically not found.

4. Microcomputer. These are general-purpose microcomputers, user-oriented, and controlled by one person. Also, microcomputers include portable computers, which are usually needed by business leaders, managers, scientists, journalists who have to work outside the office - at home, at presentations or during business trips. This group of computers includes modern personal computers and laptops.

5. Embedded microprocessors. Processors implemented in the form of integrated electronic circuits. Microprocessors can be embedded in telephones, televisions and other devices, machines and devices, medical equipment.

Many varieties of personal computers have been created. The most popular in the CIS countries are computers such as IBM PC (International Business Machines

Personal Computer). Computers of this type are produced by hundreds of manufacturers in the world. In addition, other companies produce PCs. For example, Apple's Macintosh. However, the basic principles of information processing and user interaction are the same for all PCs.

To use your PC effectively, you need to become familiar with its components.

A computer is a complex of interconnected devices, each of which performs certain functions.

The main characteristics of the computer include:

Speed is the number of instructions a computer can execute in one second.

Reliability is the ability of a computer, under certain conditions, to perform the required functions for a given period.

Accuracy is the ability to distinguish between nearly equal values.

The accuracy of obtaining the results of processing is mainly determined by the capacity of the computer, as well as the structural units used to represent information (byte, word, double word).

Reliability is the property of information to be correctly perceived.

PC structure includes: hardware, software, information resources

The minimum configuration is the minimum set of constituent elements, without which it becomes impossible to work with a PC.

A typical PC set includes a system unit, a monitor, a keyboard, a printer, and a mouse.

Currently, PCs are widely used, the set of which is enclosed in one case (monoblocks, laptops, tablet PCs, etc.)

The expansion of the functions performed by the PC is provided by additional devices. For example, a joystick is used to control computer games; the scanner is necessary for reading information from flat media according to the principle of transforming the displayed beam; The modem is for email.

The main component of a computer is the system unit. Devices that are inside the unit are called internal, and devices connected to it from the outside are called external or peripheral.

The main hardware parts of the PC are located in the system unit:

• A power supply that converts mains power into low voltage direct current supplied to the computer's electronic circuits;

• The motherboard, it contains:

- electronic circuits that control the operation of a computer (microprocessor, RAM);

- device controllers and other electronic circuits.

• A hard disk drive designed to read and write to a non-removable hard magnetic disk (hard drive). Other devices.

PC memory is divided into:

• Internal (Read Only Memory - ROM, Random Access Memory - RAM), which is located inside the system unit and is represented by a number of components: RAM (volatile), BIOS (permanent), Cache memory (volatile), CMOS memory (non-volatile) . The internal memory is fast but relatively small. The amount of RAM can be from a few megabytes to 16, 32 or more gigabytes.

Internal memory ROM (ROM - Read Only Memory) is a non-volatile memory designed to store an array of immutable data. Random access memory RAM (RAM - Random Access Memory) is designed to temporarily store programs, data and commands necessary for the processor to perform operations.

• External in the form of hard disk drives, streamers, optical disks. Flash-cards, Usb Flash-drives, etc. External memory has an almost unlimited capacity, but slower than the internal one.

Peripherals are designed to input, output data. Input devices include:

Keyboard - a device for entering alphanumeric information. The appearance of the keyboard and the location of the keys may vary depending on the computer model.

Pointing devices that convert the movements of the user's hand into control information for the computer. Among the manipulators are mice, trackballs, touchpads, joysticks. A computer mouse is a device that is designed to control the cursor and enter various commands to the computer. The cursor is controlled by moving the mouse over the surface of the table or mouse pad. Modern mice have a wireless interface and data is transmitted using infrared rays. There are optical mice in which the functions of the motion sensor are performed by receivers of laser beams reflected from the surface of the table.

The trackball is similar in function to the mouse, but the ball in it is large, and the pointer is moved by rotating this ball with your hands.

The joystick is a base with a movable handle that can tilt in the longitudinal and transverse directions. The handle and base are equipped with buttons.

Touchpad - manipulator for portable computers, built into the PC. It consists of a small touch area and two buttons, with the buttons duplicating the left and right mouse buttons, and the touch area is used to control the mouse pointer.

Monitor (display) is a device for visual presentation of data. Its main consumer characteristics are: screen size, resolution, maximum image refresh rate, protection class. The monitor works under the control of a special hardware device - a video adapter. According to the size of the screen diagonal, monitors are 15-inch, 17-inch, 19-inch, 21-inch, etc. There are monitors based on a cathode ray tube (CRT), liquid crystal (TFT), plasma (PDP), polymer LED (LEP), organic light-emitting diode (OLED) and others. OLED monitors have a number of advantages compared to the most common liquid crystal monitors at the moment: no backlight, 180° viewing angle, low power consumption. Their widespread use is hindered by expensive production processes and, as a result, their high cost.

A printer is an external computer peripheral device designed to output text or graphic information stored in a computer to a hard physical medium, usually paper or polymer film, in small print runs (from units to hundreds) without creating a printed

form. Distinguish: dot-matrix printers, letter, inkjet, laser and others. According to the method of image formation, sequential, lowercase, page images are distinguished. A separate group are plotters (plotters) - devices for printing drawings, graphs, posters and other large graphic images.

In healthcare practice, the interaction between a doctor and a computer is carried out through the use of special peripheral devices. They are quite diverse, have their own functional purpose. The effectiveness of the work of the doctor and the machine depends on the availability of such devices and their level of development. A special group is made up of equipment for obtaining biomedical information. These include: ultrasonic sensors for ultrasound, electrodes used for ECG, ultra-sensitive detectors for x-rays and computed tomography, and others.

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