Missing Child Identification System
Using
Deep Learning and Muticlass SVM

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ABSTRACT

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 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.

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 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.

MOTIVATION

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.

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.
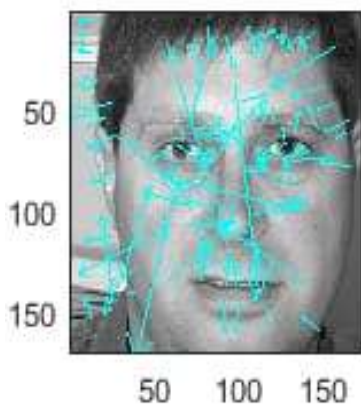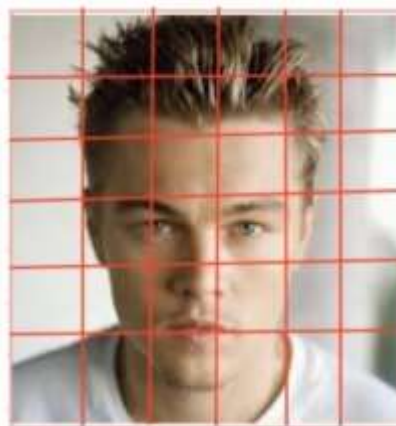
Face recognization using SIFT   Face recognization using HOG

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.

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. 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. 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 Officer can check for any matching with the database at any time using the proposed 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
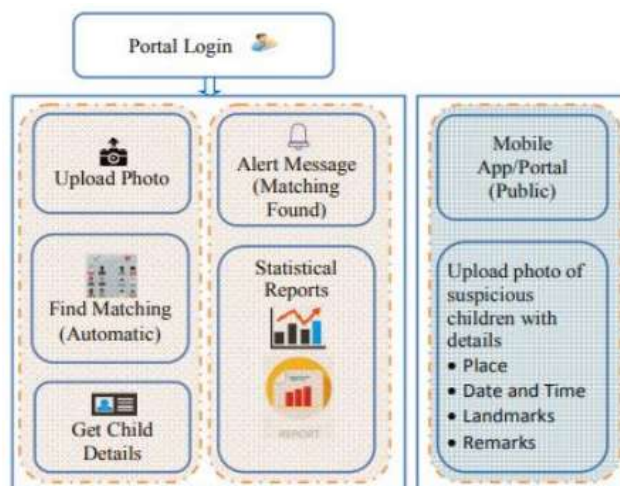
Fig. 1. Architecture of proposed child identification system

CONVOLUTIONAL NEURAL NETWORKS (CNN)

Convolutional Neural Networks (CNNs) are essential tools for deep learning methods and are more appropriate for working with image data. 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 a convolutional neural network model proposed by K. Simonyan and A. Zisserman from the University of Oxford in the paper "Very Deep Convolutional Networks for Large-Scale Image Recognition". The model achieves 92.7% top-5 test accuracy in ImageNet, which is a dataset of over 14 million images belonging to 1000 classes. It was one of the famous model submitted to. It makes the improvement over AlexNet by replacing large kernel-sized filters (11 and 5 in the first and second convolutional layer, respectively) with multiple 3×3 kernel-sized filters one after another. VGG16 was trained for weeks and was using NVIDIA Titan Black GPU's.

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.

EXISTING 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. 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

PROPOSED SYSTEM

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.

METHODOLOGY

First we used below dataset to train deep learning CNN mode

To run project follow below steps
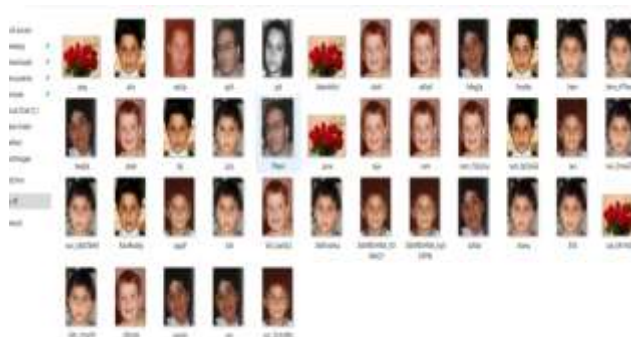
1) First create database in MYSQL by copying content from 'DB.txt' file and paste in MYQL

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

The public can click on 'Public Upload Suspected Child' now to upload the image of the child.

After uploading, the person gets the status message to the mobile and also the status is displayed on the screen .

Officials can view the public uploaded photos by clicking on Official Login

After successful login, Officials can click on View Public Upload Missing Childs Status tab to view all uploads done by public.

After clicking on 'View Public Upload Missing Childs Status'

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 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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