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The aim of the study. In order to improve the quality of CT images, different image processing tools may be used. We would like to demonstrate the feasibility of the use of MATLAB for that and the technique.

Material and methods. Digital filters are used to blur or sharpen digital images. It concerns the MATLAB software as well. Filtering can be performed by convolution with specifically designed kernels (filter array) in the spatial domain.

Results. Use of the Laplacian operator and appropriate kernels for image processing is well known approach. Sometimes, it may be desirable to smooth the image first by a convolution with a Gaussian kernel since a Laplace operator is very sensitive to noise it may detect edges (margins) along with undesired visual noise (isolated, out-of-range).

The Laplace operator is a second-order differential operator. It is the sum of the second derivatives along each of the axes of the image. If the image matrix, is I, then the Laplace operator D_L is given by the following expression:

$$D_L(I) = \frac{d^2 I}{dx^2} + \frac{d^2 I}{dy^2}.$$

Usually, CT image is represented by a two-dimensional matrix each element of which is an eight-bit integer. Each integer gives a shade of grey color in the range between 0 and 256. Calculations of the image derivatives and gradients for edge detection must be done numerically using programming language. For instance, MATLAB.

MATLAB allows processing images in versatile methods. It has a vast on-line library of radiological images, well-known specialized for image processing functions built in MATLAB (e.g. imadjust, imnoise, edge, fspecial etc.) which allows developing the unique algorithm in image processing by combining them. It provides a user with the ability for development of the custom functions library and the easy way to visualize the results and modify the initial problem. Also, using MATLAB, one may conduct to assessment of dimensions and a volume of the region of interest (ROI) for some particular tasks.

Conclusions. The use of Laplace kernels in the MATLAB software allows user to demonstrate clearly the quality reducing effect of imaging noise in radiological images. Application of the built-in MATLAB Laplace kernels to images reduces noise and improves their quality.

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CURRENT DEVELOPMENTS IN X-RAY IMAGING TECHNOLOGY: CHALLENGES AND FUTURE

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Introduction. X-rays is a discovery that took the shortest path from the moment of invention to practical use in medicine. The high penetrating ability of X-rays has made it a powerful imaging tool in medical practice. In turn, the requests of practical medicine, the development of diagnostic radiographic technologies contributed to the advancement of a wide range of disciplines from fundamental research to practical applications in close combination with modern technologies.

The aim of the study. The development of diagnostic radiographic technologies analyzing is.

Material and methods. Reviews analysis of the results presented in the latest world research in the field of X-ray imaging technology developments.

Results. The rapid development of materials science opens up a great opportunity to revolutionize the future of X-rays imaging technology. Recently, materials characterized by a tunable band gap, high quantum yield of photoluminescence and high mobility of charge carriers have been developed.They became promising materials for photovoltaic devices, fluorescent displays and radiation detection. In the recent years, the scientific community has mainly focused on the development of lanthanide-doped materials, perovskites and organometallic frameworks. Overall, new advanced materials provide opportunities to advance low-dose, high-resolution, and portable X-ray imaging technology, and X-ray imaging performance can be improved in terms of device physics, materials, and manufacturing methods. The problems associated with X-ray plates have encouraged the development of substitute substrate materials that provide high flexibility, portability, transparency, and relatively low thickness (polyester materials).

For decades, high-quality scintillators of reinforcing screens have been developed to reduce the impact of X-ray radiation due to its attenuation (materials activated by rare earth elements with high atomic numbers, e.g.lanthanum bromide oxide, lanthanum oxysulfide, etc.) and high image quality.

The quality of the X-ray images is assessed by the following physical parameters: spatial resolution, contrast and noise. High resolution is achieved due to flat-panel X-ray detectors with direct conversion based on α-Se, which are characterized by extremely low level of radiation scattering, high contrast by wide linear ranges of detectors, low noise level by calculation of Wiener spectra coefficients.

In the field of computed tomography, significant results in the quality of images are achieved through the use of spectral (multi-energy) computed tomography. The main advantage of this technique is that the tube parameters (voltage and current) and filters can be adjusted independently to adjust the radiation dose, photon flux and spectrum according to the patient's body condition and clinical indications.

Furthermore, tomography technologies in combination with X-ray microscopy are able to provide 3D-images of biological samples from nano- to micro-size that correspond to cellular resolution in vivo or ex vivo. A new transmission X-ray microscope can obtain 3D-images of cells with nanoscale based on the difference in X-rays absorption between organics and water, filling the niche between cryo-electron tomography and ultrahigh resolution fluorescence microscopy.

Conclusions. Dynamic digital radiography technology, which creates moving X-ray images (uses continuous pulses of approximately 15 frames per second to capture respiratory movements, limb or neck movements), is already approved in medical practice. There is also a tendency of integrating artificial intelligence technologies for automatic disease detection.

Tkachuk I.G.

PHOTOSENSITIVE $CuFeO_2$ / n-InSe HETEROJUNCTIONS

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Introduction. Indium monoselenide InSe has a band gap Eg = 1.2 eV which is in the range of optimal values for photoelectric conversion of the solar spectrum in terrestrial conditions. The layered structure of InSe crystals with a weak Van der Waals bond between the layers provides them with an advantage over other semiconductors in the manufacture of substrates for heterostructures by avoiding ingot cutting operations, mechanical and chemical surface treatment. In addition, the resistance of InSe to radiation expands the scope of its use.

The aim of the study. The use of indium selenide as a base material allows to create photosensitive structures of different types: based on metal / semiconductor contact , homojunctions and heterojunctions .

Material and methods. The presence of a weak Van der Waals bond between the layers and a strong ion-covalent bond in the layers in InSe determines the features of the physical properties of the crystals. In particular, the existing structural defects significantly affect the electrical properties. Packaging defects, dislocation grids placed in the plane (0001), create additional energy barriers Eδ for the movement of charge carriers along the c-axis, which causes large values of electrical conductivity anisotropy. Due to the existence of vacancies and dislocations, localized states appear near the Fermi level.

Results. Transparent conductive oxides are materials with high electrical conductivity and low optical absorption of visible light. Thin films of transparent conductive oxides are widely used in various devices such as flat panel displays, touch panels and solar panels. Delaphosites are triple oxides of copper and iron with the basic formula ABO_2, where A represents monovalent cations,