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IDENTIFYING MISSING CHILD USING MULTICLASS SVM AND CNN

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Abstract : It is estimated that a child goes missing in India every eight minutes. This paper presents novel by using deep learning methodology for identifying the missing person. The public can upload photographs of suspicious child in our portal by their landmarks and remarks. The photo will be automatically compared with registered photos of missing child. Classification of input child image and photo with best match will be selected from the database which contain missing children photos. 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.

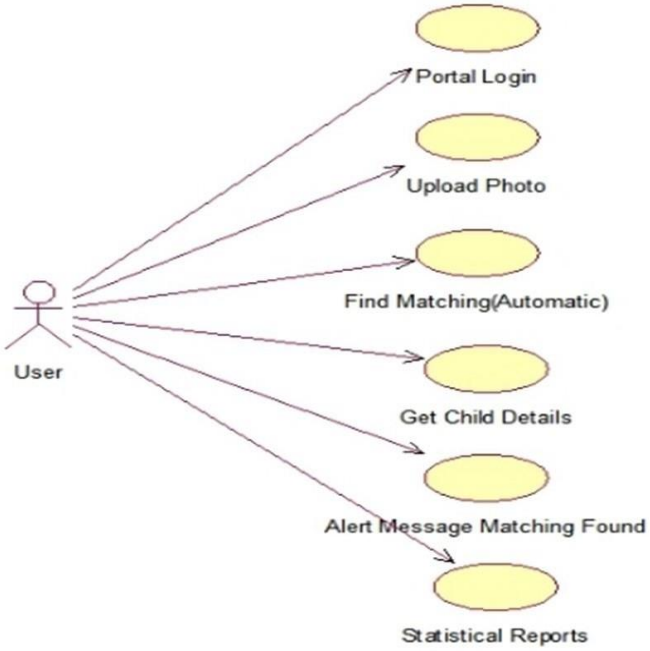
I. INTRODUCTION

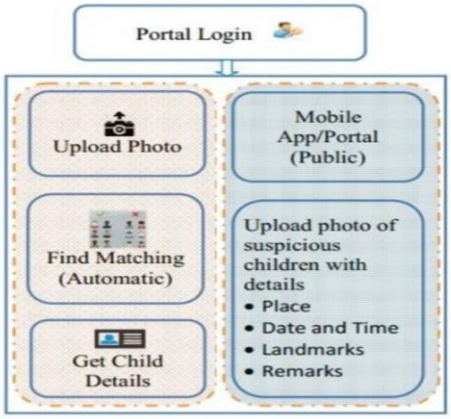
Children are the greatest asset of each nation. The future of any country depends upon the right upbringing of its children. India is the second populous country in the world and children represent a significant percentage of total population. The public is given provision to voluntarily take photographs 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 learning architecture considering all these constrain is designed here.

II. LITERATURE SURVEY

2.1 WORK FLOW 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 Itconsists 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. 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 SMS the alert message of matching child. Similarly 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 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.

III. METHODOLOGY

3.1 CONVOLUTIONAL NEURAL NETWORKS (CNN)

A convolutional neural network (CNN) is a deep learning algorithm specifically designed to process image data. Convoluted neural networks are used in image recognition and processing. The neural networks in a CNN are arranged similarly to the frontal lobe of the human brain, a part of the brain responsible for processing visual stimuli.Convolutional neural networks stand out in their ability to learn by themselves.

This algorithm works by assigning learnable weights and biases to an image to distinguish it from other images while retaining the features critical for achieving a good prediction. Images are represented as a matrix of pixels with different planes. A grayscale image consists of one plane while an RGB image consists of three planes. Now, in a convolutional neural network, there are multiple layers of artificial neurons, each with a mathematical function that calculates the sum of multiple inputs. When an image is inputted in a CNN, the first layer extracts basic features of the image. These include the edges of the image.

Once this layer extracts these basic features, the image moves to the next layer which detects more complex features such as combination edges. As the image moves through multiple layers of the convolutional neural network, more complex features are detected. At the classification layer, the algorithm assigns classes in which an image is more likely to belong. This is where the neural network will assign an image as a person, cat, horse, etc.

3.2 SUPPORT VECTOR MACHINE

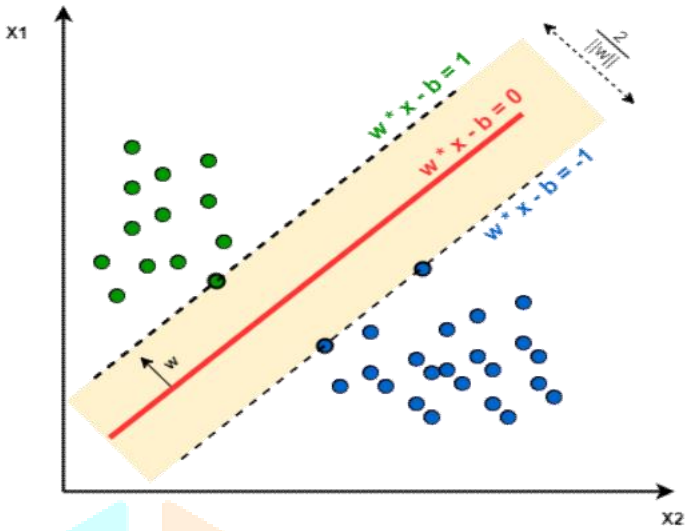
SVM is a supervised machine learning algorithm that helps in classification or regression problems. It aims to find an optimal boundary between the possible outputs. Simply put, SVM does complex data transformations depending on the selected kernel function and based on that transformations, it tries to maximize the separation boundaries between your data points depending on the labels or classes you've defined.

3.2.1 WORKING

In the base form, linear separation, SVM tries to find a line that maximizes the separation between a two-class data set of 2-dimensional space points. To generalize, the objective is to find a hyperplane that maximizes the separation of the data points to their potential classes in an n - dimensional space. The data points with the minimum distance to the hyperplane (closest points) are called Support Vectors.

In the image below, the Support Vectors are the 3 points (2 blue and 1 green) laying on the scattered lines, and the separation

hyperplane is the solid red line:



The computations of data points separation depend on a kernel function. There are different kernel functions: Linear, Polynomial, Gaussian, Radial Basis Function (RBF), and Sigmoid. Simply put, these functions determine the smoothness and efficiency of class separation, and playing around with their hyperparameters may lead to overfitting or underfitting.

3.2.2 MULTICLASS CLASSIFICATION USING SVM

In its most simple type, SVM doesn't support multiclass classification natively. It supports binary classification and separating data points into two classes. For multiclass classification, the same principle is utilized after breaking down the multiclassification problem into multiple binary classification problems.

The idea is to map data points to high dimensional space to gain mutual linear separation between every two classes. This is called a One-to-One approach, which breaks down the multiclass problem into multiple binary classification problems. A binary classifier per each pair of classes.

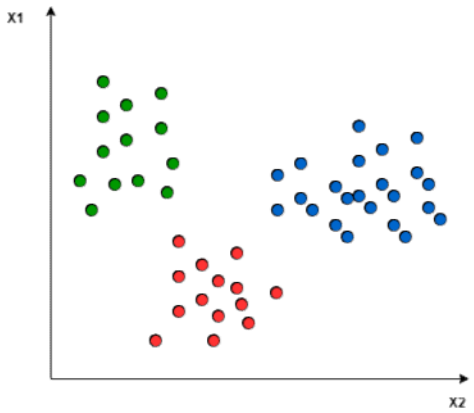
Another approach one can use is One-to- Rest. In that approach, the breakdown is set to a binary classifier per each class.

A single SVM does binary classification and can differentiate between two classes. So that, according to the two breakdown approaches, to classify data points from classes data set:

- In the One-to-Rest approach, the classifier can use SVMs. Each SVM would predict membership in one of the classes.
- m In the One-to-One approach, the classifier can use $\frac{m(m-1)}{2}$ SVMs.

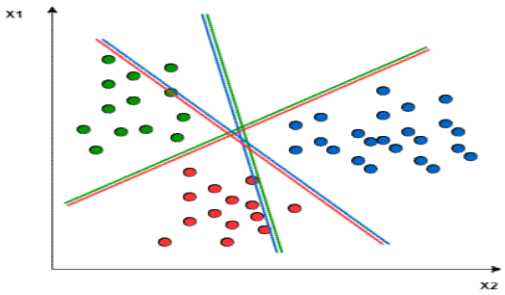
m

Let's take an example of 3 classes classification problem; green, red, and blue, as the following image:

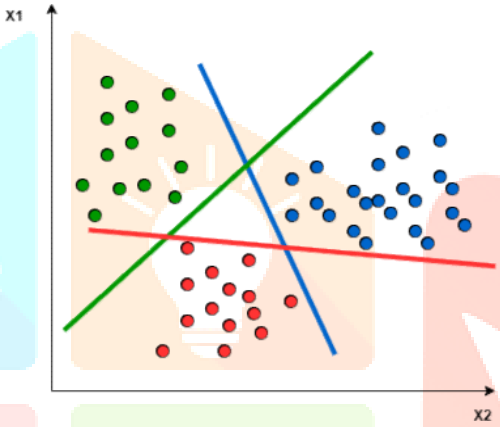


Applying the two approaches to this data set results in the followings :

In the One-to-One approach, we need a hyperplane to separate between every two classes, neglecting the points of the third class. This means the separation takes into account only the points of the two classes in the current split. For example, the red- blue line tries to maximize the separation only between blue and red points. It has nothing to do with green points:



In the One-to-Rest approach, we need a hyperplane to separate between a class and all others at once. This means the separation takes all points into account, dividing them into two groups; a group for the class points and a group for all other points. For example, the green line tries to maximize the separation between green points and all other points at once:



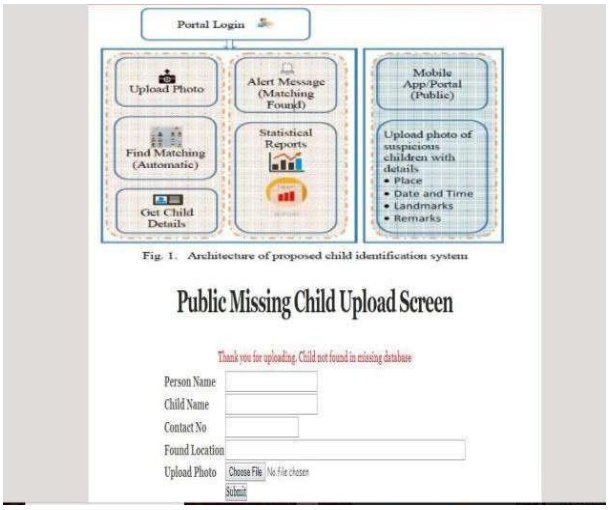
One of the most common real-world problems for multiclass classification using SVM is text classification. For example, classifying news articles, tweets, or scientific papers.

IV IMPLEMENTATION AND RESULT

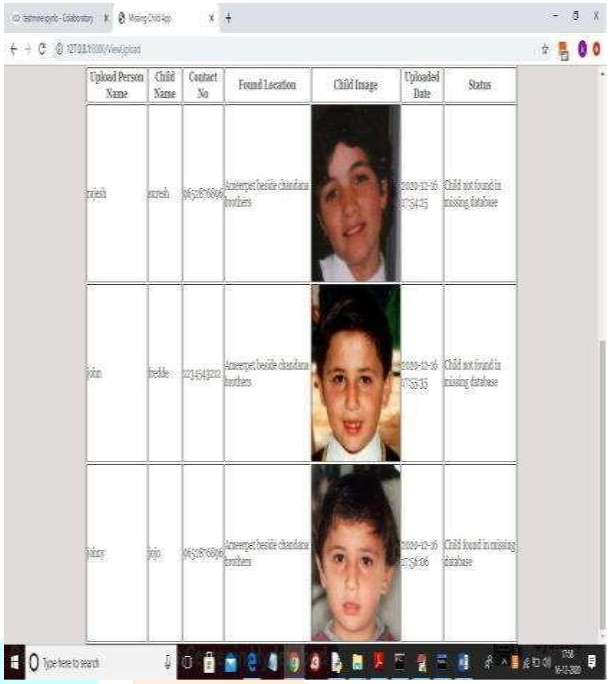
1) Using public dataset of missing children's called FGNET is used to train deep learning CNN prediction model. After training model whenever public upload any suspected child image then this model will check in trained model to detect whether this child is in missing database or not. This detected result 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.

In above screen public will enter suspected child details and then upload photo and then click on 'Submit' button and to gets result :



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



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

V 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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