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WORD COUNT 1286
TIME SUBMITTED 04-MAY-2023 09:11AM
PAPER ID 99348403

Very Small Image Face Recognition Using Deep Convolution Neural Networks

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Abstract. The very small size of face image recognition is one of a significant case in computer vision because it can be applied in many applications in the real world. The main problem of face recognition with a small size is that the area of the acquired face is very small so that many facial features cannot be obtained. In this paper, we propose a novel method using deep convolution neural networks (DCNNs). First the image resolution is enhanced using CNN and then it is classified using the backpropagation algorithm. To verify the proposed method, we use AR Database. The results show that the identification accuracy is very good but still need a larger database for further verification.

1. Introduction

Facial recognition is a topic in computer vision that is very interesting and growing very rapidly to date. Many applications have been developed based on face recognition. Many methods have been proposed and can be implemented for facial recognition. However, because the face objects taken by the camera is very dynamic, so the images obtained are also dynamic as background, size, resolution, and others. It impacts on the level of accuracy in face recognition. Hence, a novel method is still needed to create to overcome the listed problems.

The very small size of face image recognition is one of a significant case in computer vision because it can be applied in many applications in the real world such as long-distance face recognition, video surveillance, etc. The very small size image face (usually, the size 12x16 pixels, 6x8 pixels, or less) has obtained from a picture taken from a great distance, a crowd of people, or a resized smaller image. Figure 1 shows an example.

For the very small size face recognition, the area of the acquired face is very small; a direct enlargement is not a solution because it will lead to a low-resolution image. The features of this processed face image are hard to be extracted. Thus, face recognition becomes very difficult and different approaches were proposed [6] [7]. Usually, to solve this problem the researchers use super-resolution (SR) [1]. There are two approaches that we can use to obtain SR images, namely a reconstruction-based and a learning-based approach. For facial images, this technology is also called facial hallucination [2][3].

A novel method named as Very Small Image Face Recognition Using Deep Convolution Neural Network (VsFRCNN) is proposed in this paper. We use deep convolution neural networks (DCNNs) to increase the resolution of the image face. A low-resolution face image is then converted to a super resolution face image. Then the super resolution face image is classified by a neural network using three fully connected layers.

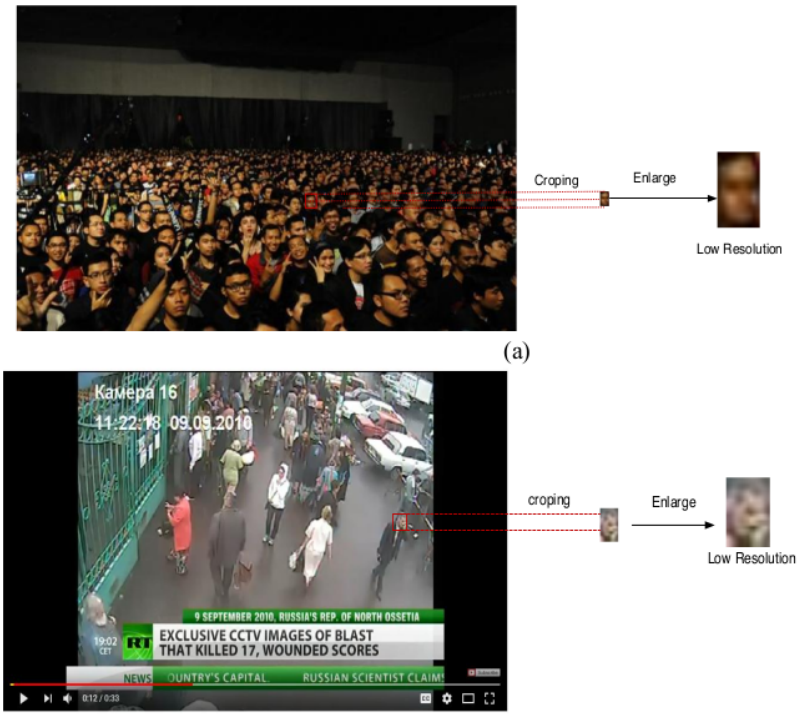


Figure 1. (a) an image from a concert (b) an image from a street.

2. Proposed Method

In general, the proposed method is shown in Figure 2. This method can be divided into two processing stages. The first is to increase image resolution and the second is to recognize the face image. The former aims to image resolution enhancement. It is done using CNN as proposed in [4]. The latter emphasizes on the classification. It uses three fully connected layers. The calculations in CNN follow [3] while calculations in the FC layer use Multilayer Neural Networks [5]. The system architecture is shown in Figure 2.

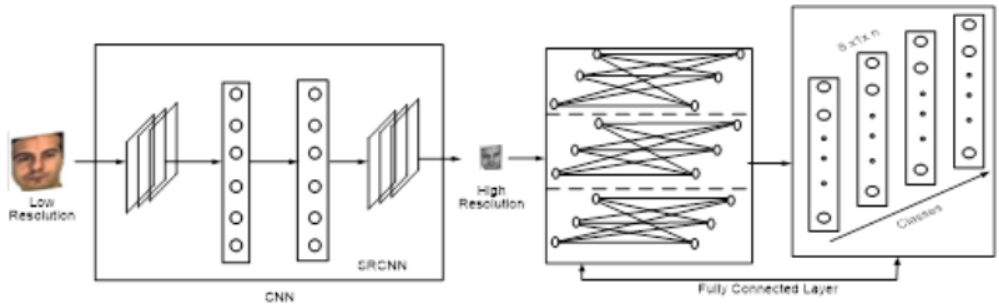


Figure 2. The framework of VsFRCNN

3. Result and Discussion

3.1. Datasets

In this research, we use AR Database datasets to verify the proposed method. The database consists of fifty people with each person having five different expresses. So, the database consists of 250 images. The image size in the database is 120 x 165 pixels. The samples of data are shown in Figure 3.

Figure 3. Image samples from AR database

To obtain very small images, we use subsampling operations on images in the database, so that the size of the produced image size is 6 x 8 pixels. An example is shown in Figure 4.

Figure 4. The sub sampling process

The results of subsampling are shown in Figure 5. Each image is of size 6x8 and labeling from M-001-01 to M-050-05.

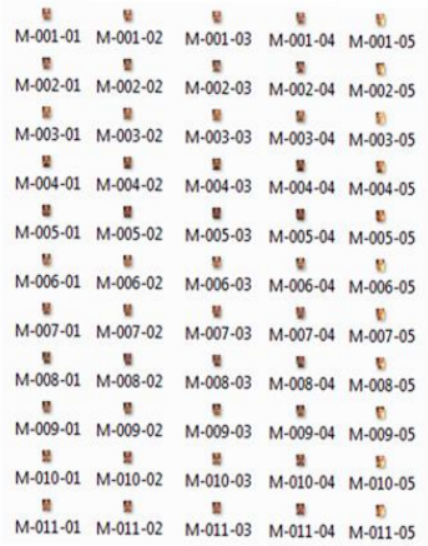
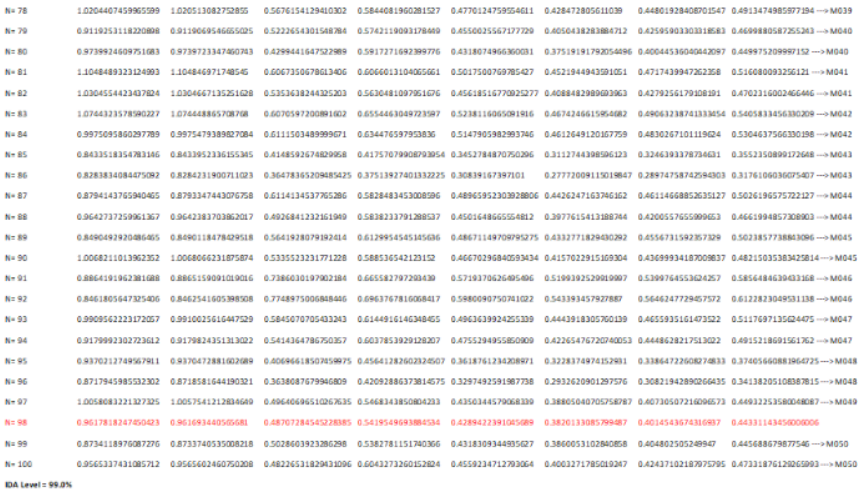


Figure 5. The sample of the result of subsampling

3.2. Result and Discussion

From the subsampling images, we have taken at random three expressions for each person to training and taken randomly two expressions for testing. So, the total amounts of training data and testing data are 150 and 100, respectively. From the testing, we have 99 images can be recognized and only one face image (M-049-004) is failed. The identification accuracy is then 99.00%.



4. Conclusion

The Identification level accuracy (IDA) of facial recognition obtained in this study is very good but it still needs a testing with a larger database for further verification.

Acknowledgement

This work was supported in part by the Ministry of Science and Technology under contract numbers 106- 2221- E-011 -149 -MY2 and 107-2218-E-011-008-, and it was also partially supported by the "Center for Cyber-Physical System Innovation" from The Featured Areas Research Center Program within the framework of the Higher Education Sprout Project by the Ministry of Education (MOE) in Taiwan.

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