MISSING CHILD IDENTIFICATION SYSTEM USING DEEP LEARNING AND MULTICLASS SVM

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Abstract
Every year, uncountable numbers of missing children in India are reported. A significant portion of missing children cases have unidentified youngsters. With the use of facial recognition, this study describes a novel application of deep learning approach for locating the reported missing child among the many children's images that are now available. A shared platform allows users to post pictures of questionable children along with notes and landmarks. The image will be automatically compared to the repository's registered images of the missing child. The input child image is categorised, and the missing children database will be searched for the photo that matches the input child image the best. This is accomplished by training a deep learning model to recognise the missing child from the from the database of missing children. In order to do this, a deep learning model is trained to accurately identify the missing child using the facial image uploaded by the public and the missing child image database that is provided. Here, face identification is accomplished using the Convolutional Neural Network (CNN), a very successful deep learning technology for image-based applications. The classification performance achieved for child identification system is 99.41%. It was evaluated on 43 Child cases.A deep learning [1] architecture considering all these constrain is designed here. The proposed system is comparatively an easy, inexpensive and reliable method compared to other biometrics like finger print and iris recognition systems.

Keywords— Missing child identification, face recognition, deep learning, CNN, VGG-Face, Multi class SVM.

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1. INTRODUCTION

The greatest resource in every country is its children. The proper raising of a nation's children determines its future. children. Children make up a substantial portion of the population in India, the second most populous nation in the world. But sadly, many children go missing every year in India for a variety of causes, such as kidnapping or abduction, runaway children, trafficking children, and misplaced children.

While 174 children go missing in India on average every day, half of them are still unaccounted for, which is a highly unsettling statistic.Children who disappear could be utilised for numerous forms of abuse and exploitation. In accordance with the National Crime Records Bureau (NCRB) study, which the Ministry of Home Affairs (MHA) stated in theParliament (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. Police departments get many reports of missing children. For a variety of circumstances, a child reported missing from one area may turn

up in another area or another state. Therefore, even if a child is discovered, it may be challenging to distinguish him or her from the reported missing instances.
This study describes a structure and process for creating an aid for locating missing children. It is suggested to have a virtual area so that the most recent pictures of kids that parents provided while reporting missing cases are preserved in a repository. The public has the option to freely take and post photos of children in allegedly dangerous settings. This photograph will be automatically found in the missing kid case images. 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.

2. RELATED WORK

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. Find Face is a website that lets users search for members of the social network VK by uploading a photograph [5]. Find Face 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.

3. PROPOSED FRAMEWORK

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. The architecture of the proposed frame work is given below
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 registered missing children and if a matching photo with sufficient score is found, then an alert message will be sent to the concerned officer.

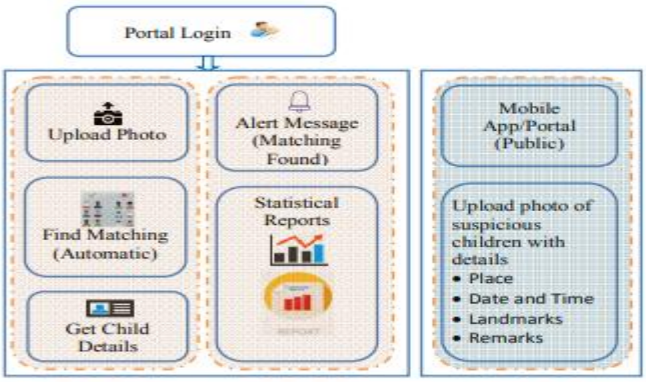

Fig. 1. Architecture of proposed child identification system

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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 image in the database.

CONVOLUTIONAL NEURAL NETWORKS(CNN)

Convolutional Neural Networks (CNNs) are essential tools for deep learning methods and are more appropriate for working with image data [7]. 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.

VGG-Face CNN descriptor

Face recognition is performed using a very sophisticated CNN called the VGG-Face network [8], whose architecture is fully described in Fig 3. The 11 blocks that make up the CNN design each contain a linear operator and one or more non-linearities, such as max pooling and ReLU. As the linear operator is a bank of linear filters, the first eight of these blocks are known as convolutional blocks (linear convolution). Throughout the network, it employs filters with a stride and pad of 1 and a size 3x3. A rectification layer follows each convolution layer (ReLU). With stride 2, the maximum pooling layers only required a 2x2 size. The size of the final three blocks, which are fully connected layers identical to convolutional layers, However each filter offers representative data from the full image since the size of the filters matches the size of the input data. The final FC layer's output has 2622 dimensions and is followed by L-dimensional metric embedding. The output of the previous two FC layers is 4096 dimensional. With mini-batches of 64 samples and a momentum coefficient of 0.9, optimization is carried out using stochastic gradient descent.

layer	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
type	input	conv	relu	conv	relu	mpool	conv	relu	conv	relu	mpool	conv	relu	conv	relu	conv	relu	mpool	conv
name	–	conv1_1	relu1_1	conv1_2	relu1_2	pool1	conv2_1	relu2_1	conv2_2	relu2_2	pool2	conv3_1	relu3_1	conv3_2	relu3_2	conv3_3	relu3_3	pool3	conv4_1
support	–	3	1	3	1	2	3	1	3	1	2	3	1	3	1	3	1	2	3
filt dim	–	3	–	64	–	–	64	–	128	–	–	128	–	256	–	256	–	–	256
num filts	–	64	–	64	–	–	128	–	128	–	–	256	–	256	–	256	–	–	512
stride	–	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	2	1
pad	–	1	0	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	1

layer	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
type	relu	conv	relu	conv	relu	mpool	conv	relu	conv	relu	conv	relu	mpool	conv	relu	conv	relu	conv	softmx
name	relu4_1	conv4_2	relu4_2	conv4_3	relu4_3	pool4	conv5_1	relu5_1	conv5_2	relu5_2	conv5_3	relu5_3	pool5	fc6	relu6	fc7	relu7	fc8	prob
support	1	3	1	3	1	2	3	1	3	1	3	1	2	7	1	1	1	1	1
filt dim	–	512	–	512	–	–	512	–	512	–	512	–	–	512	–	4096	–	4096	–
num filts	–	512	–	512	–	–	512	–	512	–	512	–	–	4096	–	4096	–	2622	–
stride	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	1	1
pad	0	1	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0

Fig 2:VGG-Face network architecture

PREPROCESSING

In the context of face recognition, preprocessing input raw photos entails obtaining the face region and standardising images in a format compatible with the CNN architecture used. The required input size varies for each CNN. For the purpose of building the database for the face recognition system, the images of missing children taken with a digital camera or mobile device are taken and divided into different cases. To obtain the input face photographs, the facial region in each image is recognised and clipped. Because only RGB images can be processed by the VGG face network at this specific scale, the cropped face images are resized to 224x224.

EXTRACTION OF FACIAL FEATURES

Other classes cannot be detected using this method since VGG-Face is taught to only recognise the 2622 identities. However, each child category may be classified using the feature representations created from the activation vectors recovered from the VGG-Face architecture.

The 4K dimensional features from the first completely connected layers of classification are extracted by removing the last classification layer. By dividing each component by the L2 norm of this 4096 dimensional vector, the resulting feature vector is normalised. In order to train the classifier, the pre-trained CNN VGG-Face is designed to operate as an automatic facial feature extractor..

MULTI CLASS SVM CLASSIFIER

Each face image belongs to a child, and the identification of children's faces is seen as a classification issue for images. The aim is to assign each input image that has been supplied by a member of the public to a certain category depending on how the image is represented. The basic components of the CNN design are computational layers for feature extraction and a classifier layer at the very end. The softmax activation function is used by the VGG-face CNN model to predict labelled class membership for each image. A multi class SVM that was trained with feature vector arrays from each image has been used in place of the softmax in the CNN layers. Utilizing the dataset, a one-versus-rest linear SVM classifier is trained. This classifier is trained using a feature vector array that was extracted.

4.METHODOLOGY

MODULES:

- ❖ USER
- ❖ ADMIN

USER MODULE :In this project we are using public module for uploading the picture of missing child with the details person name,child name,contact number,found location and upload photo. The system will store and manage the data securely.

ADMIN MODULE: This admin is responsible to view the uploaded candidate details. Admin login to system by using username as ‘admin’ and password as ‘admin’ after registration. The user can be able to see the whether any missing child is found in the database or not.

5. RESULTS AND DISCUSSION

The MATLAB 2018a platform is used to implement the facial recognition method. The tests are performed using 32GB RAM and an Intel Core i7 processor running at 3.60 GHz on Microsoft Windows 7, a 64-bit operating system. There is a requirement for increased processing power to handle CNN topologies. The models should be trained using a GPU, and an Nvidia GeForce TitanX 12GB graphics card is used. 43 distinct kid instances are represented by 846 child face photos in the user-defined database. By dividing the database photos, a training and test set is created. A total of 677 training set photos and 169 test set images are produced by choosing 80% of the photographs from each child group for training and 20% of the images for testing. Images of each child from the prior data set make up the training set and validation set and testing is done with images of children after an age gap to evaluate the system in all conditions. CNN is implemented using the MatConvNet package [9] and is tightly integrated with the MATLAB environment. MatConvNet additionally offers a VGG-Face CNN that has already been trained. The MatConvNet 1.0-beta25 version is downloaded and used for the experiments here. Before sending the training set images to the CNN model, they undergo preprocessing to the size required by the CNN architecture. Each image in the obtained input database has the facial region cropped inside a rectangle area. The photos provided to VGG-Face are scaled to 224x224 to make them fixed size images.. The activations to the input image produced by the first fully connected layer of the VGG-Face network

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architecture is taken as the CNN Feature descriptor.The normalized feature vector, each having a length of 4096, is used for training the SVM classifier for classifying the image of face and recognizes the child.To assess the flexibility of face recognition deep architecture against variations in image quality, artificially degraded images are created. Images obtained by changing noise level, brightness, contrast, lighting conditions, obstructions, blur, aspect ratio and face positions are used for testing the child identification system. Face identification accuracy is computed as the ratio of correctly identified face images to the total number of child face images in the test set. The computed recognition accuracy of the multi class SVM using learned features from CNN is 99.41%.

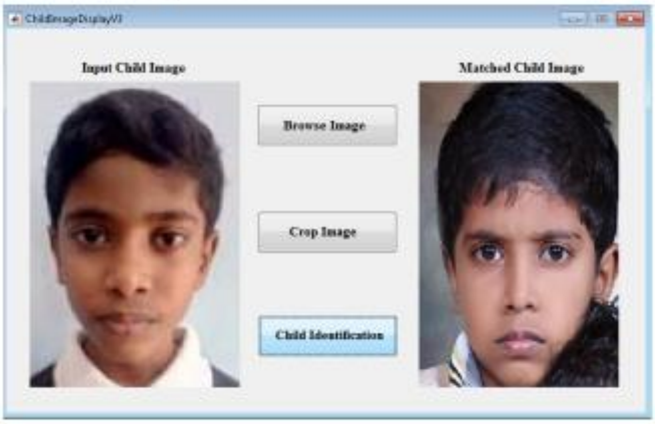

FIG 3:GUI for child identification showing an input image and matched output image in the database

6.CONCLUSION AND FUTURE WORK

The powerful CNN-based deep learning approach for feature extraction and the support vector machine classifier for categorising various child categories are combined in the proposed missing child identification system. The deep learning model used to evaluate this system was trained using feature representations of children's faces. It was able to improve performance by removing the softmax from the VGG-Face model and extracting CNN image features to train a multi class SVM. The suggested system's effectiveness is evaluated using images of children taken in various lighting and sound environments, as well as images taken at various ages. The classification had a better accuracy of 99.41%, demonstrating that the suggested face recognition technology may be utilised to accurately identify missing children.

REFERENCES

[1] Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning", Nature, 521(7553):436–444, 2015.

[2] O. Deniz, G. Bueno, J. Salido, and F. D. la Torre, "Face recognition using histograms of oriented gradients", Pattern Recognition Letters, 32(12):1598–1603, 2011.

[3] C. Geng and X. Jiang, "Face recognition using sift features", IEEE International Conference on Image Processing(ICIP), 2009.

[4] Rohit Satle, Vishnuprasad Poojary, John Abraham, Shilpa Wakode, "Missing child identification using face recognition system", International Journal of Advanced Engineering and Innovative Technology (IJAEIT), Volume 3 Issue 1 July - August 2016.

[5] https://en.wikipedia.org/wiki/FindFace

[6] https://www.reuters.com/article/us-china-trafficking-apps/mobileapp-helps-china-recover-hundreds-of-missing-childrenidUSKBN15J0GU

[7] Simonyan, Karen and Andrew Zisserman, "Very deep convolutional networks for large-scale image recognition", International Conference on Learning Representations (ICLR), April 2015.

[8] O. M. Parkhi, A. Vedaldi, and A. Zisserman, "Deep Face Recognition," in British Machine Vision Conference, vol. 1, no. 3, pp. 1-12, 2015.

[9] A. Vedaldi, and K. Lenc, "MatConvNet: Convolutional Neural Networks for MATLAB", ACM International Conference on Multimedia, Brisbane, October 2015. 2018 IEEE Recent Advances in Intelligent Computational Systems (RAICS) | December 06 - 08, 2015.