Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 7.056

IJCSMC, Vol. 10, Issue. 11, November 2021, pg.54 – 58

HUMAN IDENTIFICATION BASED ON FOOT IMAGE RECOGNITION USING CONVOLUTIONAL NEURAL NETWORK

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DOI: 10.47760/ijcsmc.2021.v10i11.007

Abstract— A human footprint is a human biometric system. Each of them has specific footprints. It can be used instead of password authentication in security systems such as user authentication for financial transactions. The password-based system cannot verify that the person entering the password is valid. Therefore, a biometric system is more secure than a password-based system. In this seminar, a new identification system using CNN was presented. In addition, a new foot image data set was created by collecting foot images from 150 people. The presented proposed method presented 100% accuracy when compared with previous studies.

Keywords— CNN, foot images, SVM

I. INTRODUCTION

Biometrics is a basic week for many days today in our progressive human history. Installation of any type of personal identity system for the commercial environment. Advanced commercial systems, real-time traffic trace recognition, in-face recognition, image and traffic trackers. The special feature within the scope of the business is designed in detail from the material point of view. However, in biometric security in general, biometric face, fingerprint, palm print, and iris examination is the main thing in fingerprint research. Biometric fingerprint, a person's texture, foot shape, small dots, special points, foot length, etc. can identify with. Know it loud. Foot biometrics studies continue with Kennedy software users Forensic Applications to apply 38 local geometries [1].

They are considered difficult because they can be applied: (a) their feet are close together, (b) they are applied high in the footprints of the facial lines and foot prints. In the options of precision and human system configuration, the choice is made from the basic and basic choices, general choices for the design of the overall design. However, personal identification using feet may be the preferred biometric identifier when three conditions apply:

- The environment guarantees a clean and comfortable capture of footprints,
- high security is not demanded and
- Users request non-invasive identifiers in terms of privacy issues.

If these biometrics are met, the foot biometrics can be used as a covert system. Due to the daily practice of wearing shoes, seat belt markings are difficult to correct or to obtain clearly. Finally, biometric data does not

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imply extensive, all-around security risks, since biometric data is not a suitable authentication for high-security applications [2,16,17,18,19].

II. SURVEY

Tanapon Keatsamarn et al. [3] Convolutional Neural Network Training is used to classify deep learning. Convolutional neural networks are essential for deep learning and are suitable for image recognition. The convolutional neural network is trained with fingerprint images of 13 people, and the validation data is validated with the trained network. This network offers 92.69% trace detection. This means that more than 92% of the predicted labels match the actual labels in the test series.

Wenxia Bao et al. [1] proposed a fingerprint recognition algorithm based on optical fingerprint images. The algorithm first converts the fingerprint image into the complex frequency range using the complex double tree wave transformation (DTCWT) and then generates a histogram of the direct gradient properties (HOG) of the fingerprint image in the complex frequency range. Finally, a symmetrical projection matrix is achieved through metric training. A symmetrical projection matrix is used to project original elements into a new element space. The SVM is then used to define the visual impression in the new functional area. Experimental results show that the algorithm described in this article has improved recognition accuracy in the optical fingerprint images of 134 people and is suitable for easier fingerprint acquisition and retrieval. As a result, the accuracy of the DTCWT and SVM was 88.13.

Rong Wang et al. [4] This publication presents a method for fingerprint recognition based on neural fuzzy and wavelet networks. The fingerprint image is first transformed with a wavelet for edge detection, then the membership functions are generated from the angle, length and area parameters based on the statistical distribution of the fingerprint images. Various forms and are used as these meanings. a single decision factor. The complex judgment vector can be obtained by working out these unique judgment factors. Finally, the distance vector between the integral decision vector and the four model vectors is calculated in order to feed the neural networks for decision making. Since the process of the blurred neural network can subjectively and accurately reproduce various forms of the finger image, the automatic recognition rate is 92.80% in total.

David Huggins et al. Semi-continuous acoustic models, in which the output distributions share a common code of Gaussian density functions for all cases of the hidden Markov model presented in [5], are a well-known and proven method for reducing calculations in automatic language recognition. However, the size of the parameter files and thus the working memory at runtime can be very large. Demonstrates how nonlinear quantization can be combined with a mixed weight distribution truncation technique to cut model sizes in half with minimal performance overhead and without increasing error rates. Testing of the data collected during the study showed an accuracy of 82.2%.

III. DATASET COLLECTION

In the study, data were collected from 150 different people living in the country of Iraq. First of all, people were informed about the study and it was explained that participation in the study was voluntary. People who agreed to participate in the study were asked to take off their shoes and socks. A piece of black cloth to be used in all subjects was determined by the researcher. It was aimed both to prevent the subjects from getting dirty by placing their feet on the ground and to prevent the formation of a different background for each subject. Photographs of each subject were taken from different angles, with a total of at least 40 and a maximum of 100. Half of these photos were taken for the right foot and the other half for the left foot. Thus, a total of 6944 images were obtained from the subjects. No information was requested to qualify or identify individuals. Each person was coded with an ID number and only their age and gender were recorded. A naming convention has been developed for each photograph taken.

IV. ALEXNET

We can't talk about deep learning without mentioning Alexnet. In fact, it is one of the pioneers of deep learning focused on image classification. It was designed by Alex Krizhevsky, Ilya Sutskever and Jeffrey Hinton and won the Image Classification Challenge (ILSVRC) in 2012 [20].

At the time, other competing algorithms were not based on deep learning. Almost everyone has done it today and ever since. This network had a huge impact on their domains and most of the networks listed below were more or less based on their architecture. Alexnet consists of 5 foldable layers (C1 to C5 in the diagram) followed by two fully connected layers (FC6 and FC7) and the final Softmax output layer (FC8). It was originally trained to recognize 1000 different objects [21].

The architectures of AlexNet and LeNet are very similar as shown in Figure 3.2. Note that we've provided a slightly more streamlined version of AlexNet that removes some of the design quirks needed in 2012 to fit the

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model into two smaller GPUs. In this study the AlexNet used as feature extraction to reduce the processing time and extracted high level features [22].

V. PROPOSED METHOD

This section details, in turn, each of the processes performed in this study. Typically, this section describes all data mining, machine learning, and deep learning processes. This process is interactive and iterative. There are many steps in the process that require collaboration between the user and the system, and these steps can be repeated several times until satisfactory results are achieved. The proposed method protocol listed below:

- Data preprocessing is the first and most important step in the data mining process. Any mistake made at this point will completely affect the next process. Therefore, all necessary pre-processing should be done on the data.
- Inconsistent or missing information in databases is called noise. Delete the data of this noise; Methods of eliminating records with missing values, assigning a fixed value instead of missing values, assigning statistics to other data (mean, maximum, minimum, etc.), or assigning values obtained by an estimation method (decision tree, regression, etc.).)) adapted to the data. In addition, subtracting data from extreme (extreme) values ensures that the results obtained are correct.
- Sometimes there may be too many redundant variables in the analyzed dataset. Such unnecessary variables degrade the quality of the models and force the algorithms to work for a long time. Convolutional neural network, pretrained models such as AlexNet and Densenet201 are used to transform this large number of variables into a small number of variables.
- In the last stage, several classifiers applied to classify the extracted features by CNN. These classifiers results are compared and presented in the last section.

VI. RESULTS

There are different numbers of image data belonging to a total of 150 people. All these data are feature extracted with LPQ. It is presented to classification algorithms to determine who each image belongs to among 100 people. The correct classification rates and algorithm information obtained are shown in the table below. The highest correct classification rate with 100% was obtained with the algorithm called Linear Discriminant, which is one of the linear models. It is seen that some algorithms achieve an accuracy rate above 90% and some algorithms below 71.34%. The number of algorithms here was 14 in total because the others did not produce results. Algorithms produce different results in each trial. However, in this study, each algorithm was run once and only one type of specified parameters were used. The value of 5 for the cv parameter and 10 for the random_state parameter is used for the Linear Discriminant algorithm here. By changing these parameters, different results can be produced.

TABLE I
comparison table

Ref	**Year**	**Results (%)**
[6]	2017	92
[7]	2016	97
[8]	2019	98.5
[9]	2015	98.7
[10]	2017	93
[11]	2019	94.1
[12]	2016	90

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[13]	2018	91.8
[14]	2019	90
[15]	2019	99.4
Our Method	2021	100

VII. CONCLUSIONS

In this study, it was aimed to determine who the person is from the foot images, how old they are and what gender they are. For this, 6944 images were collected from 150 different people. The features of these images were extracted with the CNN method and the Linear Discriminant classifier was carried out with many different algorithms in the Python program. While 100% accuracy rate was obtained for person recognition. All these results show that recognition from foot images is possible with high success with the method here. In the examinations made in the literature, no source directly similar to the study here was found. The high success rate of the study here shows that the method performs a quality image recognition. It is thought that many different diseases or personal conditions will be detected from foot images with different studies on this subject.

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