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CNN BASED FRAMEWORK FOR DESIGNING CONTACTLESS TO CONTACT BASED FINGERPRINTS

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ABSTRACT

Now a day almost each and every application is secured with some authentication technique and one among them is finger print authentication which is present in each and every mobile devices. This fingerprint recognition and authentication comes under the field of pattern recognition. This pattern recognition is example of mobile devices which use sensors for authenticating the users. As we all know that in some situations these finger print authentication is not giving accurate results when compared with contact based to contact less. Hence this motivated me to design an application using CNN(Convolutional Neural Networks) for fingerprint recognition. By using CNN model, we can design the system very accurately for identifying and match both contactless and contact-based fingerprint images. In order to design this model we initially collect finger print dataset from NIST dataset, which contains more than 2400 finger prints, which paired into 1200 paired fingerprints. In this we try to collect both identical and non-identical images and then try to train the system with these images. Once the system is trained with these images we can able to test some sample images and find whether the CNN model is accurately identifying the images either contact based or contact less. Our experimental results clearly state that our method can give accuracy of more than 90 percent compared with primitive ML models.

Keywords:

Machine Learning Algorithms, CNN Model, Finger Print Recognition, NIST Dataset, Authentication.

1. INTRODUCTION

Now a day's fingerprint verification systems are becoming more and more in order for personal authentication and verification. There are several authentication systems and one among them is fingerprint recognition, which is mostly accepted and which was used officially by many applications for user authentication. This finger print authentication is not only used for authenticating individuals in order to verify themselves but also used by the cyber-crime department to identify the criminals by using the fingerprints left on the suitable surfaces[1]. In general there are several methods used for finger print authentication in the literature but no method is giving almost accurate and efficient results. Hence in this current application we try to use CNN (Convolutional Neural networks) for improving the accuracy of our proposed fingerprint recognition in both contact based and contact less finger print authentication system[2].

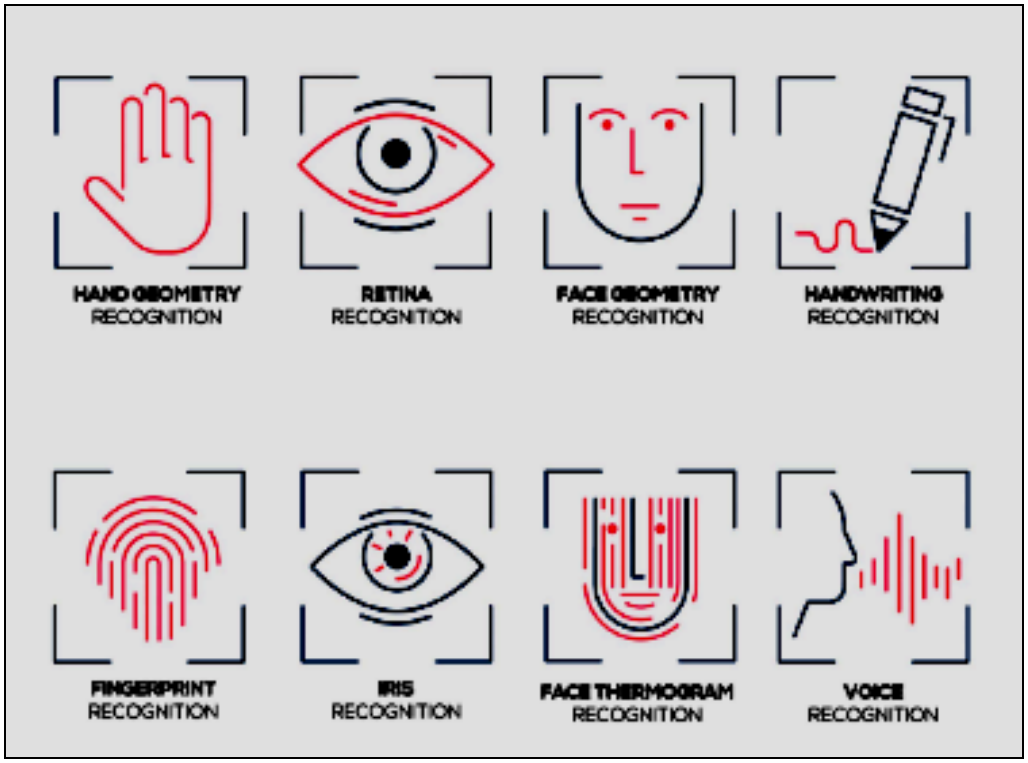

Figure 1. Represent the Static and Dynamic Methods of Authentication System

Traditional authentication systems try to use some methods such as passwords, pin numbers, smart card authentication and etc., were largely unable to meet the user original requirement. At that situation some advanced level of authentication methods came into existence like facerecognition,iris recognition, voice and finger print recognition for improving the user requirement with some more efficient and accurate result, which is shown in above figure1. Out of all the several authentication methods, especially finger print identification is one which is mostly used by civil and law enforcement department[3] for several applications in order to match the presence of culprit. In the primitive authentication methods, almost all the users try to take the input as finger print images and match those images by pressing finger against the surface that are hard, and sometimes these harder substances often lead to a partial or degraded images due to placement of improper fingers. This is becoming a major problem and serious issue in contact-based system. To solve this issue we try to replace the

contact based finger print authentication with contact less finger print authentication so that we can get accurate results without getting any problems[4].

2. LITERATURE SURVEY

Literature survey is that the most vital step in the software development process. Before developing the new application or model, it's necessary to work out the time factor, economy, and company strength. Once all these factors are confirmed and got approval then we can start building the application. The literature survey is one that mainly deals with all the previous work which is done by several users and what are the advantages and limitations of those previous models. This literature survey is mainly used for identifying the list of resources to construct this proposed application.

MOTIVATION

1) Contactless Fingerprint Recognition System Based On CNN.

AUTHORS: Isha Meshram and P. P. Rathod

In this paper, the authors mainly concentrated on the importance of finger print authentication over several types of authentication methods. The authors described that finger- print authentication is better than several other authentication systems and the main goal of them is to investigate the capability of CNN for finger print authentication. In this paper they try to study more importance about contact less finger print authentication based on primitive ML models and finally want to compare this method with CNN model[5].

2) Machine Learning Techniques for Fingerprint Identification: A Short Review

AUTHORS: Ali Ismail Awad

In this paper, the authors mainly discussed about a machine learning algorithms for finger print authentication. The authors clearly described that finger print is one kind of best bio metric trait which is having more security compared with other bio metric authentication. And this is also having another advantage like low cost to implement in any real world environment. A lot of challenges are raised for finger print authentication and classification to design a proper method which can have all the features. Machine learning algorithms are one which can provide solution for the primitive finger print authentication challenges and they can emphasize the problem by using new models[6].

3) A Study on Machine Learning Approach for Fingerprint Recognition System.

AUTHORS: Neetesh Gupta

In this paper, the authors mainly discussed the study of several ML algorithms for finger print recognition and they showed the importance of each and every method on finger print authentication. The authors discussed about the finger print authentication are an evolving technology that is used in various fields like forensics and cyber security. Also the authors discussed that finger print authentication is very oldest method which is widely used in bio metrics and this can be influence the several factors like mismatch of fingers if they are not properly scanned and also behaviour of users plays a main role while finger print authentication. These factors are the main reasons why lot of users tries to avoid finger print authentication and in this paper the authors mainly concentrated on all those factors and try to provide a proper solution for all these factors[7].

3. EXISTING SYSTEM AND ITS LIMITATIONS

In the existing system we try to use the general ML algorithms for image processing techniques technique for finding the person based on his finger prints. In general the Computer vision (CV) is platform used for matching the applications with images. This CV may not be accurate when we use for finger print comparison because the finger print matching requires some internal process like: Finger Print details, respective ridge map and specific area of ridge map. A distance-aware loss function is generated using deep fingerprint[8] representation present in the image. All these factors are not accurate in primitive ML approach in order to predict the human based on finger print detection.

LIMITATIONS OF THE EXISTING SYSTEM

1. The existing system didn't concentrate on the property of deep learning.
2. Machine learning works with lot of applications which are using image as main prediction input.
3. In primitive ML, for image based application we use Computer Vision package but this is not accurate for all image based applications.
4. The existing Ml algorithms failed to identify the finger print authentication in accurate manner compared with other CV applications.

4. PROPOSED SYSTEM AND ITS ADVANTAGES

In the proposed system we try to design a CNN model for image analysis . This paper builds a CNN-based framework to precisely match contactless and contact-based fingerprint images. This framework initially trains a multi-Siamese CNN using fingerprint details, respective ridge map and specific area of ridge map. A distance-aware loss function is generated using deep fingerprint representation. For more accurate cross comparison deep fingerprint representations generated in such multi-Siamese network are concatenated. The proposed

methodology for cross-fingerprint comparison is calculated on two publicly available data. The available database contains contactless 2D fingerprints and respective contact-based fingerprints.

ADVANTAGES OF THE PROPOSED SYSTEM

1. Machine learning works with large amounts of data. It is useful for small amounts of data too. Deep learning on the other hand works efficiently if the amount of data increases rapidly.
2. CNN-based framework works good in match contactless and contact-based fingerprint images..
3. This framework initially trains a multi-Siamese CNN using fingerprint details, respective ridge map and specific area of ridge map.
4. The traditional machine learning algorithms follow a standard procedure to solve the problem. It breaks the problem into parts, solve each one of them and combine them to get the required result. Deep learning focuses in solving the problem from end to end instead of breaking them into divisions.

5. EXPERIMENTAL RESULTS

Implementation is a stage where the theoretical design is converted into a programmatic manner. In this proposed application we try to use PYTHON as a programming language in which Jupiter Notebook as a working platform to process the current application.

STEP 1: IMPORTING ALL NECCESARY LIBRARIES

```
from __future__ import print_function
import numpy as np

np.random.seed(1337)  # for reproducibility

import pandas as pd
from PIL import Image
from keras.models import Sequential
from keras.layers import Dense, Dropout, Activation, Flatten
from keras.layers import Convolution2D, MaxPooling2D
from keras.utils import np_utils
from keras import backend as K
```

STEP 2: LOAD TRAIN AND TEST DATA INTO SEPARATE VARIABLES

```
batch_size = 10
nb_classes = 2
nb_epoch = 20

# To make the data ready for CNN, pictures are named with indexes,
like '1.jpg', '2.jpg', etc..
def dir_to_dataset(mypath, loc_train_labels=""):
    dataset = []

    gbr = pd.read_csv(loc_train_labels, sep="\t")
```

STEP 3: DATA PRE-PROCESSING

```
    gbr = pd.read_csv(loc_train_labels, sep="\t")

    #for file_count, file_name in enumerate( sorted(glob
(glob_files),key=len) ):
    for i in range(1,1201):
        image = Image.open(mypath + str(i)+'.jpg')
        img = Image.open(mypath + str(i)+'.jpg').convert('LA')
#tograyscale
        pixels = [f[0] for f in list(img.getdata())]
        dataset.append(pixels)
    # outfile = glob_files+"out"
    # np.save(outfile, dataset)
```

STEP 4: Building CNN Model

```
        model = Sequential()
        model.add(Convolution2D(nb_filters, kernel_size[0],
    kernel_size[1],
                        border_mode='valid',
                        input_shape=input_shape))
        model.add(Activation('relu'))
        model.add(Convolution2D(nb_filters, kernel_size[0],
    kernel_size[1]))
        model.add(Activation('relu'))
        model.add(MaxPooling2D(pool_size=pool_size))
        model.add(Dropout(0.25))

        model.add(Flatten())
        model.add(Dense(128))
        model.add(Activation('relu'))
        model.add(Dropout(0.5))
        model.add(Dense(nb_classes))
        model.add(Activation('softmax'))

        model.compile(loss='categorical_crossentropy',
                optimizer='sgd',
                metrics=['accuracy'])
```

STEP 5 : Start Training CNN with Parameters and fit the model.

```
model.compile(loss='categorical_crossentropy',
        optimizer='sgd',
        metrics=['accuracy'])

model.fit(X_train, Y_train, batch_size=batch_size,
nb_epoch=nb_epoch, verbose=1, validation_data=(X_test, Y_test))
score = model.evaluate(X_test, Y_test, verbose=0)
print('Test score:', score[0])
print('Test accuracy:', score[1])
```

After training the model we got classification accuracy of greater than 75 percent.

6. CONCLUSION

In this current work we for the first time designed and implemented an application using deep learning CNN model in the bio metric authentication for finger print detection using both contact based and contact less detection. This paper builds a CNN-based framework to precisely match contactless and contact-based fingerprint images. This framework initially trains a multi-Siamese CNN using fingerprint details, respective ridge map and specific area of ridge map. A distance-aware loss function is generated using deep fingerprint representation. For more accurate cross comparison deep fingerprint representations generated in such multi-Siamese network are concatenated. The proposed methodology for cross-fingerprint comparison is calculated on two publicly available data. The available database contains contactless 2D fingerprints and respective contact-based fingerprints. By conducting various experiments on our proposed model, we achieved a classification accuracy of greater than 75 percent when applied to the test dataset.

7. REFERENCES

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