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Missing Child Identification System using Deep Learning and Multiclass SVM

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ABSTRACT:

In India a countless number of children are reported missing every year. Among the missing child cases a large percentage of children remain untraced. This paper presents a novel use of deep learning methodology for identifying the reported missing child from the photos of multitude of children available, with the help of face recognition. The public can upload photographs of suspicious child into a common portal with landmarks and remarks. The photo will be automatically compared with the registered photos of the missing child from the repository. Classification of the input child image is performed and photo with best match will be selected from the database of missing children. For this, a deep learning model is trained to correctly identify the missing child from the missing child image database provided, using the facial image uploaded by the public. The Convolutional Neural Network (CNN), a highly effective deep learning technique for image based applications is adopted here for face recognition. Face descriptors are extracted from the images using a pre-trained CNN model VGG-Face deep architecture. Compared with normal deep learning applications, our algorithm uses convolution network only as a high level feature extractor and the child recognition is done by the trained SVM classifier. Choosing the best performing CNN model for face recognition, VGG-Face and proper training of it results in a deep learning model invariant to noise, illumination, contrast, occlusion, image pose and age of the child and it outperforms earlier methods in face recognition based missing child identification. The classification performance achieved for child identification system is 99.41%. It was evaluated on 43 Child cases.

Key words: CNN,Deeplearning,Svm Classifier.

I INTRODUCTION

Children are the greatest asset of each nation. The future of any country depends upon the right upbringing of its children. India is the second populous country in the world and children represent a significant

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percentage of total population. But unfortunately a large number of children go missing every year in India due to various reasons including abduction or kidnapping, run-away children, trafficked children and lost children. A deeply disturbing fact about India's missing children is that while on an average 174 children go missing every day, half of them remain untraced. Children who go missing may be exploited and abused for various purposes. As per the National Crime Records Bureau (NCRB) report which was cited by the Ministry of Home Affairs (MHA) in the Parliament (LS Q no. 3928, 20-03-2018), more than one lakh children (1,11,569 in actual numbers) were reported to have gone missing till 2016, and 55,625 of them remained untraced till the end of the year. Many NGOs claim that estimates of missing children are much higher than reported. Mostly missing child cases are reported to the police. The child missing from one region may be found in another region or another state, for various reasons. So even if a child is found, it is difficult to identify him/her from the reported missing cases. A framework and methodology for developing an assistive tool for tracing missing child is described in this paper. An idea for maintaining a virtual space is proposed, such that the recent photographs of children given by parents at the time of reporting missing cases is saved in a repository. The public is given provision to voluntarily take photographs of children in suspected situations and uploaded in that portal. Automatic searching of this photo among the missing child case images will be provided in the application. This supports the police officials to locate the child anywhere in India. When a child is found, the photograph at that time is matched against the images uploaded by the Police/guardian at the time of missing. Sometimes the child has been missing for a long time. This age gap reflects in the images since aging affects the shape of the face and texture of the skin. The feature discriminator invariant to aging effects has to be derived. This is the challenge in missing child identification compared to the other face recognition systems. Also facial appearance of child can vary due to changes in pose, orientation, illumination, occlusions, noise in background etc. The image taken by public may not be of good quality, as some of them may be captured from a distance without the knowledge of the child. A deep

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learning [1] architecture considering all these constrain is designed here.

Literature Survey

Earliest methods for face recognition commonly used computer vision features such as HOG, LBP, SIFT, or SURF [2-3]. However, features extracted using a CNN network for getting facial representations gives better performance in face recognition than handcrafted features. In [4], missing child identification is proposed which employees principal component analysis using Eigen vectors is used for face recognition system. FindFace is a website that lets users search for members of the social network VK by uploading a photograph [5]. FindFace employs a facial recognition neural network algorithm developed by N-Tech Lab to match faces in the photographs uploaded by its users against faces in photographs published on VK, with a reported accuracy of 70 percent.

WORK FLOW OF FACE RECOGNITION

Here we propose a methodology for missing child identification which combines facial feature extraction based on deep learning and matching based on support vector machine. The proposed system utilizes face recognition for missing child identification. This is to help authorities and parents in missing child investigation

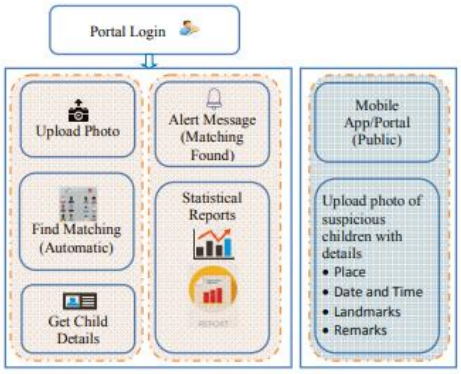

Fig. 1. Architecture of proposed child identification system

It consists of a national portal for storing details of missing child along with the photo. Whenever a child missing is reported, along with the FIR, the concerned officer uploads the photo of the missing child into the portal. Public can search for any matching child in the database for the images with them. The system will prompt the most matching cases. Once the matching is found, the officer can get the details of the child. The system also generates various statistical reports. The public can upload photo of any suspicious child at any time into the portal with details like place, time, landmarks and remarks. The photo uploaded by the public will be automatically compared with photos of the

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registered missing children and if a matching photo with sufficient score is found, then an alert message will be sent to the concerned officer. The message will also be visible in the message box of the concerned officer login screen. The portal for the public can also be maintained as a mobile app, where he or she can upload photo of suspicious children with details. In the mobile app, location of the person updating the photo will also be automatically recorded. Whenever public uploads photo of a suspected child, the system generates template vector of the facial features from the uploaded photo. If a matching is found in the repository, the system displays the most matched photo and pushes a message to the concerned Officer portal or SMSs the alert message of matching child. Similarly the Officer can check

for any matching with the database at any time using the proposed system.

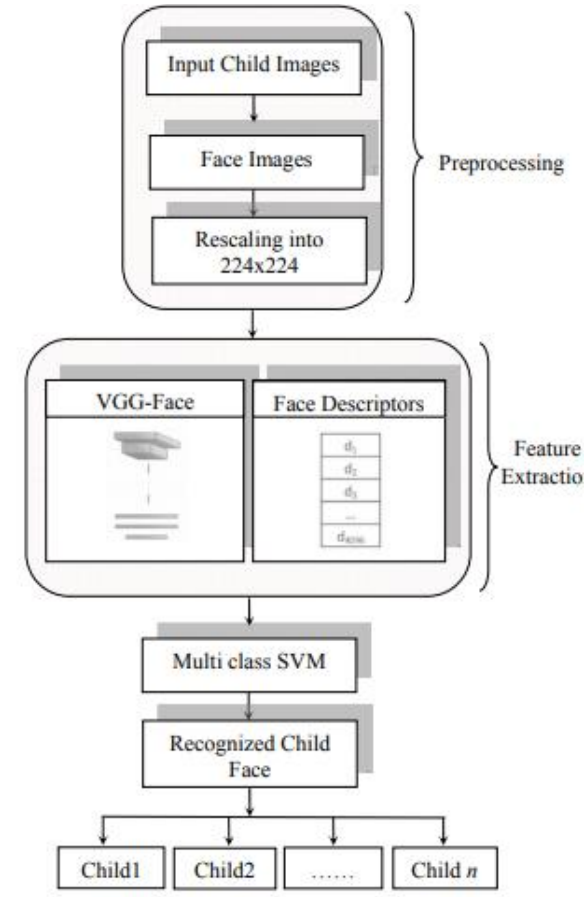

Fig. 2. Software Flow of face recognition system

Images of reported missing children are saved in a repository and the face area is selected for cropping to obtain input face images. Learned features from a Convolutional Neural Network (CNN), a specific type of deep learning algorithm, are used for training a multi class SVM classifier. This machine learning approach is used to correctly label the child using the name indicated in the database provided by the concerned authority.

CONVOLUTIONAL NEURAL NETWORKS(CNN)

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Convolutional Neural Networks (CNNs) are essential tools for deep learning methods and are more appropriate for working with image data [10][11][12][13][14]. CNNs or ConvNets are composed of series of interconnected layers and these layers consist of repeated blocks of convolutional, ReLU (rectified linear units), pooling layers and fully connected layers. Convolutional layer convolves the input face image data with different kernels to produce activation maps or feature maps representing low level features like edges or curves. This feature map is given to next convolutional layer producing activations which represent high level features indicating landmarks in face.

EXTRACTION OF FACIAL FEATURES VGG-Face is trained to recognize the 2622 identities and other classes can't be identified using this. But the activation vectors extracted from VGG-Face architecture can be used as the feature representations to classify each child category. The last classification layer is removed and extracts the 4K dimensional features from the first fully connected layers. The resulting feature vector is normalized by dividing each component by the L2 norm of this 4096 dimensional vector. Thus the pre-trained CNN VGG-Face is made to perform as an automatic facial feature extractor for training the classifier.

MULTI CLASS SVM CLASSIFIER

Each face image corresponds to a child and child face recognition is considered as an image category classification problem. The task is to classify input image uploaded by the public into one of the given category based on the image representation. Basically CNN architecture consists of computational layers for feature extraction and a classifier layer at the final stage. The VGG-face CNN model employs the softmax activation function for labeled class prediction, suggesting the class each image belongs to. The softmax in the CNN layers is replaced with a multi class SVM trained with feature vector array from each image. One-versus-rest linear SVM classifier is used and is trained on the dataset[11][12][13][14]. Extracted feature vector array is used to train this classifier.

III EXISTING SYSTEM

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FindFace is a website that lets users search for members of the social network VK by uploading a photograph [5]. FindFace employs a facial recognition neural network algorithm developed by N-Tech Lab to match faces in the photographs uploaded by its users against faces in photographs published on VK, with a reported accuracy of 70 percent. The "Tuanyuan", or "reunion" in Chinese, app developed by Alibaba Group Holding Ltd. helped Chinese authorities recover hundreds of missing children [6]. The app has allowed police officers to share information and work together with public.

IV Proposed System

The proposed system is comparatively an easy, inexpensive and reliable method compared to other biometrics like finger print and iris recognition systems. Earliest methods for face recognition commonly used computer vision features such as HOG, LBP, SIFT, or SURF [2-3]. However, features extracted using a CNN network for getting facial representations gives better performance in face recognition than handcrafted features. In [4], missing child identification is proposed which employees principal component analysis using Eigen vectors is used for face recognition system.

IV METHODOLOGY

1) Using public dataset of missing children's called FGNET is used to train deep learning CNN prediction model. After training model whenever public upload any suspected child image then this model will check in trained model to detect whether this child is in missing database or not. This detected result will store in database and whenever want official persons will login and see that detection result.
2) SVM Multiclass classifier use to extract face features from images based on age and other facial features and then this detected face will input to CNN model to predict whether this face child exists in image database or not.

First we used below dataset to train deep learning CNN model

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To run project follow below steps

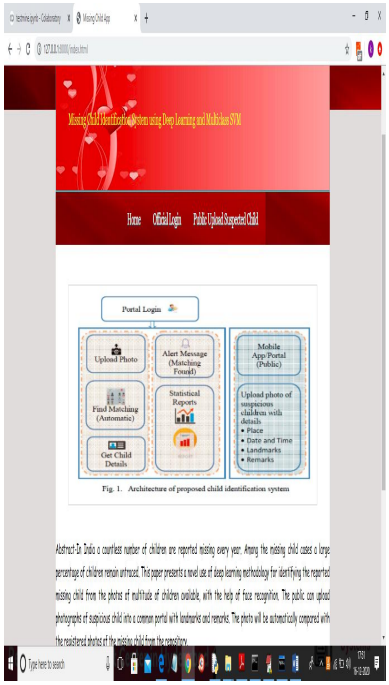
1) First create database in MYSQL by copying content from 'DB.txt' file and paste in MYQL

2) Install python, DJANGO and MYSQL software

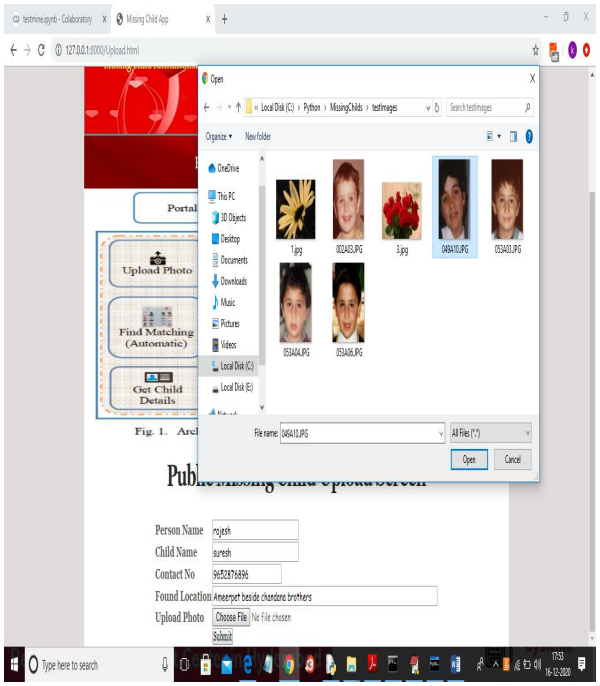
3) Create 'Python' folder in C directory and put 'MissingChilds' folder in it

4) start DJANGO server and run in browser to get first page

SCREEN SHOTS



In above screen public can click on 'Public Upload Suspected Child' link to get below page and to add missing child details



In above screen public will enter suspected child details and then upload photo and

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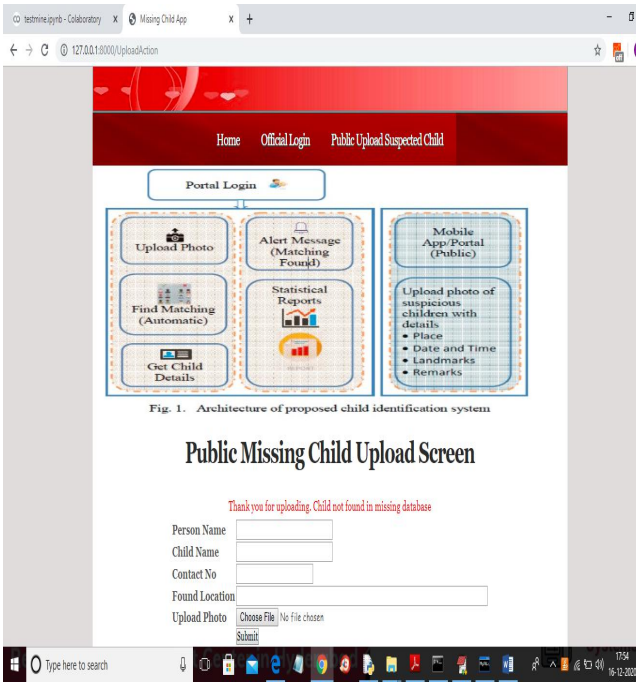
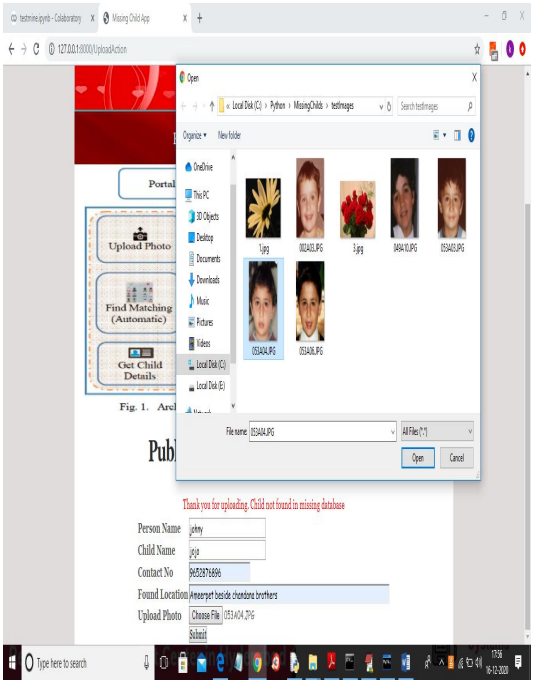
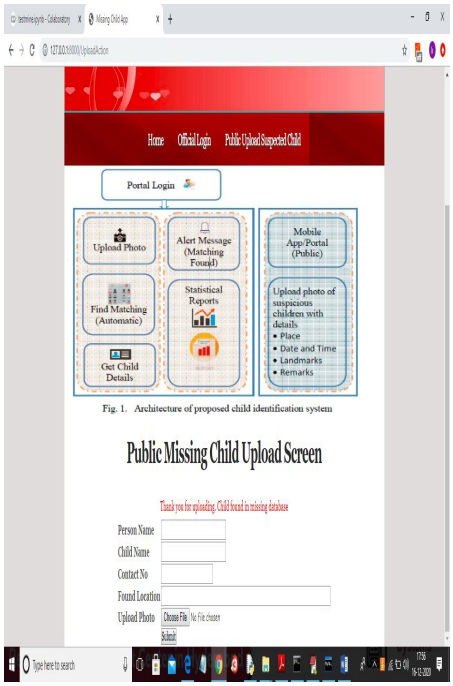
then click on 'Submit' button and to get below result



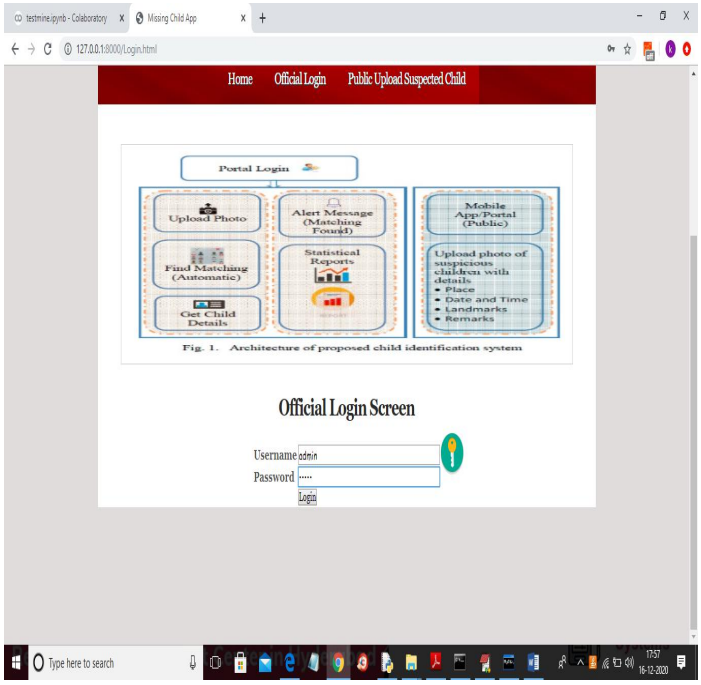
In above screen we can see child not found in missing DB and we can try with other image



And below is the result for new above child details



In above screen uploaded child found in database and now click on 'Official Login' link to get below login screen



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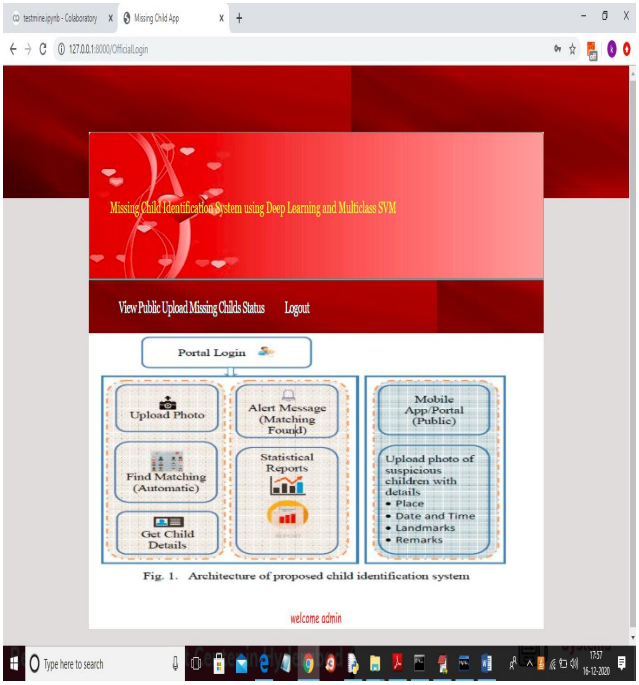
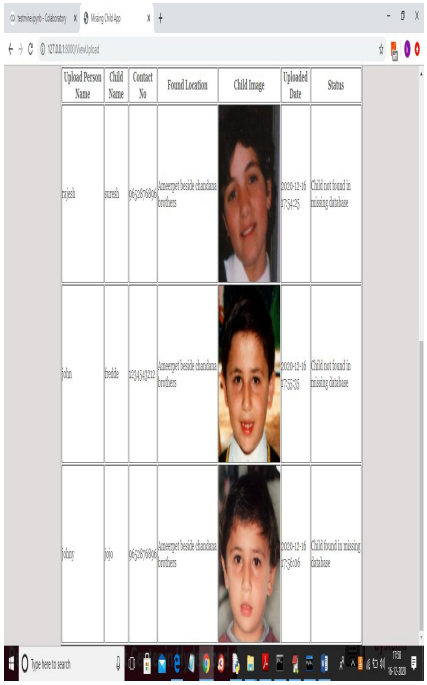
In above screen admin can login by entering username and password as 'admin' and 'admin' and after clicking on 'Login' button will get below screen



In above screen official can click on 'View Public Upload Missing Childs Status' link to view all uploads and its result done by public



In above screen officials can see all details and then take action to find that child

CONCLUSION

A missing child identification system is proposed, which combines the powerful CNN based deep learning approach for feature extraction and support vector machine classifier for classification of different child categories. This system is evaluated with the deep learning model which is trained with feature representations of children faces. By discarding the softmax of the VGG-Face model and extracting CNN image features to train a multi class SVM, it was possible to achieve superior performance. Performance of the proposed system is tested using the photographs of children with different lighting conditions, noises and also images at different ages of children. The

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classification achieved a higher accuracy of 99.41% which shows that the proposed methodology of face recognition could be used for reliable missing children identification.

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