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«ACADEMIC AND SCIENTIFIC CHALLENGES OF DIVERSE FIELDS OF KNOWLEDGE IN THE 21ST CENTURY»
«АКАДЕМІЧНІ ТА НАУКОВІ ВИКЛИКИ РІЗНОМАНІТНИХ ГАЛУЗЕЙ ЗНАНЬ У 21-МУ СТОЛІТТІ»

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До збірника увійшли доповіді, присвячені актуальним проблемам різноманітних галузей знань у 21-му столітті.

Для наукових працівників, студентів та аспірантів усіх спеціальностей.

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THE USAGE OF COLOR SYSTEMS FOR VIDEODERMATOSCOPIC IMAGES

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Анотація. Кольорові системи - це класифікація кольорів у певному порядку з використанням кольорового тону, легкості та насиченості. Зараз існують різні типи кольорових систем, починаючи від звичайних кольорових кіл, атласів, масштабів, вентиляторів, кольорових таблиць, об'ємно-просторових кольорових систем до сучасних кольорових понтонів. Сьогодні важливо чітко розуміти кольорові системи та координати для професіоналів, які займаються цифровою обробкою та аналізом зображень. Будь-яка обробка зображення передбачає використання кольору, контрасту, яскравості та тонів. Більше того, обробка зображень широко використовується в медицині. Існують системи, для яких цифровий аналіз зображення є надзвичайно важливим. Відомо, що лікування може допомогти в дерматології та сучасній косметології виявити різні шкірні захворювання. Тому метою статті є вивчення основних кольорових систем, їх відмінностей та застосованості в медичній практиці.

Ключові слова: дерматологія, система HSV, обробка зображення, система RGB, відеодермоскопія.

Abstract. The color systems is a classification of colors in a certain order, using color tone, lightness and saturation. There are now various types of color systems starts from ordinary color circles, atlases, scales, fans, color tables, volumetric-spatial color systems to modern color pontoons. Nowadays, it is essential to have a clear understanding of the color systems and of the coordinates for professionals who are involved in digital processing and image analysis. Any image processing involves the usage of color, contrast, brightness and tones. Moreover, image processing is widely used in medicine. There are systems for which digital image analysis is highly important. It is known that treatment can help in dermatology and modern cosmetology to detect various skin diseases. Therefore, the aim of the article is to study the basic color systems, their differences and the applicability in medical practice.

Key words: dermatology, HSV system, image processing, medicine, RGB system, videodermoscopy

Video dermatoscopy is a branch that is widely used to study skin in cosmetology. Dermoscopy is used as an adjunct to clinical examination in the diagnosis of skin lesions, including melanoma. Videodermoscopy, which allows for the concurrent examination of dermoscopic features at high magnification by instructors and trainees, may serve as a useful educational tool during bedside instruction. Using the method of video dermatoscopy, dermatologists can determine the diseases that patient has. This method involves the usage of computer technology. In order to make a diagnosis, it is necessary to examine the problem areas with the subsequent treatment of the skin area. And after that, you can select the necessary treatment. Image processing is key method of video dermatoscopy, since it is the analysis of dermatoscopic images that allows you to establish the correct diagnosis and figure out if there are any tumors [1].

Image processing is a form of information processing for which the input data is represented by images, such as photographs or video frames. The video dermatoscopy method uses the concept of digital image processing, which means the use of computer algorithms for digital image processing. As an area of digital signal processing, digital image processing has many advantages over analog processing. This allows you to apply a wider range of algorithms to the input and avoid problems such as adding noise and distortion during the processing [2, 3]. Digital image processing can be modeled as multidimensional systems since images are defined as two-dimensional.

The special features of video dermatoscopic image processing are a comprehensive analysis of color [3, 4] and morphological characteristics of the studied areas [4, 5].

Color systems. A color model is a way of describing color using quantitative characteristics. In the color model, they usually mean a term denoting an abstract model for describing the representation of colors in the form of three- or four-digit numbers, called color components (sometimes - color

coordinates). The color model is used to describe the radiated and reflected colors. Together with the method of interpreting this data, the set of colors of the color model determines the color space.

RGB is a color model, named after the three capital letters of the names of the colors underlying it: Red, Green, Blue, or red, green, blue. These colors form all the intermediate ones. This is also called the additive model. It is used to display images on screens of monitors and other electronic devices, and has a large color gamut.

HSV system in its turn, which is characterized as:

- Hue - color tone (for example, red, green or blue-blue).

- Saturation - saturation.

- Value or Brightness - brightness.

CMYK model. All shades of the color visible spectrum can be obtained by mixing of not radiation, but substances – paints, varnishes, solutions. In the printing industry, in order to create a color image on a print, paints of various colors are put onto white paper. White light incident on the print passing through the ink layer is reflected from the surface of the paper and again passing through the ink layer of a certain color, is perceived visually. This color is called reflective. Reflected colors do not appear by radiation, but are obtained from white light by subtracting certain colors from it. Reflected colors are also called subtractive, since they remain after subtraction of the main additive colors, and color synthesis is subtractive. It is clear that in this case there will be three main subtractive colors: cyan, magenta, and yellow. These colors make up the so-called printing triad of printing inks. During the printing process using of these colors inks, they absorb red, green, and blue areas of the white light spectrum, and thus, most of the visible color spectrum can be reproduced on paper when printing a multi-color print using three inks – yellow, magenta, and cyan.

The resulting color is darkened, while mixing two subtractive colors, and mixing all three, black color should be obtained. In the complete absence of paint, presumably, it turns out white. As a result, it turns out that the zero values of the components give white, their maximum values should give black, their equal values should give shades of gray, in addition, there are pure subtractive colors and their double combinations. This means that the model in which they are described is similar to the RGB model. The geometric image of the CMYK model is the same "cube" in which the origin has moved.

The issue lies in reality and the purity of the color of real paints. This model describes real printing inks, which, alas, are far from being as perfect as color radiation. They have impurities, solvents, binders and therefore cannot completely cover the entire visible color range of the white light spectrum, and this leads to the fact that the mixture of the three basic colors, which should give black, gives some kind of vague dark color, rather dark brown than true black. To compensate this shortcoming, black ink was introduced into the number of basic printing inks. Black ink added the last

letter to the name of the CMYK model: C - Cyan; M - Magenta; Y - Yellow and K - Key color or blacK [6].

Thus, the RGB and CMYK models, despite the fact that they are connected to each other, while their mutual transitions into each other do not occur without loss. Moreover, the color gamut at CMYK is less due to the lower purity of the basic colors compared to the main RGB emissions.

CIE Lab model. It was created by the International Commission on Lighting (CIE) in order to overcome the significant shortcomings of the models above, in particular, it is intended to become a hardware independent model and determine colors without taking into account the individual characteristics of the device. In this model, any color is determined by lightness and two chromatic components: parameter A, which varies in the range from green to red, and parameter B, which varies in the range from blue to yellow.

Unlike RGB and other systems using primary colors, HSV is closer to how people perceive colors. It consists of three components: hue, saturation and value. This color space describes colors in terms of their hue and brightness value.

As a result of the study, it is found that with image processing methods it is advisable to switch from the RGB system to the HSV system, since the HSV system uses the characteristics of colors quite precisely, but not the colors themselves as the RGB system does.

Conclusions. Choosing color systems in digital image processing it's essential to choose the system that is able to describe the image from the side of brightness, saturation or color tone. The methods of color systems, their difference between each other are studied. The RGB system is hardware-oriented, while the HSV is tuned for humans. It was found that when processing images, especially the medical one, it is advisable to switch from the RGB system to the HSV system. We examined the use of image processing in cosmetology and studied the type of diagnosis of skin diseases - video dermatoscopy.

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