Research Journal of Pharmaceutical, Biological and Chemical Sciences

Development the Module Algorithm of Information System to Face Detection for Smart Environments.

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ABSTRACT

Image Database Creating individual employees, as the unit of information management systems, allow developing new modern methods and techniques of management of the enterprises and organizations, including in the Stavropol region. The result may be the concept of regional development in the innovation sphere, taking into account the assessment and, based on it, the prognosis state of human resources in the region.

Keywords: pattern recognition, information system, human resources

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INTRODUCTION

The rapid development of computer technology in recent years has enabled large number individual tasks, which previously required a direct or indirect participation of a person to provide a computer. Most of the problems with a known algorithm of actions of modern information systems solve no problems, be it complex mathematical calculations of trajectories of motion of celestial bodies, or the most precise calculations needed for fast and high-quality operations in the field of medicine, without human intervention. Moreover, most important task for such a person will not be any difficulty for the computer system.

It should note that there are a number of problems, the solution which by computer cannot be compare with a man. It is about recognizing the biological images and, in particular, the recognition of human faces. For such a task the computer is difficult is feasible and requires large computational resources.

Perfect information system does not even need to assist the user. Application software and hardware systems with the ability to quickly and accurately recognizes facial images and their subsequent classification is very extensive. For example, it can be a database of employees of an enterprise, electronic medical records, security of protected sites, etc. All of this involves the use of pattern recognition capabilities - gestures, emotions and individual voices.

There are methods of recognition of persons, based on a two-dimensional image from the front face and based on 3D reconstruction. The latter are more accurate, but require special equipment, such as stereo - camera, as well as large computational resources. First, on the contrary, the ordinary computer user are available and easy to understand.

MATERIALS AND METHODS

To successfully solves face recognition tasks required to solve the following non-trivial task:

- Isolation of the face region (face isolation in the photos or video sequence localization area containing the face).
- Advanced image processing from the high-frequency noise, the use of different filters (to equalize the brightness, contrast, color), morphological operations.
- Reducing the input image dimension without loss of essential information (allocation of key features (features), display in another space of smaller dimension).
- Compare the resulting set of features and, in fact, the image classification based on them.

Consider the implementation of the above-described algorithm of actions on a specific example.

Selecting the person in the image can have be realized in several ways. The most simple and effective algorithm for finding open people today is the method of Viola-Jones, by the way appropriate to highlight the images not only individuals, but also of any biological objects. The method is have based on the principle of building a classification tree with signs of Haar.

For example, consider a database with human faces. Common to all the images is that the area in the region of the eyes is darker than the area in the vicinity of the cheeks. Consequently, a common feature for individuals Haar is 2 adjacent rectangular region lying on the eyes and cheeks.

At detection Viola-Jones method, set the size of the window moves over the image, and for each area of the image, over which the window is calculated feature Haar. The presence or absence of an object in the window is have determined by the difference between the characteristic value and the threshold of the trainees.

The function that implements this algorithm takes as input an image on which you want to search for people, and trained in advance of the Haar classifier cascade. This function provides the input image conversion from the three-way in single channel. To quickly finds the image is scaled to a certain coefficient. Another feature provides an extended search on the image of persons with the use of the described algorithm.

Return value - array of rectangles, given the coordinates of the upper left corner, width and height, describing the person found. If people cannot find the image, the returned array will be empty.

For successful detection face image filtering is used or with different image convolution kernels.

Application of the necessary filters with complex morphological operations allows achieve uniformity of the resulting images, which reduces sensitivity to interference classifier.

In this case, the most appropriate to use the luminance histogram equalization, in connection with the feature of the application program.

The next stage - the allocation of image features or signs of getting cards. There are many ways for the operation and identify the best possible, so it is best to use them all in sequence.

Human face can be represented by a certain set of numbers, each of which lies within a certain range of pixels. The converted image can have be viewed as a point in a multidimensional space, and the brightness of each pixel, respectively, regarded as a coordinate on a particular basis vector.

One method of reducing the dimensionality of the input data with minimal loss of information is an algorithm based on finding such a subspace of smaller dimension that would be lost in the projection minimum of information.

Let there be a set of face images shown to the same size. From the coordinates of these points in a matrix as follows: the coordinates of the first point to the first line, the coordinate of the second point - the second and so on.

A matrix whose number of columns is equal to the dimension of the original space and the number of lines - the volume of training sample. To find a subspace of smaller dimension is necessary to select a subspace, and so that would be the orthogonal projection on the line with his maximum standard deviation from the mean. To do this, we calculate the covariance matrix of the original matrix and find the eigenvalues of the resulting matrix. Let us sort them in ascending order, and for the first n, that is the largest of the eigenvalues, we find the eigenvectors. Since the eigenvectors are linearly independent, then they form a basis of n-dimensional subspace. Further, by orthogonal projection of training sample images in the resulting space will get a set of points or features.

Let us now consider the process of identifying a new man. Measure image close set a given function. Measure images proximity is set using the Euclidean distance or Mahalanobis distance between their projections in the resulting space. It differs from the Euclidean distance that takes into account the correlation between variables and invariant to the scale.

RESULTS AND DISCUSSION

Using described methods, was have developed the program interface, showing the work of algorithms. Like a basic programming language has been selected C++, as a programming environment used QtCreator 4.7.4.

In order to stabilize the operation of the program in a variety of conditions added external editable configuration file. The program allows you to add new users to the database and to make comparisons with the base image individual received from the video source. There is a functional view content downloaded user base. Each user has a field for some metainformation.

The testing program revealed that the recognition rate greatly depends on the number of positive examples for each class of individuals, but also the number of different classes. The highest percentage of recognition of 93% is achieved by testing the same class comprising about 100 positive images from different angles, varying within a small range (about 10 degrees), and a small change in lighting.

CONCLUSION

In view of the above, it becomes relevant applied research in the field of pattern recognition. Image Database Creating individual employees, as the unit of information management systems, allow developing new modern methods and techniques of management of the enterprises and organizations, including in the Stavropol region. The result may be the concept of regional development in the innovation sphere, taking into account the assessment and, based on it, the prognosis state of human resources in the region.

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