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DETECTION OF CRIME USING DACTYLOSCOPY AND FACIAL RECOGNITION

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Abstract

Fingerprint images in crime scene are important clues to solve serial cases. In this paper we present a complete crime scene fingerprint identification system using deep machine learning with Convolutional Neural Network (CNN) and face recognition using Deep Network with Adaptive Threshold. Images are acquired from crime scene using methods ranging from precision photography to complex physical and chemical processing techniques and saved as the database. The images collected from the crime scene are usually incomplete and hence difficult to categorize. Suitable enhancement methods are required for pre-processing the fingerprint images. Minutiae are extracted from the fingerprint images. The features of pre-processed data are fed into the CNN as input to train and test the network. In face recognition feature vector (or embedding) is extracted form an input face image by using a deep network. We assign a threshold to the registered face during each registration, and the thresholds of the other registered faces will be modified accordingly. For recognition, given a query image, we extract its feature embedding and compute the similarity scores between it and all of the other stored embeddings. Then we intended use the similarity scores to determine the identity of the query image. The experimental results demonstrated on database using Open CV-Python shows high accuracy recognition a partial or full fingerprints and face in the criminal database. Final part shows the matched person details like name, mobile number, address, face.

Key Terms: CNN – Convolutional Neural Network, ReLU – Rectified Linear Unit, MTCNN - Multi-task Cascaded Convolutional Networks

1. Introduction

Given the image of fingerprint or face image as input, the output of finding who has committed the crime at fastest rate is our goal. We use registered data set if the data are new, we can add it to the data set in our server. the extra features like Modifying, adding, delete or retrieve it according to the circumstances of our case. Convolutional Neural Network (CNN) and face recognition using Deep Network with Adaptive Threshold are used as our algorithm. This algorithm gives feasible output in short time. The experimental results demonstrated on database using Open CV-Python shows high accuracy recognition as partial or full fingerprints and face in the criminal database. Final part shows the matched person details like name, mobile number, address, face. Etc.

2. Literature Survey

Chen Liang and others [1] work introduced an adaptive learning algorithm with an adaptive learning rate, and the algorithm is applied into the human face recognition. It solves the problems in choosing the appropriate rate and improves the slow process when faced with big data. The complexity of the layers structures and improving the computing ability further method which can reduce our complexity time and overhead.

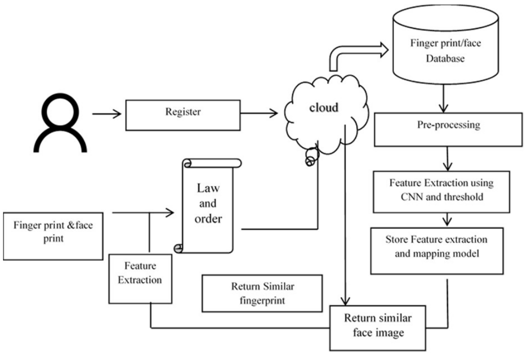
Kaipeng Zhang and others [2] propose a deep cascaded multi-task framework which exploits the inherent correlation between them to boost up their performance. In particular, the framework adopts a cascaded structure with three stages of carefully designed deep convolutional networks that predict face and landmark location in a coarse-to-fine manner.

Hsin-Rung Chou and others [3] propose the technique of data feature specific adaptive thresholding to improve the recognition accuracy. This value of threshold is calculated according to score value and each image gets checked with the input given. only if the score meets the passing criteria only then their details are displayed fast.

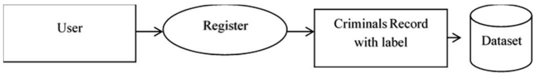
Wahid Zafar and others [4] proposed an alternate method. In this method first, Fingerprint image is enhanced using Fast Fourier Transform and converted to binary image for further processing. In second step, image is thinned and minutiae are extracted. Finally, minutiae pairs of two fingerprints are matched to get matching score.

3. System Design

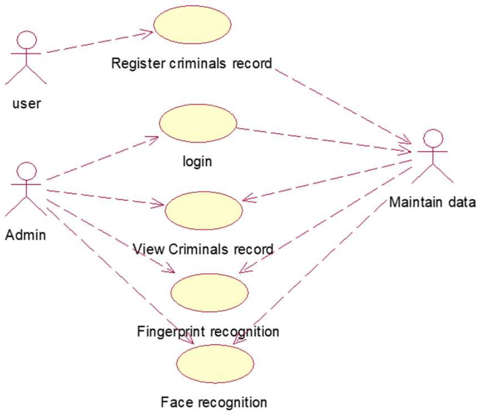
The system uses a combination of techniques in two topics; face detection and finger print recognition. The face detection is performed on images and fingerprint images is identified. The process is done by using two algorithms each of one is explained further in the process. In this work, we introduce another kind of margin to the Softmax loss function, which is more intuitive and interpretable. including the image resolution, pre-processing method and the network structure.



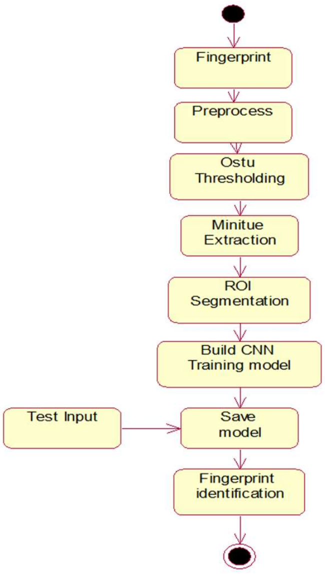
In our proposed system propose we use novel two factor biometric crime detection using face and fingerprint. It contains two phase fingerprint identification and face recognition. From the crime scene fingerprint and face image identification we use deep machine learning with Convolutional Neural Network (CNN) and face recognition using Deep Network with Adaptive Threshold. we register our fingerprint and face in the registration module. After that we are training the fingerprint and face with threshold. Finally recognizing the similar fingerprint and face image on the recognition phase which result can mapping with database the display the criminal personal information.



Suitable enhancement methods are required for pre-processing the fingerprint images.



Minutiae are extracted from the fingerprint images. The features of pre-processed data are fed into the CNN as input to train and test the network.



We assign a threshold to the registered face during each registration, and the thresholds of the other registered faces will be modified accordingly.

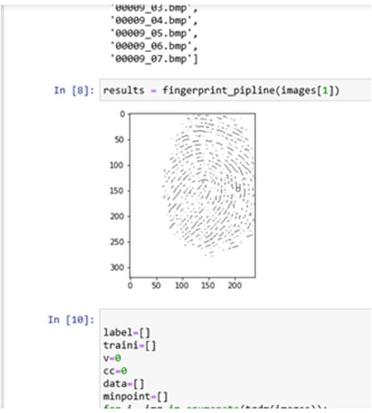
For recognition, given a query image, we extract its feature embedding and compute the similarity scores between it and all of the other stored embedding's. Then we use the similarity scores to determine the identity of the query image.

4. Implementation

The CNN is a convolutional neural network based on deep supervised learning model. In this regard, CNN can be viewed an automatic feature extractor and a trainable classifier Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resemble of the organization of the animal visual cortex.

CNNs use relatively little pre-processing compared to other image classification algorithms. This means that the network learns to optimize the filters (or kernels) through automated learning, whereas in traditional algorithms these filters are hand-engineered. This independence from prior knowledge and human intervention in feature extraction is a major advantage. The configuration details of the proposed fingerprint-CNN architecture. The proposed model has five convolutional layers and three max-pooling layers which can be are computed in addition, three rectified linear unit (ReLU) are used to our system.

Simple Thresholding was explained with different types of thresholding techniques. Another Thresholding technique is Adaptive Thresholding. In Simple Thresholding, a global value of threshold was used which remained constant throughout. So, a constant threshold value won't help in the case of variable lighting conditions in different areas. Adaptive thresholding is the method where the threshold value is calculated for smaller regions. This leads to different threshold values for different regions with respect to the change in lighting.

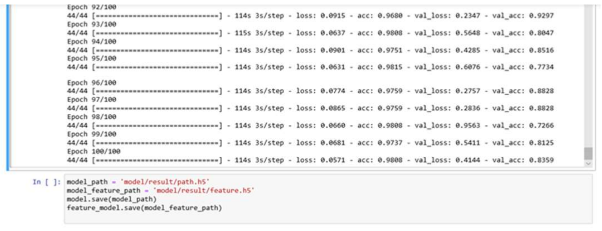


```
 '00009_03.bmp',
 '00009_04.bmp',
 '00009_05.bmp',
 '00009_06.bmp',
 '00009_07.bmp']

In [8]: results = fingerprint_pipline(images[1])
```

```
In [10]:
         label=[]
         traini=[]
         v=0
         cc=0
         data=[]
         minpoint=[]
```

Given a query image, we first utilize the Multi-task Cascaded Convolutional Networks (MTCNN) to detect and align the face. Next, we utilize a well-trained face recognition model trained on Inception-ResNet-v1 with a L2 normalization layer as proposed by Face Net. In the inference phase, we extract the output of the L2 normalization layer as the unified facial feature embedding. As the embeddings are L2–normalized, we use the inner product between two embeddings to compute their similarity.

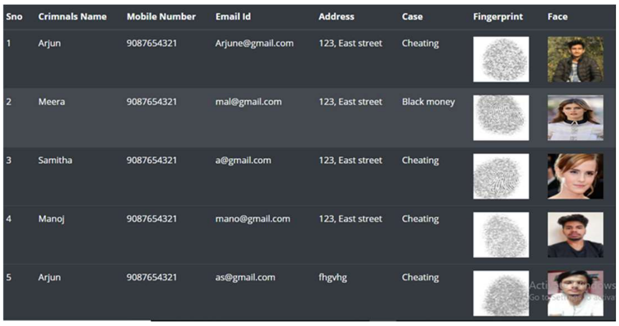


```
Epoch 92/100
44/44 [==============================] - 114s 3s/step - loss: 0.0915 - acc: 0.9680 - val_loss: 0.2347 - val_acc: 0.9297
Epoch 93/100
44/44 [==============================] - 115s 3s/step - loss: 0.0637 - acc: 0.9808 - val_loss: 0.5648 - val_acc: 0.8047
Epoch 94/100
44/44 [==============================] - 114s 3s/step - loss: 0.0901 - acc: 0.9751 - val_loss: 0.4285 - val_acc: 0.8516
Epoch 95/100
44/44 [==============================] - 114s 3s/step - loss: 0.0631 - acc: 0.9815 - val_loss: 0.6076 - val_acc: 0.7734

Epoch 96/100
44/44 [==============================] - 114s 3s/step - loss: 0.0774 - acc: 0.9759 - val_loss: 0.2757 - val_acc: 0.8828
Epoch 97/100
44/44 [==============================] - 114s 3s/step - loss: 0.0865 - acc: 0.9759 - val_loss: 0.2836 - val_acc: 0.8828
Epoch 98/100
44/44 [==============================] - 114s 3s/step - loss: 0.0660 - acc: 0.9808 - val_loss: 0.9563 - val_acc: 0.7266
Epoch 99/100
44/44 [==============================] - 114s 3s/step - loss: 0.0681 - acc: 0.9737 - val_loss: 0.5411 - val_acc: 0.8125
Epoch 100/100
44/44 [==============================] - 114s 3s/step - loss: 0.0571 - acc: 0.9808 - val_loss: 0.4144 - val_acc: 0.8359

In [ ]: model_path = 'model/result/path.h5'
        model_feature_path = 'model/result/feature.h5'
        model.save(model_path)
        feature_model.save(model_feature_path)
```

At each registration t, we insert the feature embedding Ft and its identity Pt into the database; then we update the threshold σ τ t accordingly. Σ τ t denotes the threshold of registered feature embedding F τ when Ft is registering into the database.



Sno	Crimnals Name	Mobile Number	Email Id	Address	Case	Fingerprint	Face
1	Arjun	9087654321	Arjune@gmail.com	123, East street	Cheating		
2	Meera	9087654321	mal@gmail.com	123, East street	Black money		
3	Samitha	9087654321	a@gmail.com	123, East street	Cheating		
4	Manoj	9087654321	mano@gmail.com	123, East street	Cheating		
5	Arjun	9087654321	as@gmail.com	fhgvhg	Cheating		

We assign a different threshold for each facial embedding in the database. For threshold σ τ t we first compute the similarity score between the embeddings F τ and F v in the database. Given a query facial image Iλ without its identity label, we first extract the embedding Fλ by the deep CNN.

5. Conclusion and Future Enhancement

Fingerprint and Face identification system used for identifies the criminal who involved in the crime helps to automate fingerprint identification process and face recognition. Pre-processing was performed with Otsu thresholding, fingerprint thinning and minutiae extraction with Cross-Number method.

Using CNN classifier, improved fingerprint identification accuracy of near 90% is achieved. In our loss function, the margin is a manually tuned global hyperparameter. How to automatically determine the margin, what's the performance of class-specific or sample-specific margins are still very interesting questions to be studied. prove the prediction accuracy.

6. References

[1]: Heng-Wei Hsu, Tung-Yu Wu, Wing Hung Wong and Chen-Yi, "CORRELATION-BASED FACE DETECTION FOR RECOGNIZING FACES IN VIDEOS in ICASSP 2019.

[2]: Kruti Goyal, Kartikey Agarwal, Rishi Kumar, "FACE DETECTION AND TRACKING Using OpenCV "in ICECA 2018

[3]: Adrian Rhesa SeptianSis want to, AntoSatriyo Nugroho, Maulahikmah Galinium, "IMPLEMENTATION OF FACE RECOGNITION ALGORITHM FOR BIOMETRICS BASED TIME ATTENDANCE SYSTEM "in ICTSS 2014.

[4]: S. Sharma, Karthikeyan Shanmuga Sundaram, Sathees Kumar Ramasamy, "FAREC — CNN based efficient face recognition technique using Dlib "inICACCCT 2016.