ANALYSIS OF COMPUTER VISION METHODS IN THE TASKS OF IDENTIFYING PEOPLE IN THE VIDEO STREAM

Bashuk I.Y., *kiidtt1@gmail.com*
Dmytro Motornyi Tavria State Agrotechnological University

What is photography to us is just a set of pixels with different color settings for an image recognition system. To teach the system to recognize individual objects in an image, you need to give it a dataset - a set of thousands of images, which indicate exactly where the desired object. For example, if we want the system to learn to recognize people in pictures, we need to show it many photos of people of different ages, in different poses and clothes, in different conditions. After this training system can accurately identify people in photos. However, another question arises: if the photo system - is a set of pixels, the same as the neural network realizes that it is in the picture.

Various methods used to recognize objects in the image, but one of the most promising is the method of histograms of oriented gradients (HOG). Image discolored, and then in blocks of 16x16 pixels the system finds the direction of color change (gradient vector), builds a map of these vectors around the image, and thus "snapshot" of the object's features, which do not change depending on position and lighting.

Let us define the list of the tasks solved by systems of recognition and identification of persons on video recording in real time:

1. Verification. The real-time video recognition and identification system can confirm a person's identity by comparing the advanced sample with a reference sample recorded in the system previously. In fact, the comparison done on a "one to one".

2. Identification on a closed set. The system of recognition and identification of persons by video recording in real time compares the image obtained from the video stream with many previously recorded patterns of different people in order to identify the person who owns this sample. This problem may be solved on the basis that the person who owns pattern is present in the database. In this task, a comparison of samples according to the scheme "one to many".

Today in Ukraine there are large projects aimed at recognizing and identifying objects by video recording in real time. Since September 2017, a share of 50,000 CCTV cameras in Kyiv connected to the face recognition system. The existing network combines access video cameras, cameras on the territory and in the buildings of schools and kindergartens, stadiums, public transport stops and bus stations, in parks, subways and other public places. Thanks to this approach, an additional tool for finding criminals and violators.

Face recognition across the city provides unique opportunities for law enforcement officers. About 16,000 law enforcement officers, state and municipal organizations gained access to the city surveillance system.

Regardless of the video stream processing algorithm, the software function of face recognition and identification works on the principle of comparing the scanned image with the standards available in the database. While the scan is on the go, the visitor only needs to turn his face to the scanner while driving.

In essence, recognition systems are computer programs that analyze images of people's faces in order to identify them. The program takes an image of a person and measures its characteristics such as the distance between the eyes, the length of the nose, the angle of the jaw, which creates a unique file, called a "template". Common sources of images for use in facial identification are signals from video cameras or previously obtained photographs, such as those stored in the driver's license database.

Typically, the system consists of a video surveillance camera and software that performs image analysis. Face recognition software is based on image processing and calculations of complex mathematical algorithms that require a more powerful server than is usually required for video surveillance systems. We will be primarily interested in the quality of software. In the second, what server capacity will be needed to analyze the image and process the database with images, and in the third, we will consider the use of IP cameras for face recognition purposes.

There are two types of face recognition 2D and 3D.

At the heart of 2D (two-dimensional) face recognition technology are flat two-dimensional images. Facial recognition algorithms use: anthropometric facial parameters, graphs - models of persons or elastic 2D-models of persons, as well as images with faces are represented by a set of physical or mathematical features (See Fig. 1). 2D image recognition is one of the most sought after technologies now. Since the main databases of identified persons are accumulated in the world - it is two-dimensional. Moreover, the main equipment, already installed, around the world is 2D - according to 2016 - 350 million CCTV cameras. That is why the main demand is for 2D face recognition systems.

A huge advantage of 2D face recognition is the availability of ready-made databases of reference persons, and ready-made infrastructure. The maximum demand will fall on this segment

3D recognition (Three-dimensional face recognition - English) is usually made with reconstructed three-dimensional images. 3D face recognition technology has higher quality characteristics. Although of course, it is not perfect. There are several different 3D scanning technologies. These can be laser scanners with an estimate of the distance from the scanner to the elements of the object's surface, special scanners with structured illumination of the object's surface and mathematical processing of band bends, or they can be scanners processing photogrammetric synchronous stereo pairs of facial images.

Do not use 3D face recognition to protect against unauthorized access to laptops, smartphones, rooms with a special level of secrecy, they can all be easily broken by professionals.

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Scientific adviser: *Mozgovenko AA, assistant, Department of Computer Science, Dmytro Motornyi Tavria State Agrotechnological University.*