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Visual Imaging Processes in Medical Imaging

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Abstract: In medicine, the role of medical images in the field of radiology is very important. Accuracy of medical images and high quality of images are very important to the attending physician in making an accurate diagnosis of the patient. Medical image processing, storage, transformation, conversion from analog to digital, and technologies in the field of radiology are described.

Keywords: Medical images, analog form, digital forms, pixels, their main advantages when switching to a matrix form system, clarity and high quality of images.

Introduction: In medicine, doctors mainly use medical images to accurately diagnose and treat patients. Medical imaging is the creation of visual images of the internal structures of the body for clinical analysis and medical intervention, as well as some. Medical imaging allows you to visualize the internal structures hidden by skin and bones, the method and process of visual representation of the functions of organs or tissues, as well as to diagnose diseases. Different images appear in the diagnosis process. They are also called diagnostic images. Methods of obtaining medical images consist of radiation diagnostic methods - X-ray, magnetic resonance, radionuclide and ultrasound. Medical images can be divided into two groups: digital and analog. Analog images are images that contain continuous data. Like all analog images, medical images have their drawbacks. Analogue medical images are much duller than digital ones, and the desire of clairvoyants is greater clarity and clarity of medical images. This is due to the fact that doctors have a high level of error in diagnosis. Analog images include images that contain information of a continuous nature.

These images are presented to the doctor to diagnose diseases. All analog images, including medical images, have flaws. In particular, it is difficult to store them, process them according to diagnostics, and transfer them from computer to computer. In analog form, the images have a lot of unnecessary signals, as well as noise that degrades their quality.

All these disadvantages are not found in digital images. They originate from the signals of diagnostic devices and based on cellular structure (matrix) containing information (in digital form) about body parts. Medical imaging is the creation of visual images of the internal structures of the body for clinical analysis and medical intervention, as well as some. Medical imaging allows you to review the method and process of visual representation of the functions of organs or tissues of the internal structures hidden by the skin and bones, as well as to diagnose diseases. There are several technological devices in the medical imaging industry that are aimed at doctors

Different images appear in the diagnosis process. We will briefly describe the above image processing devices.

Radiography - Medical practice divides two forms of radiography - radiography and fluoroscopy. This 2D technique is still widely used today due to its low cost, high accuracy and low radiation

doses, leading to the development of 3D tomography. This imaging technique uses a wide range of X-rays to create an image and is considered the first imaging technique used in modern medicine. Magnetic resonance imaging - Magnetic resonance of water in human tissues uses powerful magnets to track the hydrogen nuclei (i.e. protons) of the molecules, which produces a spatially encoded, detectable signal, resulting in images of the body. The MRI machine emits a radio frequency (RF) pulse at the resonance frequency of hydrogen atoms in water molecules. Radio frequency antennas send pulses to target areas of the body.

The RCh pulse is driven by protons, as a result of which their orientation changes relative to the main magnetic field. When the RCh pulse is fired, the protons "bounce" and realign with the main magnet, emitting radio waves in the process.

The radio emission of hydrogen atoms in water is detected and reconstructed into an image. The resonant frequency of the rotating magnetic field is called the Larmor frequency and is determined by the chemical environment of the nuclei of the main magnetic field. **Ultrasound -** Ultrasound uses high-frequency sound waves that bounce off tissue in different directions to create an image. It is usually used to image the fetus in pregnant women, but ultrasound is much broader is used. Other important applications include imaging of the abdomen, heart, chest, muscles, tendons, arteries, and veins.

Compared to methods like CT or MRI, ultrasound can provide anatomical details, but it has a number of advantages that make it inferior in most cases, in particular, it can show the movement of the structure in real time, and does not emit ionizing rays (radiation). Ultrasound is also used as a research tool to characterize tissues and introduce new methods of processing tissue images. Ultrasound differs from other medical imaging methods in that it uses high-frequency sound waves sent to tissues, and depending on the composition of different tissues, the signal weakens and returns at different time intervals. Ultrasound scanners can be used for critically ill patients in intensive care units without moving the patient. moving images can be captured in real time and can be used to guide drainage and biopsy procedures. Modern scans show the flow of deposits in arteries and veins. Elastography is a relatively new imaging technique that shows the elastic properties of soft tissues. This method has been around for twenty years. Elastography is useful in medical diagnostics because elasticity can distinguish between healthy and unhealthy tissue for specific organs. For example, cancer often spreads to surrounding tissues

When you look at it, it becomes bigger, and a diseased liver is bigger than a healthy one.

There are several medical techniques based on the use of ultrasound, magnetic resonance imaging and tactile tomography. Ultrasound elastography is a technology with widespread clinical application, and we can expect to see it implemented in clinical ultrasound machines. In recent decades, the continuous growth of elastography activity has shown the successful application of the technology in various fields of medical diagnosis and treatment monitoring.

Tactile imaging is a digital medical imaging technique.

The tactile image is a function of R (x,u,z), where R is the pressure on the soft tissues of the surface when the deformation is applied. The tactile image is similar to hand palpation, because the device with a set of pressure sensors installed on it works like human fingers that slightly deform soft tissues. This procedure is used to visualize the reproductive structures and muscle trigger points of the prostate, breasts, vagina, and pelvis.

Thermography - It is mainly used to image the mammary glands. There are three approaches: telethermography, contact thermography and dynamic angiothermography. These digital thermographic infrared imaging techniques can detect metabolic activity and circulation in precancerous tissues and in the area surrounding breast cancer.

based on the principle that it is always superior to normal breast tissue.

Malignant tumors increasingly require copper nutrients and therefore increase the supply of minerals to the cells of the existing vascular wall, as well as open "dormant" vessels and create new ones (neoangiogenesis theory).

Proponents of telethermography and contact thermography claim that this procedure increases the regional breast surface temperature, but there is little evidence that thermography is an accurate means of detecting breast tumors.

Telethermography is based on the conversion of infrared radiation from the human body into an electrical signal, which is displayed on the thermometer screen. Contact cholesteric thermography relies on the optical properties of cholesteric liquid crystals, which change color to a rainbow of colors when applied to heat-emitting surfaces.

appears with . The coldest places are red, the warmest brown.

In 1860, one of the first researchers of thermal radiation, Gustav Kirchhoff, was able to prove that the ratio of emission and absorption of a body does not depend on its nature, but is the same (universal) function of frequency for all bodies.

Echocardiography - A process where ultrasound is used to image the heart called echocardiography. Echocardiography allows you to see detailed structures of the heart, including the size of the chambers, how the heart works, its valves, and the pericardium (the sac around the heart). Echocardiography creates images of the heart and the flow through each of the four heart valves uses 2D, 3D and Doppler images for visualization. Echocardiography is widely used in a variety of patient populations, from patients experiencing symptoms such as dyspnea or chest pain to those undergoing cancer treatment.

Transthoracic ultrasound is different from other imaging methods in that it is suitable for patients of all ages, from shingles to caries, harmful side effects or radiation has been proven to be safe. Echocardiography is one of the most widely used imaging modalities in the world due to its portability and portability. In emergency situations, echocardiography is quick, easy to swallow, and can be performed at the bedside, which is a challenge for many doctors.

With the help of computer devices, images of body parts are created using complex algorithms from the signals stored in the matrix.

Digital images are characterized by high quality, accuracy and clarity of the image, without any errors in the transmission of signals. Images are easy to store on a variety of magnetic, optical, and magneto-optical digital media, easy to process on a computer, and easy to send over long distances over telecommunication networks, without any change in image quality or appearance. Digital their main advantages when converting images to a matrix-shaped system are the clarity and high quality of the images. At the same time, it is possible to easily store these images on the computer devices where they are to be stored and perform other processes on the images.

In addition to the medical technological devices described above, there is the term Nuclear Medicine Diagnostics, which is designed to study the anatomical and physiological picture of the medical body. Nuclear medicine includes both diagnostic imaging and treatment of diseases and can be called molecular medicine. Nuclear medicine uses certain properties of isotopes and particles emitted from radioactive substances to diagnose and treat various pathologies. This functional approach to medical evaluation is used in many fields such as oncology, neurology, and cardiology. Different from the usual concept of radiology, nuclear medicine allows assessment of physiology. For research, a short-lived isotope, for example, 99m Tc, is injected into the patient. These isotopes are mainly absorbed by biologically active tissues and can be used to detect tumors or bone fractures.

Images collimated photons emit a light signal is obtained from the annealed by the crystal, which in turn becomes data for calculation.

LITERATURE ANALYSIS AND METHODOLOGY

No matter how many generations of medical scanners there are today, the function of all of them is to digitize analog images. Today, the recommendation to doctors is to use technologies that produce images with the highest resolution.

Medical images are divided into three types: vector, raster and matrix. Vector images consist of elementary lines.

Image data has vector properties and we can change it as needed without losing quality. Digital images are created from a series of such dots of different colors. The main difference between a vector and a raster image is that a raster image produces a much closer look to a life-like image than a vector image. A raster image is made up of very small elements called pixels. Raster graphics work with hundreds and thousands of pixels that make up the image.

The advantage of raster graphics: If the pixel size is small, the image will be close to the quality of a photograph. A computer easily handles peripherals that use dots to represent individual pixels. Therefore, raster images are easily printed on printers. Matrix images are instead composed of a large number of cells, which we call pixels. The higher the number of pixels, the higher the image quality. When working with such images, we encounter their compression or stretching (deformation). When their size changes. Such situations are observed in the processes of printing images in the fields of fluorography, tomography and radiology. In rendering processes, we can convert matrix images to vector images. Each element in matrix images has a specific location in memory. In medical diagnostics, the area of display screens is described in matrix form as follows: 64x64, 128x128, 256x256, 512x512, 1024x1024, 2048x2048 and 4096x4096 pixels. The larger the matrices, the better the quality. As the quality increases, the capacity of the memory address also increases. Therefore, a high level of matrix size is selected and the quality indicator is preserved.

DISCUSSION

Various medical images, regardless of how they are imaged, X-ray, ultrasound, radionuclide or magnetic resonance, can be grouped into two main groups: analog and digital. Images are first created in analog quality, and then they are digitized during transmission from the detector to the display.

Analog images:

- ✓ conventional film radiography, including linear tomography;
- ✓ conventional fluoroscopy,
- ✓ sonography (diagnostic medical examination using ultrasound waves to create an image of structures in the body).

This test is often simply called ultrasound or sonography.

Analog-digital images:

- ✓ digital radiography (secondary digitization of radiography), digital
- ✓ fluoroscopy,
- ✓ digital subtraction angiography,
- ✓ sonography,
- ✓ scintigraphy (from internal radionuclides to create two-dimensional images
- ✓ use)

Digital images:

- ✓ primary digital methods of radiography;
- ✓ computer tomography,

- ✓ magnetic resonance imaging,
- ✓ emission tomography (one- and two-photon),
- ✓ doppler mapping.

The appearance of diagnostic images on the monitor can be of two types.

A vector consists of a set of elementary lines and curves described by mathematical formulas in the form of mathematical objects called images.

The latter has a graphic feature and can be changed according to the programs chosen by the doctor without compromising the quality of the image.

CONCLUSION

In this article, we can see that the role of medical images in medicine is very important, in addition to this; it can be seen as an auxiliary guide to doctors in making accurate diagnoses for patients.

The accuracy of the images and the high quality of the images in the diagnosis make the attending physician not to make mistakes. In order to solve this problem, it is important that all medical devices are in modern condition and that all medical specialists have high qualifications, which leads to the absence of errors in the diagnosis of patients. Through the clarity of the image, we can clearly see the location of the injury, for example, we can express the size, diameter, and depth of a tumor located in the patient's brain in a computer tomography scan, and in traumatology, the quality, accuracy and clarity of the images when diagnosing a patient with a fractured shoulder and shoulder in traumatology do not mislead the doctor. We consider it the right decision to choose the right treatment method. In conclusion, we emphasize that if any of our medical images are clear, crisp and of good quality, our doctors will have no difficulty in diagnosing patients.

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