VISUAL MAPPING FOR MISSING CHILD DETECTION USING KNN

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Abstract:
Missing children‟s becoming a concern in the globe particularly in India, as more number of missing children is reported in day today life. This issue switches the research community to spotlight on this era. Several theories and models have been proposed to mitigate this issue, however almost all techniques use conventional methods such as register complaints, face recognition using image processing algorithms. No doubt these methods fulfill the gap of missing child, but may not be optimum because of detection delay and success rate. Moreover few authors presented deep learning concept to improve the detection process of missing child, though deep learning is used to overcome the issue of delay and success rate, but needs huge date set to train the model which is not available in the respective police satiation at the time of registering FIR. In this paper we use the face recognition module of deep learning to extract the landmarks from the face and encode it to give the feature vector, latter KNN is used to classify the feature vectors of the image extracted by deep learning. The presented approach minimizes the delay and improves the success rate to identify the missing child. We validate our approach using Python programming.

Keywords: Deep learning, KNN, Face recognition, missing child, Python.

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1. Introduction

In Asian countries, mostly under developed and developing countries missing child cases are alarming. Many of the children trafficking, lost child and kidnapping cases remains unresolved even after years of complaint. The most commonly used methods to find missing child manually, give a police complaint or print the posters. However, these methods consume time with less possibility of finding the child. Due to advancement in the technology researchers proposed multiple techniques to identify the facial features of a person. Several algorithms of image processing such as Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), and wavelet transform and lift transform have been employed to extract the exact facial feature. But all the above techniques are complex and shows blur pixels at the edges and may not be optimum in real time applications.

To overcome this issue Artificial intelligence (AI) was introduced [1]. AI can recognize and classify the images and faces as it is software based, it can simultaneously make a search with multiple images in the dataset with precision of 99%. However in AI the feedback mechanism introduces delay which reduces its efficiency. To improve the feature extraction and reduce the complexity of feedback the art of work used Deep learning concept [2] to identify the missing children. Deep learning is a part of machine learning which employs neural artificial networks. In the network, deep learning uses various layers which are not bounded but have limited size. Different architectures of deep learning are employed for wide range of real-time applications. This method of learning requires huge dataset to generate the feature vector which is mainly used for face recognition. However in real time applications the images registered at the police station are very few and the model cannot trained for that particular image, hence may not be optimum for real time application.

Here in the proposed approach, face recognition module of deep learning is used. This module is used to extract the landmarks from the face and encode it. Encoding of face image gives 128D feature vector which can later be used in KNN for classification of image. The presented approach reduces the delay and improves the probability of success rate. This method is simple to implement and can be extensively used in real time application.

The rest of the paper is organized as follows, in section 2 we described related work, Background and motivation is given in section 3. The proposed model is presented in section 4, moreover section 5 shows the results of the proposed approach and the conclusion of the paper is presented in section 5.

Related Work

Deep learning methodology is most efficient approach for facial recognition. Salama et al. [2] the authors used deep CNN to get the specified features of a person and the system is trained to learn using online scheme and recognize particular group of people. Wang et al. [3] address the problem of face discrimination as CNN is capable of performing the task of face verification and identification. Oo Shun and Oo Aung [4] presented a method using deep learning to identify children as it is difficult to recognize the children when compared to the age people. All these approaches use CNN and require huge dataset which induces delay and needs huge memory to store it. Mei and Weihong [5] conducted a survey on the developments of facial recognition and discussed various models, algorithms, protocols applications and designs. Ji Tao and Yap-Peng [6] proposed a novel approach is discussed for automatic identification and grouping of individual faces appeared in the videos. The face which is continuously appearing in each video slot is recognized and sequences of face are formed. However, this method is time consuming and may be complex. In [7] the authors presented a model to identify the children who are missing using a model of KNN. The KNN model is best applicable for image identification and hence a set of pictures is used to train the system and a repository is created to be used as reference for the new images (of suspicious child) uploaded by the people. Processing of the image is performed to recognize the child but, these methods are time consuming and may be complex as the image data set increases and overlapping may also occur. There are also some challenges related to these methods as the child picture may be old and the newly uploaded image of the same child may have some changes. Moreover, some features of the children below the age group of 5 may change making face recognition difficult. In [8, 9] the authors discussed an efficient deep learning technique to identify the missing individual. The image of suspected person can be uploaded by the people or police and is converted into statistical values by using encoding technique. This encoding value are compared with the values of the already existing one or if the image is new to the system „new registration" option is enabled and the image is stored in the repository, hence, time consumed is less. Face identification is done using histogram of oriented Gradients and the location on every image of the face is identified and rotation, shearing and scaling of the picture is performed using algorithm called (landmark) location estimate. However, these methods may have less accuracy and efficiency for

identifying the children below 10 years. Rohit et al. [10] proposed a face recognition mechanism to find the missing children by implementing principal component analysis. But this method is less efficient as it has complex computations and it can process only the images with similar facial expressions. Arniker et al. [11] presented a radio frequency identification (RFID) system to recognize the missing persons. However, small kids and mentally disturbed persons may not agree to wear it or may be it can be lost by them at any point. Hence, making the task of finding them is more difficult. O. Deniz et al [12] proposed a technique of face recognition using Histograms of Oriented Gradients (HOG), no doubt that the authors improved the recognition system when compared with the previous approaches. However this method is complex as the algorithm has to go with number of stages that not only improves the delay but also reduces the recognition efficiency. Y. LeCun, et al [13] presented deep learning technique to extract the various features of image and video, however the authors did not explore the technique to recognize the face of a child which can inherently change with the age. C. Geng and X. Jiang[14] proposed a face recognition approach using sift technique. But this approach has a possibility that noise can enter easily into the system due to weak design of filtration process and can corrupt the desired signal which can reduce the probability of face recognition. In [15, 16] recognition of face techniques has been proposed; however, both the two approaches have classification problems. Sumeet et al [17] proposed a face recognition method to find lost children, people and identifying the criminals at any instant of time and at any place. But this approach is costly and the efficiency was approximately 85%. In [18] the author discussed a facial recognition system to find the lost persons by using local binary pattern histogram algorithm. However, this approach not suitable when the brightness of the picture is varied and efficiency of this approach is 67.5%.

In this paper, an efficient technique of face detection for missing children has been proposed with the combination of deep learning and KNN which reduces both complexity and delay. The presented approach optimizes the probability of missing child detection and success rate even if the image of the child is compared with the adult image (of same person). This property of the proposed approach proves the novelty of the algorithm and may give the pathway to the research community to proceed the work in future direction.

Background and Motivation

Chandran et al [19] proposed a missing child identification approach (Support Vector Machine (SVM) approach) using deep learning and mapping dependent on support vector. A nationwide portal is created in which the official persons can upload the missing child photo and check in the repository for any match. In the same manner people can also upload the picture of suspicious or lonely wandering child along with the location and remarks. If the matching image is found, an alert is sent to concerned police officials regarding the found child and his/her location. Accordingly the child is handed over to their parents or guardians. Various positions of face and different image characteristics are used to test this approach and its accuracy is 99.41%. However, in this approach the authors did not discuss the authors did not discuss the situation when the image uploaded by the people does not found a match in already existing images. And the efficiency of this approach decreases if the children are below 5 years old as some of their features may vary as compared to the picture already uploaded in the protocol. Sutabri et al [20] presented a face recognition system to automatically provide the attendance ((AA) automatic attendance) for the students using deep learning. The size of the photo is set to 600*800 pixels and the photos of the students were captured at different angles namely ±30 and ±60 degrees to right and left so as to get better accuracy. The staff admin is responsible to upload the data such as subject, schedules and lectures of the student and the student only has to give attendance. The camera captures the student‟s photo and sends it to the system where processing and recognition of the image takes place. After the face recognition the student is identified and the information like student ID, time, and date will be stored in the repository. The method employed for this process is facial embedded deep learning using Dlib‟s CNN. However this approach requires more storage as the number of students increases so as to store students image along with their academic details. Imran et al [21] presented a masked facial identification (MFI) approach to recognize the people wearing masks. The authors employed supervised learning along with neural network-based face identification in-depth. For training the SVM classifier, pictures of masked people were collected. The efficiency of this method is 97% and this approach may not be appropriate as if the dataset is large then SVM takes more time for training. As it contains hyper-parameters, small adjustments cannot be made in it. Hence it cannot be employed for real time applications. Since the existing methods have the above mentioned drawbacks, in this paper a facial identification method using deep learning and KNN to find the missing children is proposed and the efficiency of the proposed approach outperforms the existing approaches. Aliyu et al [22] presented model called wearable location trackers for child safety, however this model fails to locate the child if wearable‟s are

removed, so may not be the optimum solution for real time applications

In this paper, the face recognition module of deep learning and KNN is used to find the missing children.

Proposed Approach

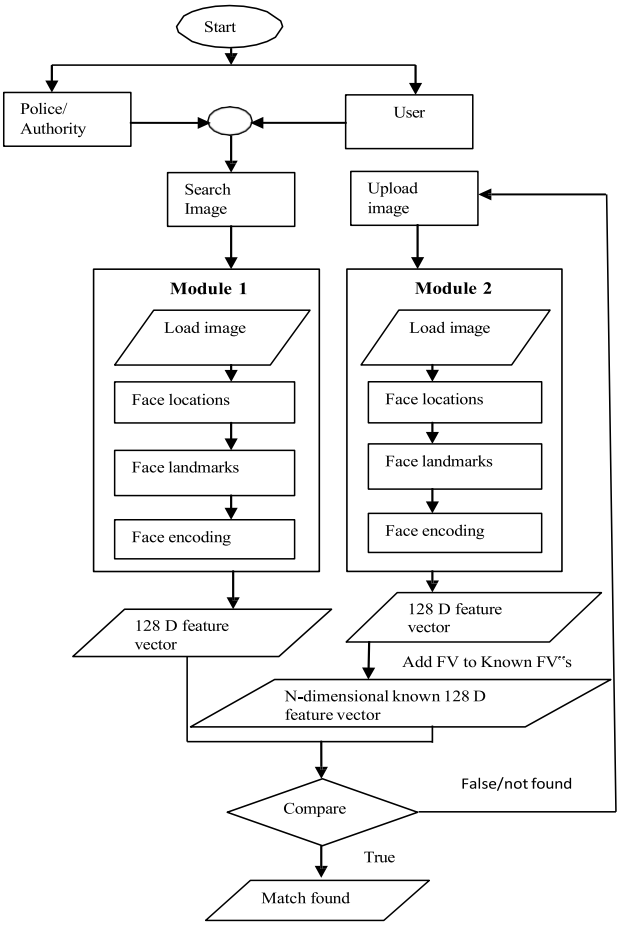

Figure 1: Flow Diagram of Proposed approach

Initially, in order to extract the primary features of the image like eyes, nose, mouth deep learning module has been implemented as represented in figure 1. The algorithm and function of each block of figure 1 is represented as

Search Block

The function of this block is to search for the image of missing child in the portal. Both the Police/Authority and User block can search for the images. In the beginning search operation is executed to avoid the redundancy of the images uploaded by user and police simultaneously. On other side User can also search for the image which is captured by them in the portal. This image may be of wandering child or suspicious child.

Module 1

This module deals with the search mechanism. Loading of image is the first block of this module. Once the image is loaded its features are extracted using face recognition module which consists of three steps.

Algorithm 1: File Loading

Step 1. **Input**: Photo of child is given to face recognition module.
Step 2. The image/photo of the child is loaded.
Step 3. face_recognition.photo_load(*photo path*)
Step 4. Step-3 loads the photo and stores it in NumPy array.
Step 5. **Output**: An Array which is NumPy is returned consisting of Photo contents.

Step 1(Face location block): Generally, an image consists of a background and one or more than one persons face. In this block the image is cropped and only the face is considered. The face locations are retrieved that gives the bounding rectangles of the faces present in the image.

Algorithm 2: Face location

Step 1. **Input**: Photo which is in the form of NumPy array.
Step 2. face_recognition.location_of_faces(input photo)
Step 3. Step-2 takes the photo in NumPy array form and returns all locations of the faces found.
Step 4. **Output**: Face Image. 4(four) coordinates in the order of (up, right) and (down, left) as a tuples list.

Step 2 (Face landmarks block): The face image from step 1 is taken and the facial landmarks like eyes, nose etc are extracted using this block.

Algorithm 3: Face Landmarks

Step 1. **Input:** Takes the Face Image as input.
Step 2. face_recognition.landmarks_of_face(Face Image)
Step 3. Step-2 takes the Face Image and returns feature locations such as nose, eyes and mouth etc.
Step 4. **Output**: A dictionary (dict) is returned that contains feature locations of all the faces present in the Photo.

Step 3 (Face encoding block): The landmarks extracted in step 2 are now encoded in this block. This face encoding gives a 128-dimension Feature vector (128 D feature vector block). The extracted feature vector is compared with the known feature vectors of the images that are already uploaded into the portal. The comparison is based on distance between two feature vectors for which KNN algorithm is used. If the image is matched the facial recognition of the missing child is complete.

Algorithm 4: Face Encoding

Step 1. **Input**: Takes the image and known face locations.
Step 2. Face recognition encoding of face (Input)
Step 3. Step-2 takes the image and returns a 128 dimensional Feature Vector.
Step 4. **Output**: returns the encoding i.e. a column vector of 128 dimension.

Else if the image is not found in the portal, then module 2 come into picture. It has same blocks of that of module 1 to extract the feature vector. The image that is not found in the portal is uploaded into the portal either by user or the Authority/Police, the image uploaded again undergoes the features extraction process and the output feature vector is added into the known n-dimensional 128D feature vectors that is used for comparison using KNN. Each test image is compared with the entire known Feature vectors that are already uploaded into the portal using KNN.

2. Results and discussion

In this section simulated result of the presented approach has been presented, in which it has been observed form figure 2– 12 that missing children information can be easily monitored to optimize the probability of recognition of a missing child.

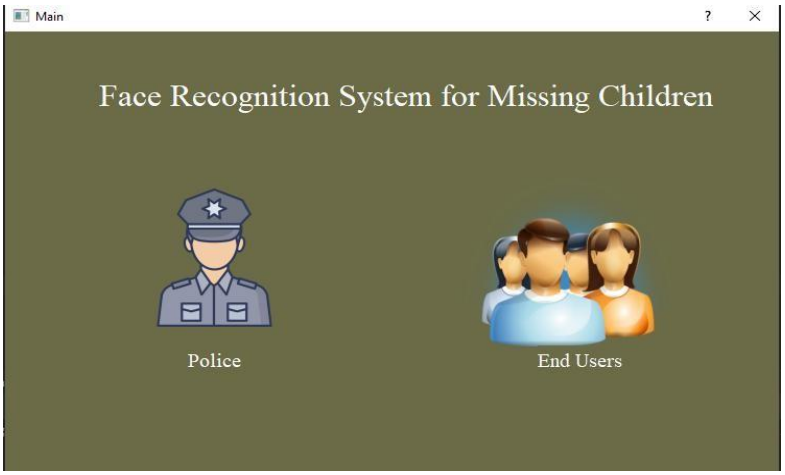

Fig 2: Home Page of the desktop application

Fig 2 represents home page of the desktop application that has been created and contains separate registration/login for police and for the end users.

Fig 3 represents the login page of the police officer in which authentication of the police is verified.

Fig 3: Login page of the police into the potal

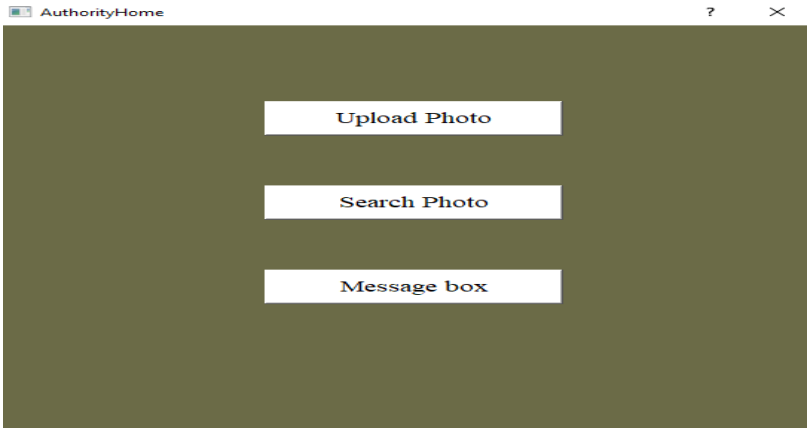

Fig 4 : Operation page of the police officer

Fig 4 represents the actions that a police officer can perform, it consists of 3 actions. Fig 5 represent the uploading image of missing child, searching for an image and message box that contains all the searches made by the user for which match has been found.

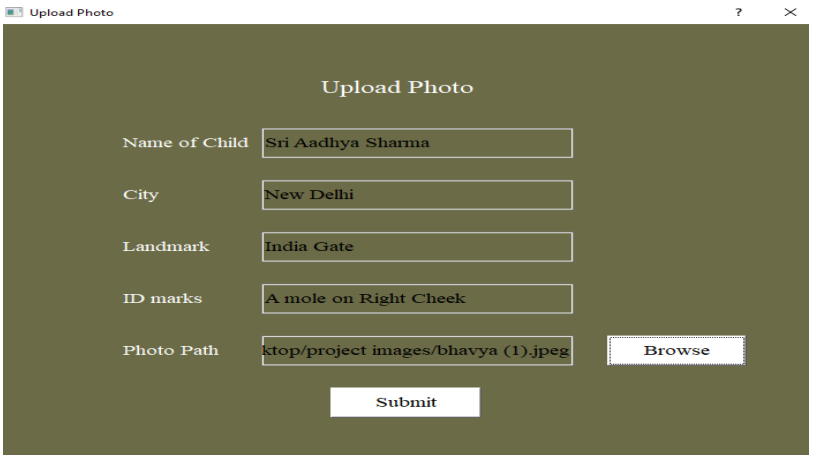

Fig 5 Uploading the details of the missing child

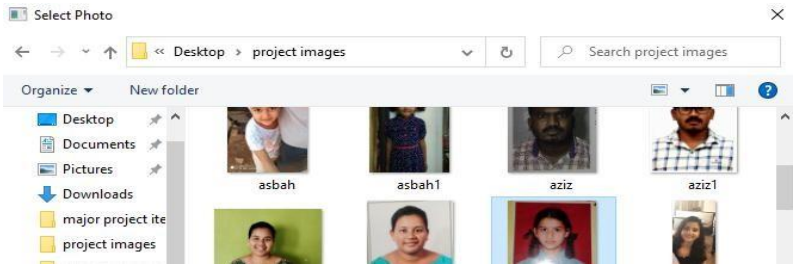

Figure 6 is the image of the available photos in the desktop, simply we can say that it is the available data to check the missing children.

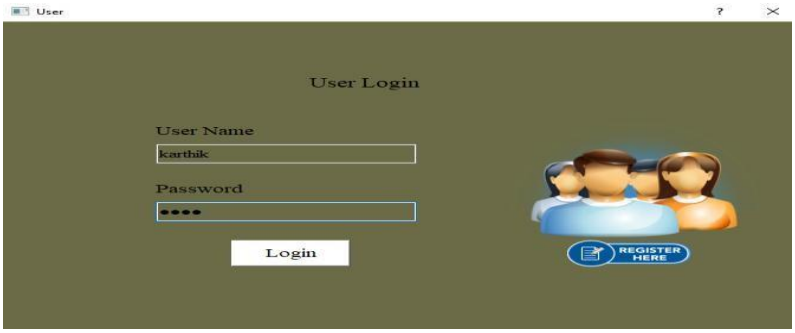

Fig 7: Login page of user

Fig 7 represents the login page of the user where the registered users are verified and can use the service provided by the appl

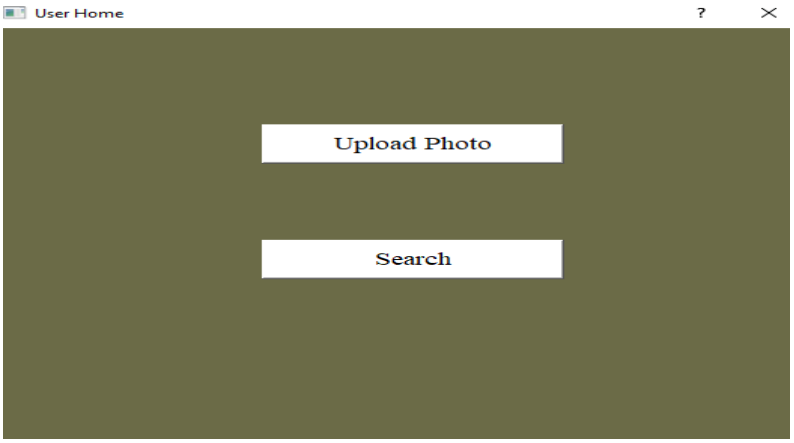

Fig 8: Operation page of the user

Fig 8 represents the actions that a user can perform. User can search an image by browsing and selecting the image as represented in fig 9 and can upload the photo of missing child

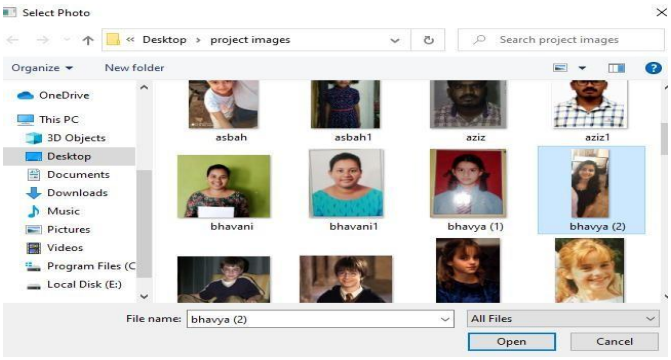

Fig 9 : User browsing an image in order to search

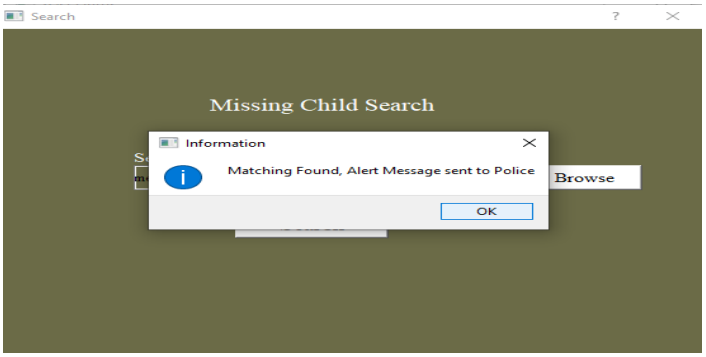

Fig 10: match found page.

Fig 10 represents if a match is found an alert message is sent to the police officer in his message box as given in fig 12.

Fig 11: Search Results page.

Fig 11 represents the results of the search if a matching image is found in the portal.

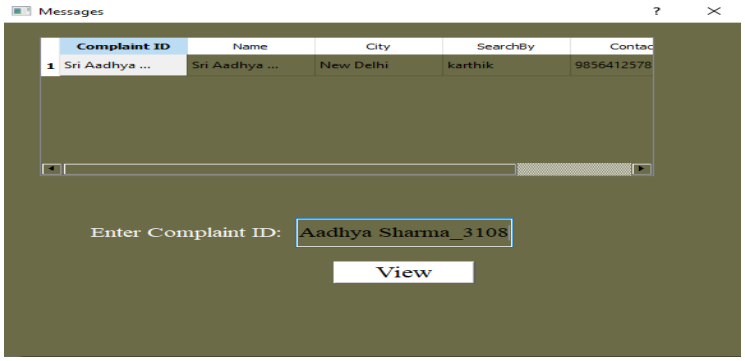

Fig 12: Message box of the police officer

Figure 13 represents the comparative analysis of different approaches with the presented approach. From the figure it is observed that the presented approach have more accuracy of finding missing children if the uploaded image is older one (i.e. present image differs from uploaded image).

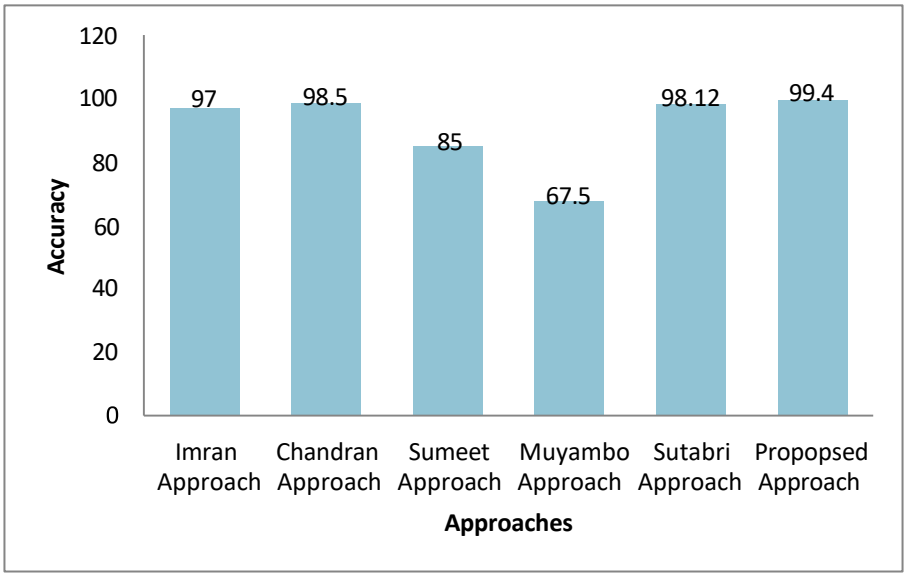

Figure 13: Accuracy of existing approaches and presented approach

3. Conclusion

The presented approach is very simple to operate and may give the path to the research society to work on this era for further improvement. The novelty of proposed approach is it integrates the property of deep learning to extract the features and KNN to classify the feature vectors of the image, which improves the finding probability of missing children. Our approach can easily distinguish the image if the available image is too old. The proposed approach is also validated by python.

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