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Personal Identification Using Facial Images for Surveillance Systems in a University

Abstract**—**Identity recognition is essential for intelligent surveillance systems. Computer vision is used to identify and recognize objects of various sizes, shapes, and positions. Deep learning with Convolution Neural Networks has been used to achieve high accuracy and precision. To facilitate object detection in a university environment, the proposed approach for student identification is based on a deep learning method for feature extraction and classification, which was evaluated on standard databases and our own dataset uses tensor flow object detection API and haar cascade method of OpenCV. It achieved high accuracy and is suitable for practical applications.

Keywords—ID card, Face detection, Face recognition, Tensor flow, OpenCV.

INTRODUCTION:

Nowadays, monitoring systems based on artificial intelligence techniques have been studied and applied in many sectors of security monitoring such as medical applications, education, intelligent transportation systems, etc. [1]-[4]. One of the most interesting orientations is focusing on how to improve the efficiency and feasibility of monitoring solutions, ensuring security in specialized situations or public applications. In public surveillance applications, there are many limitations for human identification, such as identifying a person's name in crowds at public airports or docks, train stations, and also in a university. Therefore, it is possible to classify the systems in two approaches: (1) systems that require an obligation to nominate a person in order to active data receiving; (2) systems that would not require an obligation to nominate a person for the task. The motivation behind face detection algorithms is to locate whether there are any faces in an image or not. In an image to recognize the face in it, first, have to detect[5] whether there is a face in the image or not. In this study, we propose an approach with expecting to be able to how TensorFlow identify a large number of student identities through their facial images by providing enough amount of image data for training a machine learning model for human recognition and identification task which will identify the presence of the face.

RELATED WORKS:

In recent years, deep learning techniques have been used extensively in various areas such as object classification, product defecting monitoring, fraud detection, handwriting recognition, voice recognition, medical diagnosis, and so on. The most important details in this text are the various approaches to the biometric measurement for human identification, such as retinal blood vessels bifurcation, 3D superimposition techniques, hand back skin texture, fusion at the feature level of finger vein and finger dorsal texture, and facial image data. These approaches have been tested on a hundred iris images of the CASIA database and have achieved high accuracy scores. Gibelli et al. has proposed a method based on 3D superimposition techniques for constructing 3D models of palatal reggae for personal identification, while Yang et al. have proposed an approach based on fusion at the feature level of finger vein and finger dorsal texture. Tran D proposed [1] a method that chose images with large variations in scale, pose, and lighting and labeled them manually with LabelImg. Ali Sharifara, Mohd Shafry, et al. [2] discussed a review of recent methods of face detection such as template matching, knowledge, appearance, and feature-based. R. Samet and M. Tanriverdi [3], developed a mobile-based face recognition system for classroom attendance management using Euclidean distance calculation. Tsang Ing Ren, Joao Paulo Magalhaes, et al. [4] described a template matching-based face recognition for dynamic faces with either horizontal or vertical movements. Christian Szegedy, Wei Liu, et al. proposed Inception architecture that makes use of local sparse structure in a convolutional vision network that leads to optimum results. Jia Deng, Wei Dong, et al. suggested that ImageNet can be used as a large-scale database for most of the applications in the field of visual recognition. Korsh, M.H.J.D. developed a framework based on a capsule neural network. Our contribution presents an identity recognition approach based on deep learning techniques using facial image data, which is collected from a web camera with normal-quality of images.

PROBLEM STATEMENT AND SYSTEM OVERVIEW:

The process of identifying or detecting an object involves collecting data in various formats, [6] such as XML, CSV, and TFRecord. As there are few publicly available datasets paradoxically we used our own datasets. This data is then labeled and trained to create a TensorFlow object detection model. To identify an ID card, the system is trained with the number of ID card images in various positions and backgrounds. This model is shown in Figure 1.

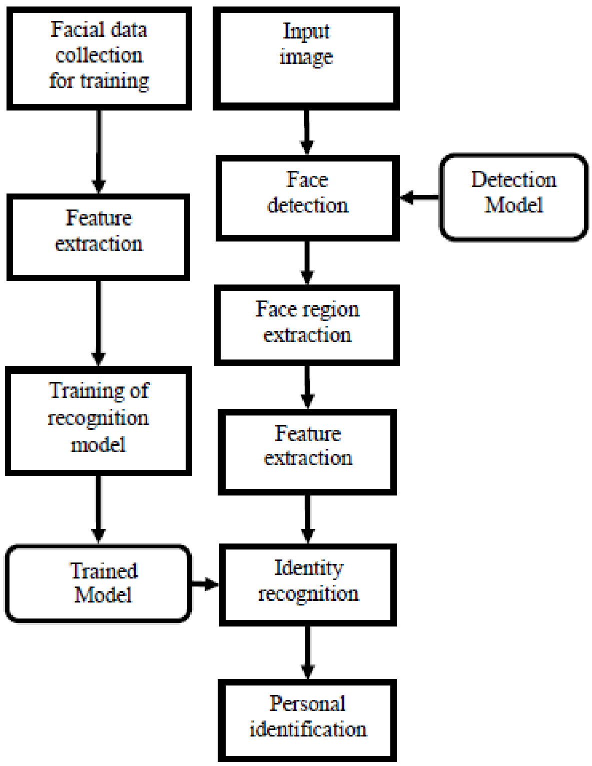

Fig. 1. General flowchart of the identity recognition system.

The flowchart consists of two tasks: detecting the positions of faces from input images and identity recognition of the detected face regions. In our paper, we focus on the second one. Viola's method for real-time face detection was used to train a facial dataset using TensorFlow model with a 98% detection rate.

ARCHITECTURE PROPOSAL:

A. *Deep Learning Architecture Construction*

This research proposes a deep learning network architecture based on a serial convolutional neural network, which includes 25 layers such as an input image layer, convolution layer, rectified linear unit (ReLu) layer, standard cross normalization layer, max-pooling layer fully connected layer. The network model maps the input image into the serial hierarchical analysis, and the input layer is processed on an image with 192×192×3 size.

TABLE I: THE DEEP NETWORK ARCHITECTURE CONSISTS OF 23 HIDDEN LAYERS AND THE INPUT LAYER AND THE FINAL CLASSIFICATION LAYER

Image Input 192x192x3 image
Convolution 64 7x7x3 convolutions, stride [1 1]
ReLU Rectify linear unit
Normalization Cross channel normalization
Max Pooling 3x3 max pooling, stride [2 2]
Convolution 64 7x7x64 convolutions, stride [1 1]
ReLU Rectified linear unit
Max Pooling 3x3 max pooling, stride [2 2]
Convolution 64 7x7x64 convolutions, stride [1 1]
ReLU Rectified linear unit
Max Pooling 2x2 max pooling, stride [1 1]
Convolution 96 7x7x64 convolutions, stride [1 1]
ReLU Rectified linear unit
Max Pooling 2x2 max pooling, stride [1 1]
Convolution 96 7x7x96 convolutions, stride [1 1]
ReLU Rectified linear unit
Normalization Cross channel normalization
Max Pooling 3x3 max pooling, stride [2 2]
FulConnection 1024 fully connected layer

ReLU Rectified linear unit
FulConnection 512 fully connected layer
ReLU Rectified linear unit
FulConnection *n* fully connected layer
Softmax Softmax
Classification Crossentropyex *n* classes

B. Data Augmentation for Training

The most important details in this text are the data augmentation methods [7]-[12] used to augment data for small datasets in deep learning. Image augmentation uses deformations to enhance data without changing its characteristics. These methods include color normalization and balance, geometry transformations, affine transformations, resampling, rotation, stretching, shearing, flipping, and normalization. Color normalization and balance are used to improve system accuracy, while geometry transformations are used to shear, distort, and scale stroke data. Resampling techniques include rotation, stretching, shearing, and flipping. All images are normalized by converting all pixels into the [-2.0, 2.0] range to create normalized data.

TABLE II: DATA AUGMENTATION FOR IMPROVING ACCURACY

Dataset	**#Class**	**#Samp**	**Original set A**	**ugmentation**	
			ACC	**#Samp**	**ACC**
ATT-faces	40	240	25.00	6000	88.13
Our dataset	27	1673	91.89	18140	96.14

C. Framework

The outline of the proposed methodology is shown below in Figure 2.

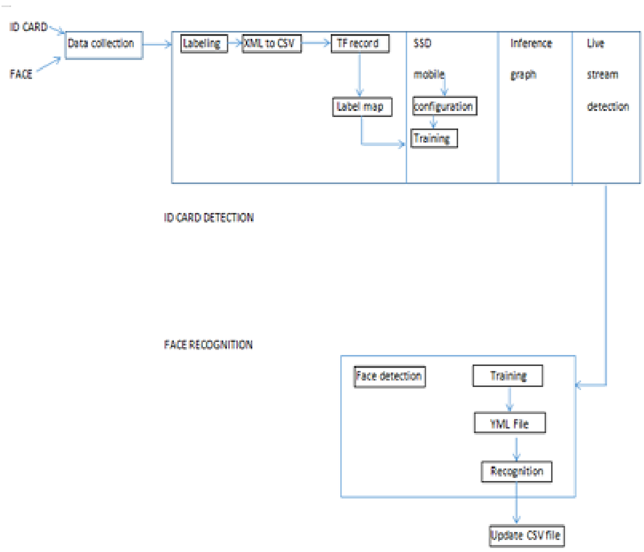

Figure 2: Framework

1. Id card detection:

ID card detection is done using tensor flow to identify if a person is wearing an ID card or not. This process involves-

- Data collection,
- Image labeling,
- Training data generation,
- Label mapping,
- Training configuration,
- Inference graph, and
- ID card detection.

2. Face Detection:

Face detection is a process of determining whether there is a face in the image or not, and providing the coordinates of the face if it is detected. This process is performed using the Haar cascade method, which involves two types of data: positive images (images containing faces) and negative images (images that do not contain faces). The collected dataset is trained [13] and an XML file is obtained.

This process involves-

- Data collection
- Collecting positive images (images containing faces)
- Collecting negative images (images that do not have any faces in them)
- Training the system with the details of positive and negative images
- Generating an XML file
- Face detection

3. Face Recognition:

LBPH (local binary pattern histogram) is a preferred face recognition and pattern recognition method in computer vision. In a grayscale image, a small part of the image is taken as a window of 3x3 pixels or a 3x3 matrix containing intensity levels. The threshold value is taken as the threshold value and a binary matrix is built using it. The binary value is then converted into a decimal value and set to the center of the matrix shown below in figure 3.

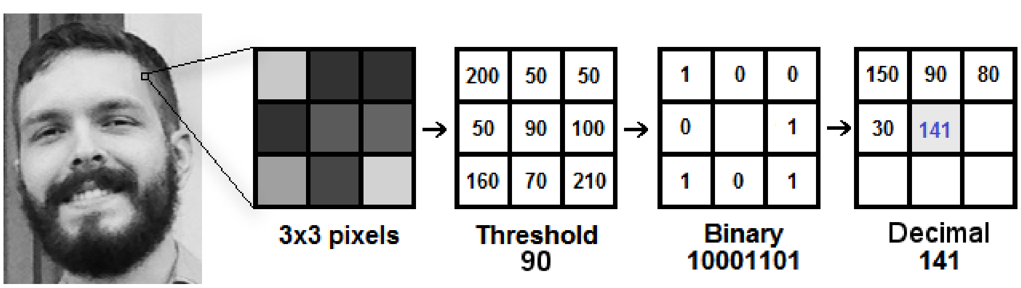

Figure 3: Local binary pattern

The image is converted into grids and a histogram is formed for each grid to form a single histogram as shown below in figure 4.

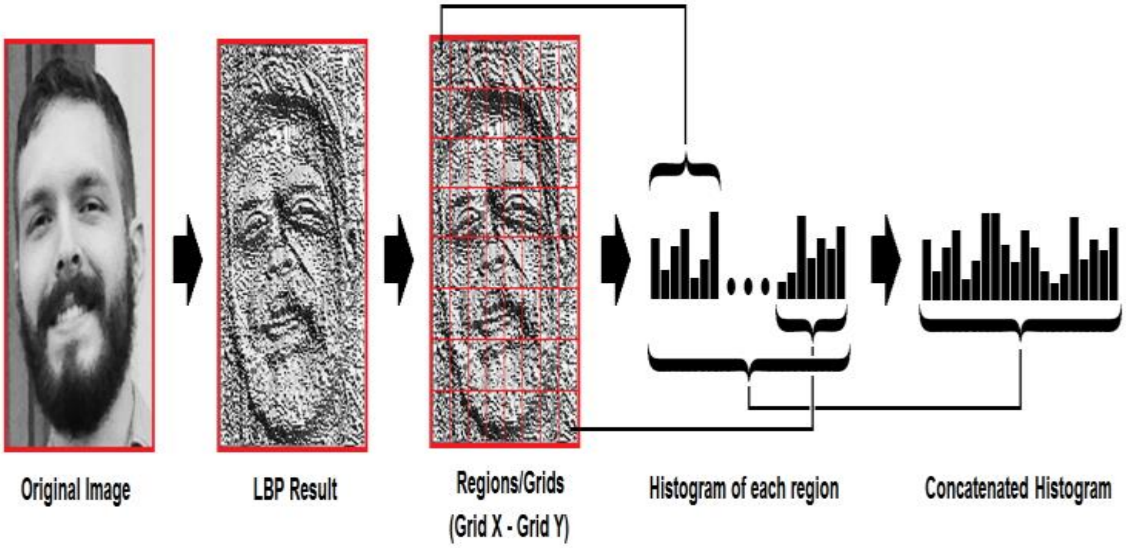

Figure 4: LBPH

The process is performed using the following steps:

- Collecting face data
- Labeling the face data
- Generating a YML file
- Face detection
- Face recognition

RESULT AND ANALYSIS:

The proposed work is designed to detect if a person is wearing an ID card using object detection using tensor flow. If the person is wearing an ID card, the system will mark it with a green rectangle as shown in Figure 5.

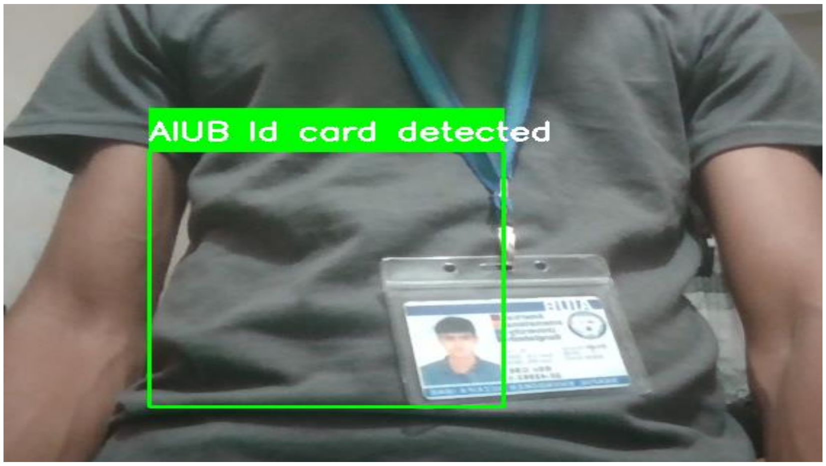

Figure 5: Person wearing ID card

Person not wearing ID card is not detected.

Step 1: ID card not detected.

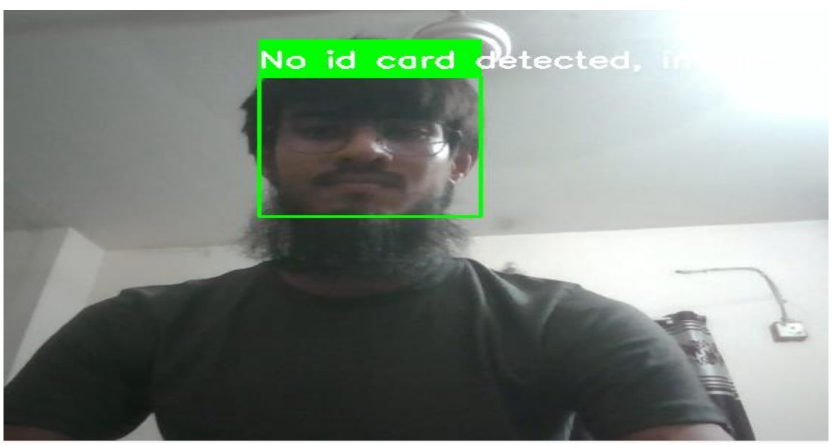

Figure 6: Person not wearing ID card

Step 2: Detect with reorganization the face present in the image.

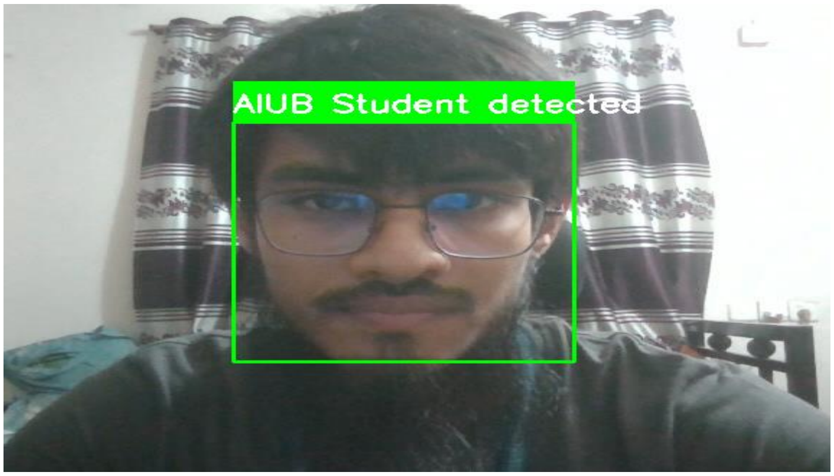

Figure 7: Recognization of the detected face present in the image

CONCLUSION:

Solutions for identity recognition have been proposed, but public surveillance systems still require general information to recognize human identity. The proposed model was tested to detect ID Cards and faces and recognize faces using Tensor Flow Object Detection API with features for ID card detection, Harrcascade classifier for face detection, and LBPH method for face recognition. The results showed that –

- The system was able to detect the presence of ID cards, faces and provide their coordinates.
- Problem areas were moving objects and objects of the same size.
- Face recognition using LBPH is a tremendous success.

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