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PROBLEMS OF USING FACE IMAGE SEGMENTATION, IDENTIFICATION, FILTERING, FACIAL SIGNS DISTRIBUTION CRITERIA IN DETERMINING PERSONAL BIOMETRIC CHARACTERISTICS

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Abstract:

In this article, using the possibilities of today's information and communication technologies (ICT), scientific researches focused on this field, such as collecting data on the facial image based on the biometric characteristics of the person, processing the facial image, converting it to a digital image, segmentation, identification, filtering, distinguishing facial features the results of extensive analysis of their work are presented.

Keywords: Biometric features, segmentation, Wavelet library, control theory, neural networks, linear filtering, high-pass filters.

Mainly in the process of working with facial images, the sequence of steps of processing the data stored in the computer, which is the working tool of digital image processing problems, imposes certain requirements on the users. The MATLAB package environment is one of the most convenient software tools for digital image processing using wavelets. Nowadays, the MATLAB core includes LAPACK (Linear Algebra Package) and BLAS (Basic Linear) software for matrix calculations. Algebra Subprograms) libraries are installed. In a university setting, MATLAB is the standard computing package for introductory and advanced courses in mathematics, engineering, and other scientific disciplines. And in industry, MATLAB package is widely used by many researchers and developers. The MATLAB package consists of two major parts: the core and plug-in libraries (or "toolboxes"). The MATLAB kernel provides most functions and general-purpose operations. Libraries store narrowly specialized functions and allow users to perform computations and image processing in a strictly defined domain. Functions in these libraries solve cutting-edge applied problems in mathematical logic, control theory, neural networks, image and signal processing. Mainly in the process of face image processing, the analytical results of the digital face image processing methods of the standard library system available in the MATLAB package environment using Wavelet were summarized and implemented in the following processes.

The wavelet library is a set of functions based on the MATLAB package. The wavelet library provides instrumental tools for digital processing, analysis and synthesis of signals and face images within the framework of the MATLAB package. Any function in the library can be modified to work. For this, M-files are copied, renamed and appropriate changes are made in the created copy. The user can expand the library by adding his own M–files.

Image Processing is a set of functions that extend the capabilities of the MATLAB package environment using wavelets. The Image Processing library is currently used by 4,000 companies and universities around the world. At the same time, users use this library to solve problems related to many fields, for example: space exploration, military production, astronomy, medicine, biology, building robots, image processing and recognition, and other related issues.

This library supports a wide range of face image processing operations and is performed for the following face image parameters:

1) formation of geometric operations of the face image;
2) development of linear filtration and filters on facial images;
3) determining the state of shape change of face image parameters;
4) static analysis of the face image located in the object, face images in another object;
5) is to perform detection operations with 2D face images.

There are 2 versions of this library, the 1st version has many advantages has an ar. In this case, in the process of working with face images, multidimensional arrays are displayed and 8-bit data is supported. Also, most of the functions of version 1 are used to increase speed and use less memory. In addition, version 2 includes many functions that extend the capabilities of the library.

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Image processing toolbox - a wide spectrum of digital face image processing and image analysis tools is recommended. This includes the Image Processing Toolbox package, a set of functions (Fig. 1) that extend the capabilities of the MATLAB package environment for digital face image calculations using Wavelets. Image Processing Toolbox is used in facial image compression, transmission and facial image enhancement system development, tracking and recognition, biometrics and other fields.

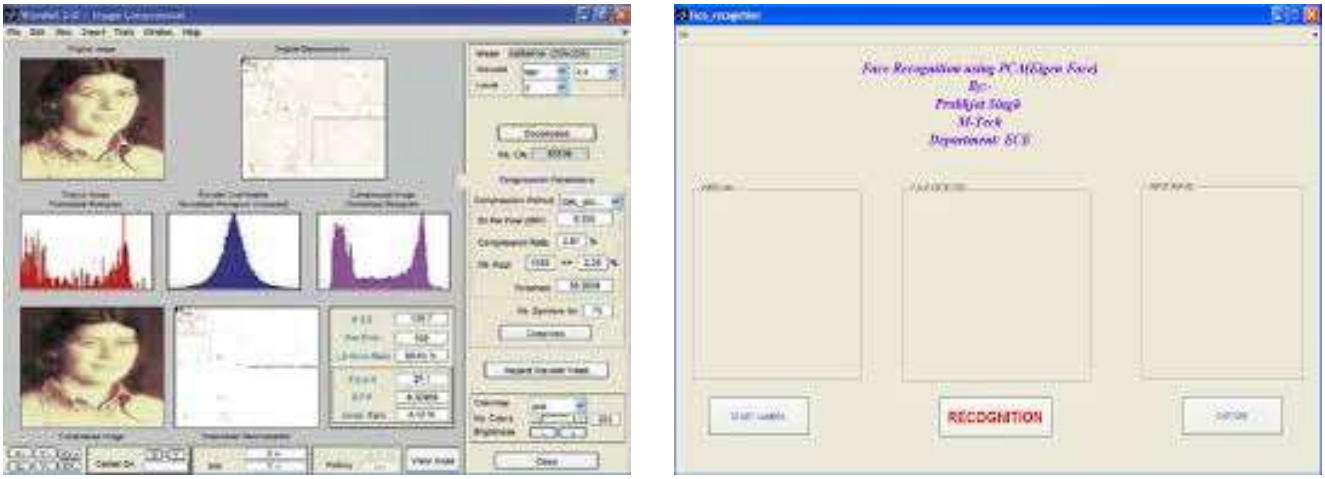

Figure 1. Parameters of face image digital processing

We use the whos function of the Image Processing Toolbox environment. Here, information about the image name, size, bytes and class is generated in the working window. The histeq function is used to increase the clarity of the image. In this case, after increasing the resolution of the original image, the resolution of the information about the image increases. To compare the two images, we display the original image and its histogram, the enhanced image and its histogram in one window, using the subplot, imhist, and imshow functions.

```
  Name      Size                Bytes  Class
  I         657x1122x3        2211462  uint 8 array
  h         1x1                     8  double array
  new       657x1122           737154  uint 8 array
Grand total is 2948617 elements using 2948624 byte
>> I2 = histeq (new); % тасвир контрастини ўзгартириш
>> subplot(2,2,1),imshow(new),title('chiquvchi tasvir');
>> subplot(2,2,2),imhist(new),title('tasvir gistogrammasi');
>> subplot(2,2,3),imshow(I2),title('uzgartitilgan tasvir');
>> subplot(2,2,4),imhist(I2),title('uzgartirilgan tasvir gistogrammasi');
```

This application supports various operations of digital processing of facial images, including:

- change of facial images over time;
- morphological operations on the facial image (change);
- face image processing based on variable parameters;
- linear filtering of face image using different filters;
- to analyze the face image in the object and improve them;
- restoration of damaged images in the object;
- elimination of destruction and damage occurring in the facility;
- work on the field of focus in general.

Based on the mentioned parameters, the facial image is digitized and analyzed based on the Image Processing Toolbox application. A wide spectrum of tools used for face image object is presented and the main criteria of digital processing features of face image for object are as follows;

- restoration and separation of facial image details in the object;
- work with the selected area of the face image in the object;
- comparative analysis of the face image with the face image of another person;
- linear filtering of face image in object;
- change facial images in the object;
- taking into account geometric changes in the face image;
- increasing the contrast of important details in the face image;
- taking into account binary changes in the face image;

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• taking into account color changes in the face image;
• taking into account the change of the palette in the image of the face;
• Clarify changing face image types.

Based on the main criteria presented, the Image Processing Toolbox package is optimally adapted to the development of the user's and methods. It is possible for this to be a set of packages focused on solving specific problems and non-traditional problems. You can develop image enhancement, noise reduction, analysis, visualization and algorithms.

Experiments on filtering face images in Image Processing Toolbox environment - boundary reproduction show that photographic and television images with distinct boundaries are perceived better by a person than a natural scene with imperceptible color transitions. This feature and the problems of removing interference in the form of border spreading in the image put forward the problem of automatic image processing, border enhancement, that is, increasing the difference between the background and object lights. Methods for solving this problem are widely used in image processing. Usually, the threshold is enhanced using high-pass filters.

$$A_1(m,n)=\begin{vmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{vmatrix};\quad A_2(m,n)=\begin{vmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{vmatrix};$$

$$A_3(m,n)=\begin{vmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{vmatrix};\quad (1)$$

It can be seen that the working masks of these filters will have an average value of (1). That is, the sum of negative and positive values in the mask is equal to 0. This is because when a mask is applied, a result of 0 should be obtained for a homogeneous area and a non-zero result for a boundary area. Another way to enhance the boundary field is statistical differentiation. In this case, the value of each element is divided by the statistical estimate of the root mean square constraint.

$$E_{ij} = f_{ij} / 0(i,j)$$
$$0^2(i,j) = \sum_i \sum_{ji} \left[f_{ij} - Z_{ij}\right]^2$$
$$i,j - N(i,j) \qquad (2)$$

is calculated around the coordinate point, and is the average light value estimated by low-pass filtering of the source image at the point. Enhanced quality - the image differs from the source image in that the values in the border areas are large, and in other areas they are small. There are many more methods of boundary boosting that take into account different algorithms.

In recent years, medical filtering, which includes non-linear methods, has been widely used in digital image processing. This method is a leveling process and has the following advantages:

1. Sharp differentiation-border areas in field illumination are preserved.
2. Scattered point interferences are effectively smoothed out.

Algorithms of these methods are heuristic, that is, the consumer gets filter parameters depending on the quality of the source image. There are four main reasons why double-valued images fail:

• dirt in the original copy of the image, i.e. interference;
• low quality of painting;
• small errors in the process of entering the image into the memory;
• threshold for converting multi-valued images to double-valued ones

will cause errors such as incorrect selection.

Eliminating these defects is called image denoising, and one of the effective ways to remove them is filtering. The development of filtering techniques provides effective benefits in removing the main interferences found in the two types of images. The most common obstacle is the unevenness of the line shape. It takes different forms:

• change in thickness;
• excessively wide and narrow sections in the lines;
• unevenness of the contour of the lines.

Another error is the presence of small isolated spots in the image. Isolated gaps and the most simple, yet difficult to overcome defect are breaks in lines and merging of several lines. It is good to choose the filter size and threshold value while changing some of its parameters for quality image processing. Depending on the size of the objects, double-valued images are divided into four classes:

• highly disturbed images, that is, the presence of all types of interference in the image;
• presence of all interferences, except for line breaks and connections;
• the presence of interference in the form of border unevenness of small spaces in the image;
• presence of interference only at the boundaries of the object.

In order to remove distortions, facial images use a process of modeling smoothing filters, which are mainly based on the elements around the center value.

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In the MATLAB package environment, face image filtering commands are provided as follows, and the given modeling process is defined by the commands:
• conv2 – image comparison;
• convn - comparison of N-dimensional signals;
• convmtx2 – calculation of comparison matrices;
• filter2 – two-dimensional linear filtering;
• freqz2 – two-dimensional filtering;
• fspecial – predefined filtering mask assignment;
• fsamp2 - forming a linear filtering mask;
• ftrans2 – method of frequency exchange of the mask of linear filters
form with;
• fwind1 – linear using a one-dimensional window forming a filter mask;
• fwind2 - linear using a two-dimensional window;
• forming a filter mask;
• blkproc – image block processing;
• bestblk – block size determination;
• nlfilter – combined nonlinear filter;
• colfilt – optimized operations of the filter;
• im2col – replacement of image fragments into a column;
• col2im – replacement of auxiliary images;
• ordfilt2 – color filtering;
• medfilt2 – median filtering;
• wiener2 – Wienerovsky adaptive filtering;
• roifilt2 – filter the field of interest;
• imfilter – filtering of two and multidimensional images.

IN CONCLUSION

The MATLAB package environment with Wavelet is one of the convenient software tools for digital image processing. Currently, the core of MATLAB is the installation of the LAPACK (Linear Algebra Package) and BLAS (Basic Linear Algebra Subprograms) libraries, which contain the most modern software for matrix calculations. In the university environment, MATLAB is the standard computing package for introductory and advanced courses in mathematics, engineering, and other scientific disciplines. Experiments have shown that this feature in the face image, border spreading in the image, the problem of removing interference in the view, poses the problem of border enhancement of face images, that is, increasing the difference between the background and object lights. Usually, the threshold is increased using high-pass filters. The main purpose of the digital face processing step is to preserve the structure and shape of the source face image.

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