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MISSING CHILD IDENTIFICATION USING DEEP LEARING 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 algorithmuses 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.

Keywords : Missing child identification, face recognition, deep learning, CNN, VGG-Face, Multiclass SVM.

1.INTRODUCTION

1.1 ABOUT THE PROJECT

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 everyyear 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 missingchildren are much higher than reported. The public is given provision to voluntarily take photographs of children in suspected situations and uploaded in that portal. Automatic searchingof 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 backgroundetc. 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. The proposed system is comparatively an easy, inexpensive and reliable method compared to other biometrics like finger print
And the iris recognition systems.

1.2 OBJECTIVES OF THE PROJECT

The Major objective is to find the missing child using the deep learning algorithms and multiclass SVM.This is an ambitious project with a social impact that aims to assist missing children identification.Missing child identification system combines the CNN based deep learning algorithms for facial features extraction and support vector machine classifier for text classification.It is used to match the child photos with the SVM classifier.We also create a website for the missing children in the project.There is also a need to create a systematic and centralized mechanism for tracking large number of children who either run away or missing for various reasons, and to facilitate their recovery and rehabilitation, a database of missing child is created.

1.3 SCOPE OF THE PROJECT

Children are the greatest asset of each nation. The future of any country depends upon theright 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 numberof 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 childrengo missing every day, half of them remain untraced. Children who go missing may be exploitedand 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 havegone 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.

1.4 ADVANTAGES

This system is comparatively an easy, inexpensive and reliable method compared to otherbiometrics like fingerprint and iris recognisation systems.
In missing child project ,we implement RESNET 50 and VGG 16 and compare their accuracy with CNN .

DISADVANTAGES

The methods for face recognition commonly used computer vision features such as HOG, LBP, SIFT or SURF. However, features extracted using a CNN network for getting facial representations gives better performance in face recognition than handcrafted features.
A deeplydisturbing fact about India's missing children is that while on an average 174 children go missingevery day, half of them remain untraced.

1.6 APPLICATIONS

Two application examples are given: one combining face detection with indexed collateral text for image retrieval regarding human beings, and the other combining face detection withconventional similarity matching techniques for image retrieval with similar background.

1.7 HARDWARE AND SOFTWARE

HARDWARE REQUIREMENTS

Minimum hardware requirements are very dependent on the particular software being developedby a given Enthought Python / Canopy / VS Code user. Applications that need to store large arrays/objects in memory will require more RAM, whereas applications that need to perform numerous calculations or tasks more quickly will require a faster processor.

HARDWARE SPECIFICATIONS

Operating system : Windows, linux Processor: Minimum intel i3
Ram : Minimum 4gb
Hard disk : Minimum 250gb

SOFTWARE REQUIREMENTS

The functional requirements or the overall description documents include the product perspectiveand features, operating system and operating environment, graphics requirements, design constraints and user documentation.The appropriation of requirements and implementation constraints gives the general overview ofthe project in regards to what the areas of strength and deficit are and how to tackle them.

SOFTWARE SPECIFICATIONS

Python idle 3.7 version
Django, Mysql

2. LITERATURE SURVEY

FACE RECOGNITION USING HISTOGRAMS OF ORIENTED GRADIENTS

Authors: O. Deniz, G. Bueno, J. Salido, and F. D. la Torre

Abstract: Face recognition has been a long standing problem in computer vision. Recently, Histograms of Oriented Gradients (HOGs) have proven to be an effective descriptor for object recognition in general and face recognition in particular. In this paper, we investigate a simple but powerful approachto make robust use of HOG features for face recognition. The three main contributions of this work are: First, in order to compensate for errors in facial feature detection due to occlusions, pose and illumination changes, we propose to extract HOG descriptors from a regular grid. Second, fusion of HOG descriptors at different scales allows to capture important structure for face recognition. Third, we identifythe necessity of performing dimensionality reduction to remove noise and make the classification process less prone to overfitting. This is particularly important if HOG features are extracted from overlapping cells. Finally, experimental results on four databases illustrate the benefits of our approach.

FACE RECOGNITION USING SIFT FEATURES

Authors : C. Geng and X. Jiang

Abstract: Scale Invariant Feature Transform (SIFT) has shown to be a powerful technique for general object recognition/detection. In this paper, we propose two new approaches: Volume-SIFT (VSIFT) and Partial-Descriptor-SIFT (PDSIFT) for face recognition based on the original SIFT algorithm. We compare holistic approaches: Fisherface (FLDA), the null space approach (NLDA) and Eigenfeature Regularization and Extraction (ERE) with feature based approaches: SIFT and PDSIFT. Experiments onthe ORL and AR databases show that the performance of PDSIFT is significantly better than the originalSIFT approach. Moreover, PDSIFT can achieve comparable performance as the most successful holisticapproach ERE and significantly outperforms FLDA and NLDA.

MISSING CHILD IDENTIFICATION USING FACE RECOGNITION SYSTEM

Authors: Rohit Satle, Vishnuprasad Poojary, John Abraham and Shilpa Wakode.

Abstract: The human face plays an important role in our social interaction, conveying people's identity. Face recognition is a task that humans perform routinely and effortlessly in their daily lives. Face recognition, as one of the primary biometric technologies, became more and more important owing to

rapid advances in technologies such as digital cameras, the Internet and mobile devices, and increased demands on security. A facial recognition system is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source. Face Recognition System is a computer based digital technology and is an active area of research. This paper addresses the building of face recognition system by using Principal Component Analysis (PCA) method. The PCA hasbeen extensively employed for face recognition algorithms. It not only reduces the dimensionality of the image, but also retains some of the variations in the image data. The system functions by projecting face image onto a feature space that spans the significant variations among known face images. The significant features are known as "Eigen faces", because they are the eigenvectors (Principal Component)of the set of faces they do not necessarily correspond to the features such as eyes, ears, and noses.The projection operation characterize an individual face by a weighted sum of the Eigen faces features and so to recognize a particular face it is necessary only to compare these weights to those individuals.

VERY DEEP CONVOLUTIONAL NETWORKS FOR LARGE-SCALE IMAGE RECOGNITION
Author : karen simonyan and andrew zisserman
Abstract : In this work we investigate the effect of the convolutional network depth on its accuracy in the large-scale image recognition setting. Our main contribution is a thorough evaluation of networks of increasing depth using an architecture with very small (3 × 3) convolution filters, which shows that asignificant improvement on the prior-art configurations can be achieved by pushing the depth to 16–19 weight layers. These findings were the basis of our ImageNet Challenge 2014 submission, where our team secured the first and the second places in the localization and classification tracks respectively.
We also show that our representations generalize well to other datasets, where they achieve state-of-the-artresults. We have made our two best-performing ConvNet models publicly available to facilitate further research on the use of deep visual representations in computer vision.

2.1 EXISTING SYSTEM

Mostly missing child cases are reported to the police. The child missing from one region may be found inanother 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.

Disadvantages of existing system

Earliest methods for face recognition commonly used computer vision features such as HOG, LBP, SIFT, or SURF. However, features extracted using a CNN network for getting facial representations gives better performance in face recognition than handcrafted features.

2.2 PROPOSED SYSTEM

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 publiccan 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. In missing child project student asking to implement RESNET 50 and VGG 16 and compare their accuracy with CNN.

Advantages of proposed system

A deep learning 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.
In missing child project student asking to implement RESNET 50 and VGG 16 and compare their accuracy with CNN.

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3. PROPOSED ARCHITECTURE
3.1 SYSTEM ARCHITECTURE

Here we propose a methodology for missing child identification which combines facial featureextraction 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 framework is given below

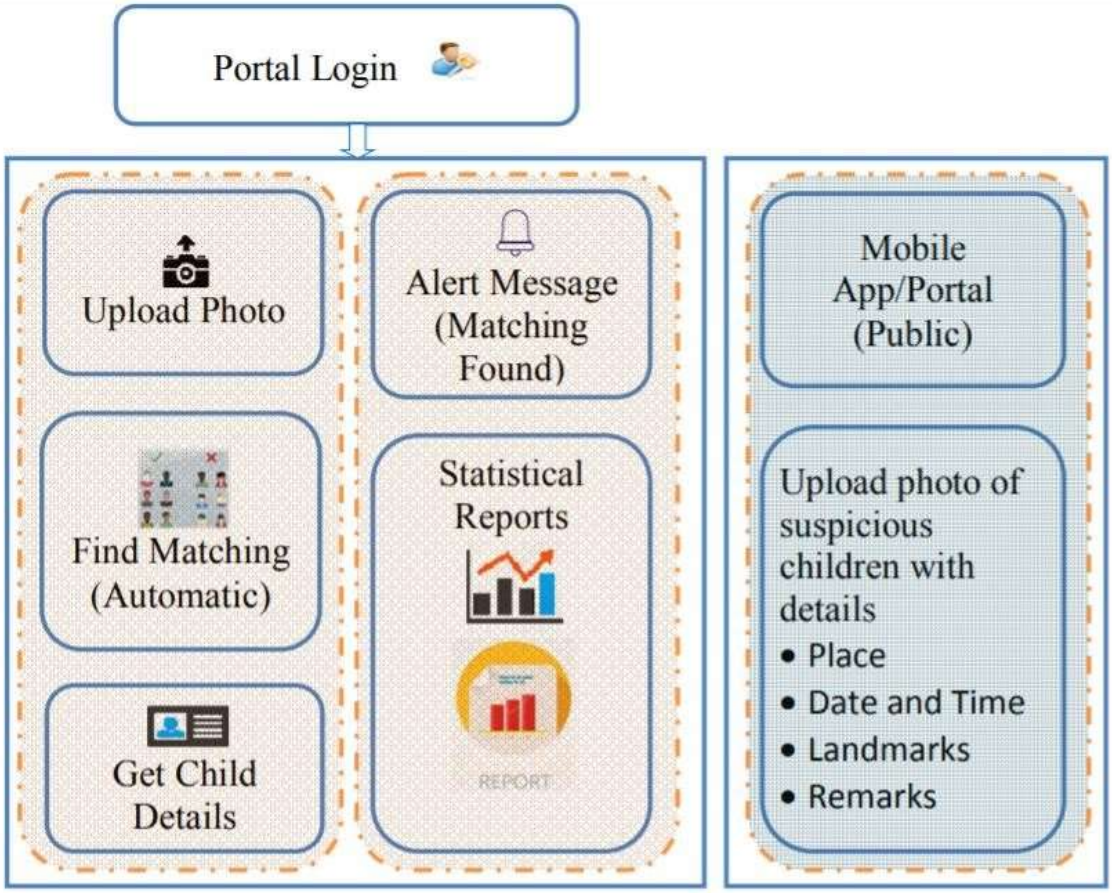

Fig : 3.1 System Architecture

Images of reported missing children are saved in a repository and the face area is selected for cropping toobtain 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. In the following sections the paper details the work flow for child matching methodology. The block diagram of the automatic child face identification methodology is as shown in Fig 3.2

3.2 BLOCK DIAGRAM

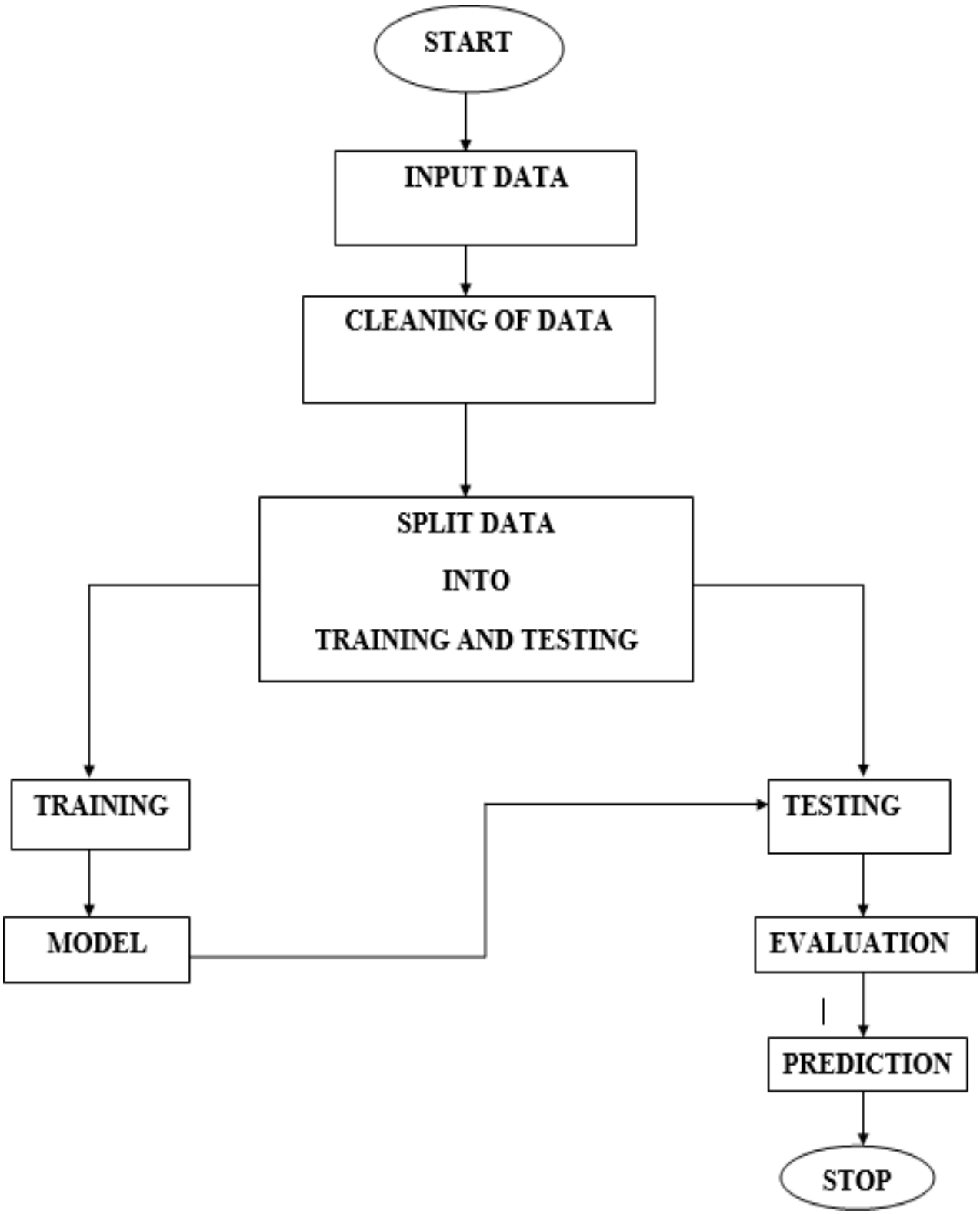

Fig : 3.2 Block Diagram

3.3 UML DIAGRAMS

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group. The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML. The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems. The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems. The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

GOALS

The Primary goals in the design of the UML are as follows:

Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.

Provide extendibility and specialization mechanisms to extend the core concepts.

Be independent of particular programming languages and development process.

Provide a formal basis for understanding the modeling language.

Encourage the growth of OO tools market.

Support higher level development concepts such as collaborations, frameworks, patterns and components.

Integrate best practices.

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3.3.1 USE CASE DIAGRAM

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

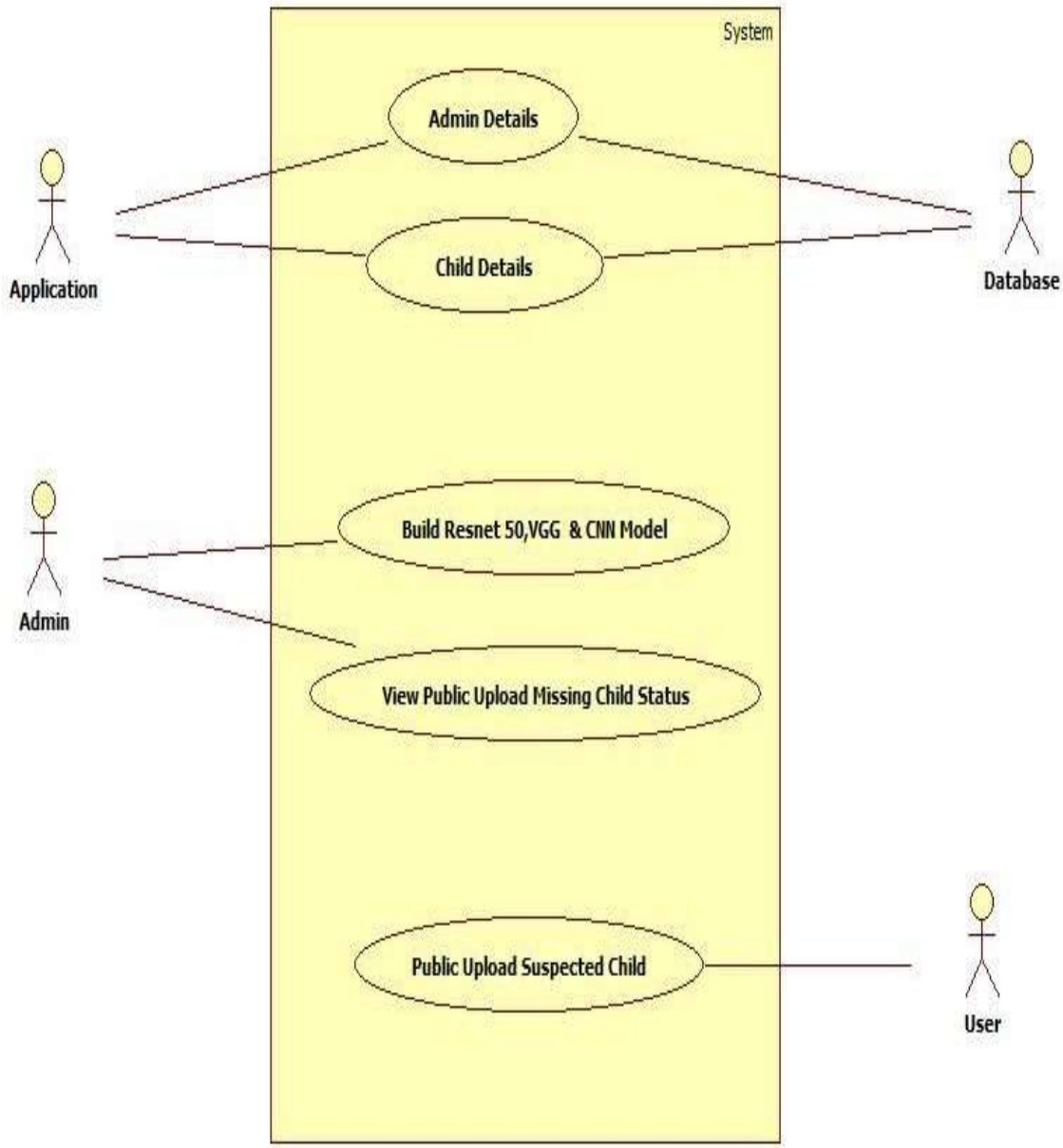

Fig : 3.3.1 Use case diagram

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3.3.2 CLASS DIAGRAM

The class diagram is used to refine the use case diagram and define a detailed design of the system. The class diagram classifies the actors defined in the use case diagram into a set of interrelated classes.
The relationship or association between the classes can be either an "is-a" or "has-a" relationship. Each class in the class diagram may be capable of providing certain functionalities. These functionalities provided by the class are termed "methods" of the class. Apart from this, each class may have certain "attributes" that uniquely identify the class.

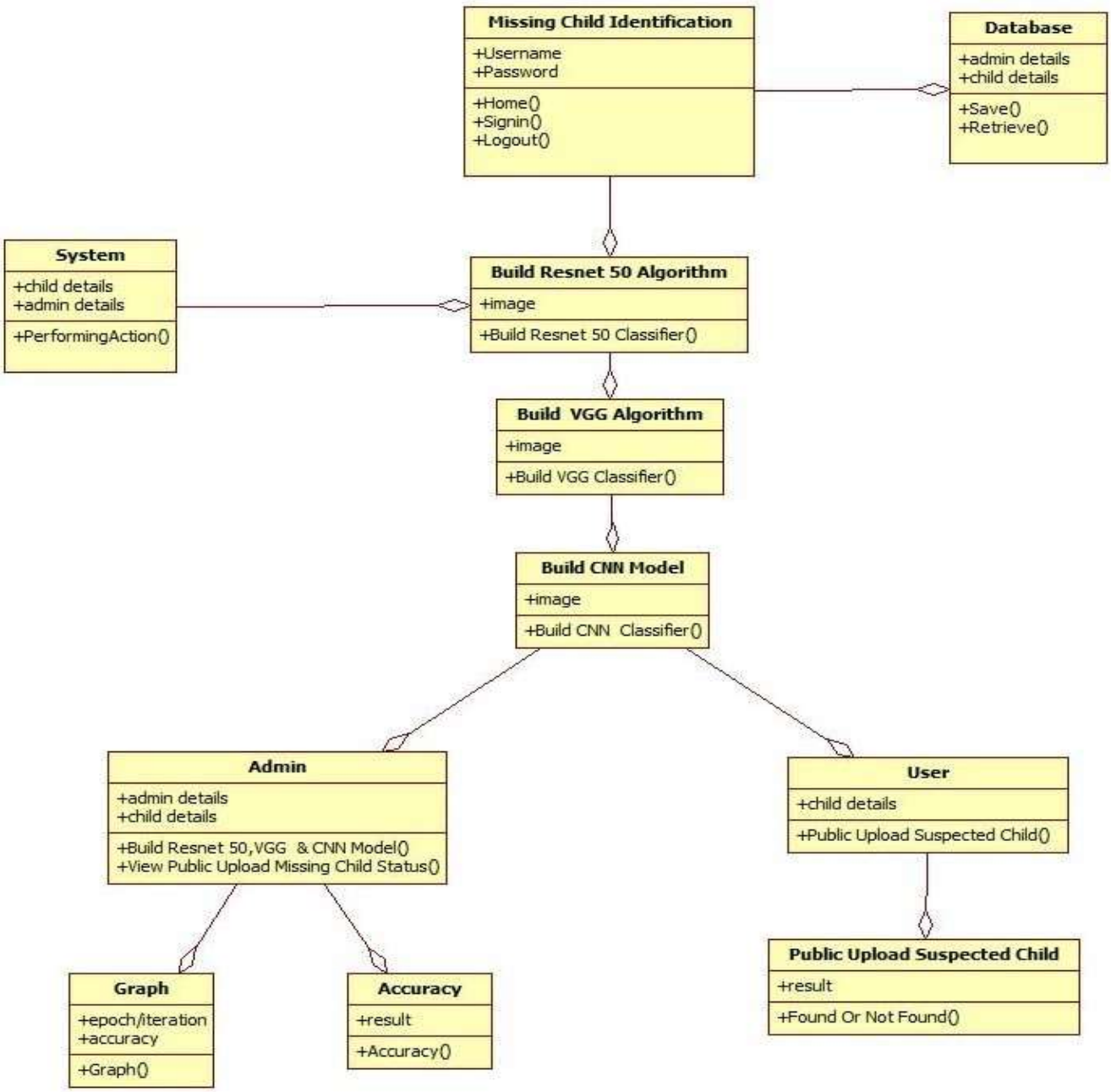

Fig : 3.3.2 Class Diagram

3.3.3 STATE DIAGRAM

A state diagram, as the name suggests, represents the different states that objects in the system undergo during their life cycle. Objects in the system change states in response to events. In addition tothis, a state diagram also captures the transition of the object's state from an initial state to a final state in response to events affecting the system.

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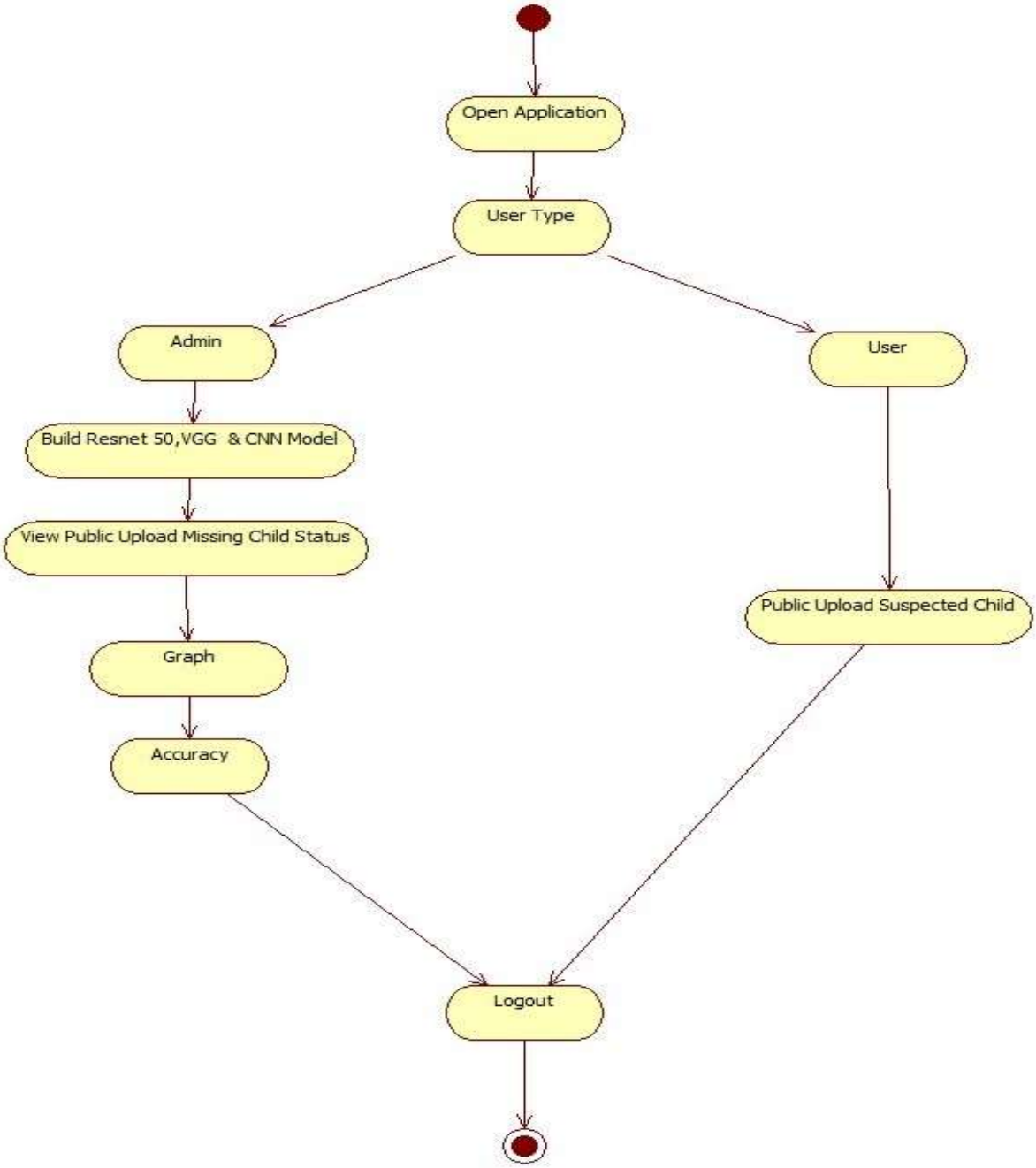

Fig : 3.3.3 State diagram

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3.3.4 ACTIVITY DIAGRAM

The process flows in the system are captured in the activity diagram. Similar to a state diagram, an activity diagram also consists of activities, actions, transitions, initial and final states, and guard conditions.

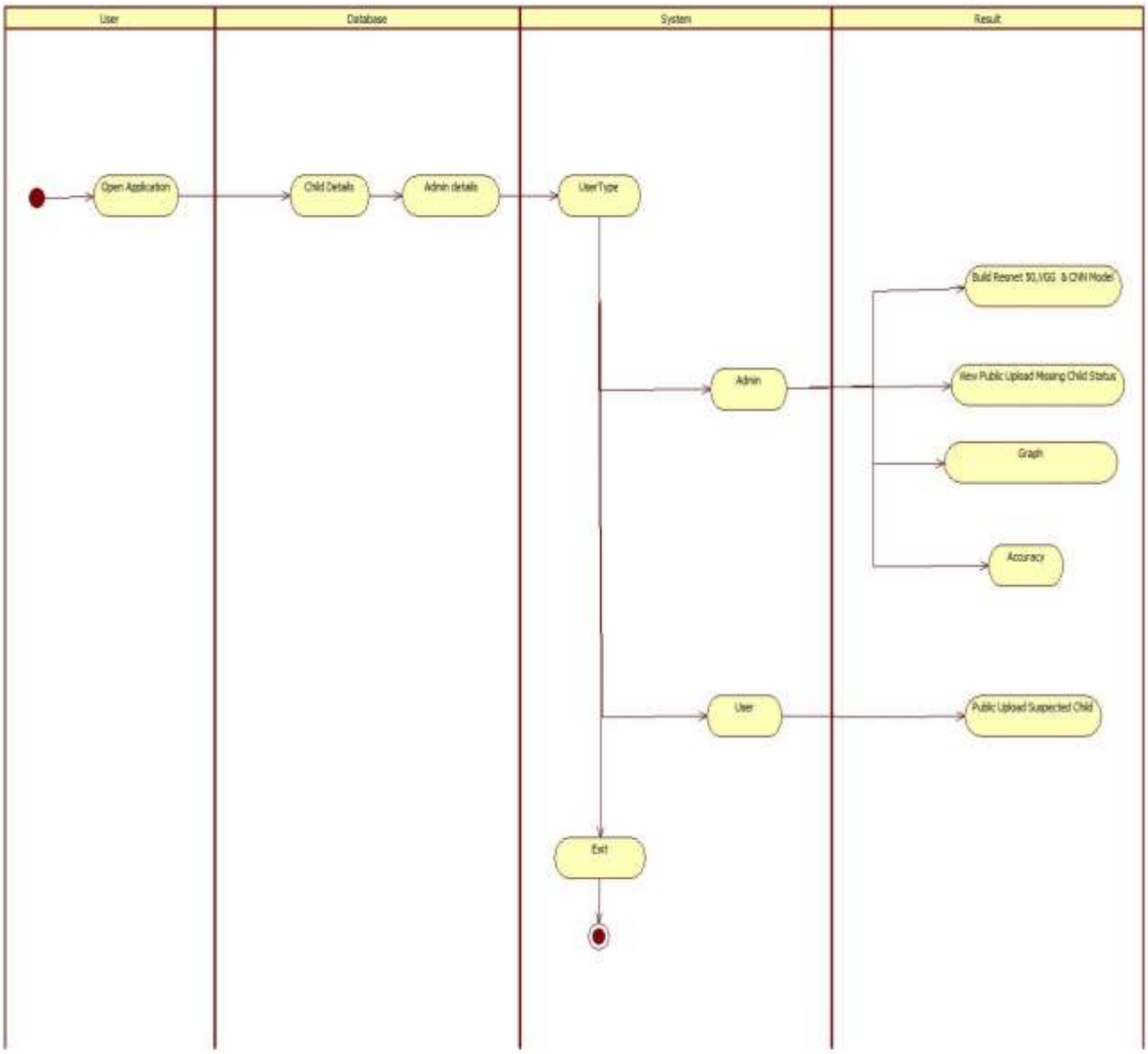

Fig : 3.3.4 Activity diagram

3.3.5 SEQUENCE DIAGRAM

A sequence diagram represents the interaction between different objects in the system. The important aspect of a sequence diagram is that it is time-ordered. This means that the exact sequence of the interactions between the objects is represented step by step. Different objects in the sequence diagram interact with each other by passing "messages".

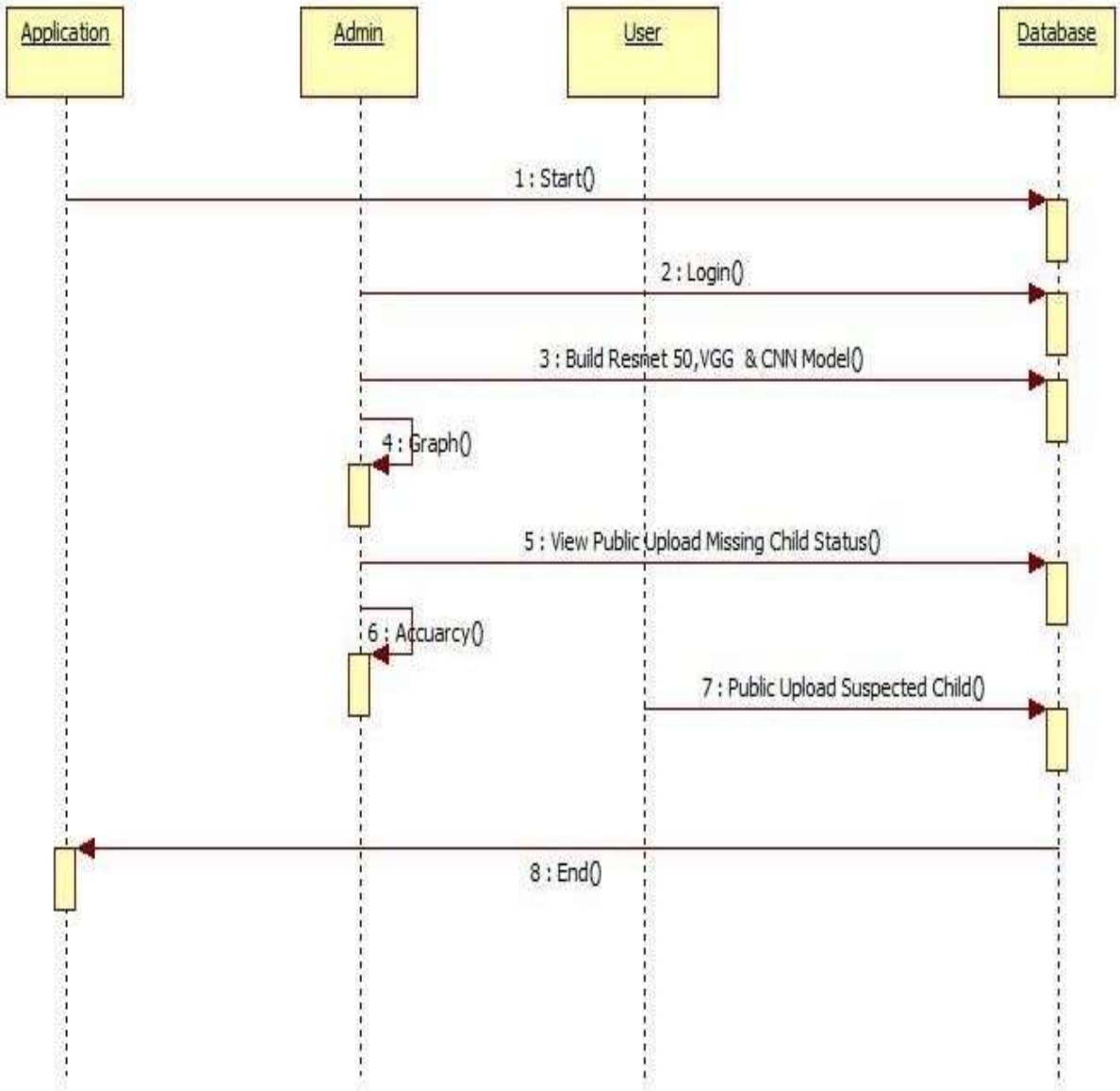

Fig : 3.3.5 Sequence diagram

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3.3.6 COLLABORATION DIAGRAM

A collaboration diagram groups together the interactions between different objects. The interactionsare listed as numbered interactions that help to trace the sequence of the interactions. The collaboration diagram helps to identify all the possible interactions that each object has with other objects.

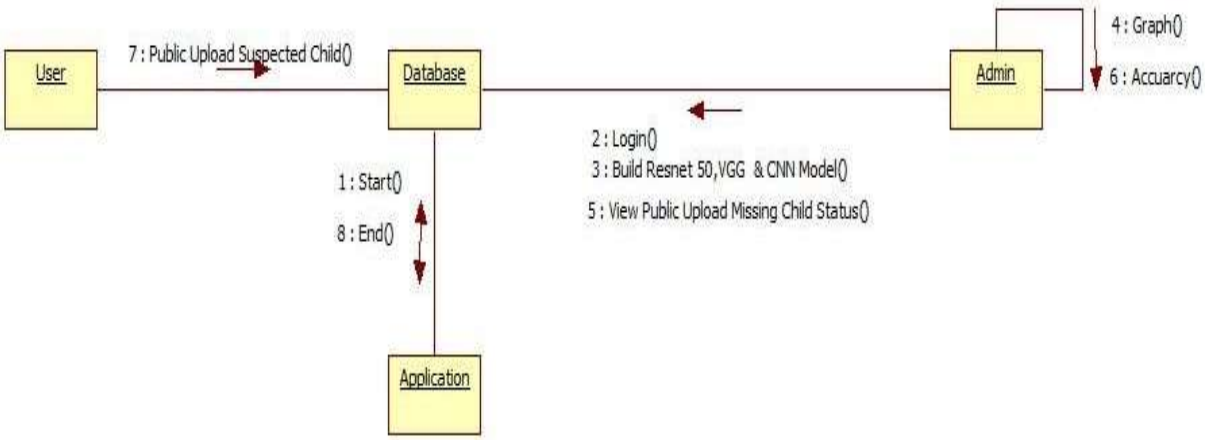

Fig : 3.3.6 Collaboration diagram

IMPLEMENTATION

MODULE DESCRIPTION

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.
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 inimage database or not.

EXTENSION MODULE
In missing child the implement RESNET 50 and VGG 16 and compare their accuracy with CNN.
Graph with increasing epoch all algorithms accuracy is getting better and better and in above graph green line represents RESNET and blue line represents VGG 16 and orange line represents CNN accuracy
The Accuracy of CNN and VGG 16 was Increased.

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ALGORITHM:

4.1.1 CONVOLUTIONAL NEURAL NETWORK

To demonstrate how to build a convolutional neural network based image classifier, we shall build a 6 layer neural network that will identify and separate one image from other. This network that we shall buildis a very small network that we can run on a CPU as well. Traditional neural networks that are very good at doing image classification have many more parameters and take a lot of time if trained on normal CPU. However, our objective is to show how to build a real-world convolutional neural network using TENSORFLOW.

Neural Networks are essentially mathematical models to solve an optimization problem. They are made ofneurons, the basic computation unit of neural networks. A neuron takes an input (say x), do some computation on it (say: multiply it with a variable w and adds another variable b) to produce a value (say; z= wx+b). This value is passed to a non-linear function called activation function (f) to produce the final output(activation) of a neuron. There are many kinds of activation functions. One of the popular activation function is Sigmoid. The neuron which uses sigmoid function as an activation function will be called sigmoid neuron. Depending on the activation functions, neurons are named and there are many kindsof them like RELU, TanH.

If you stack neurons in a single line, it's called a layer; which is the next building block of neural networks.See below image with layers

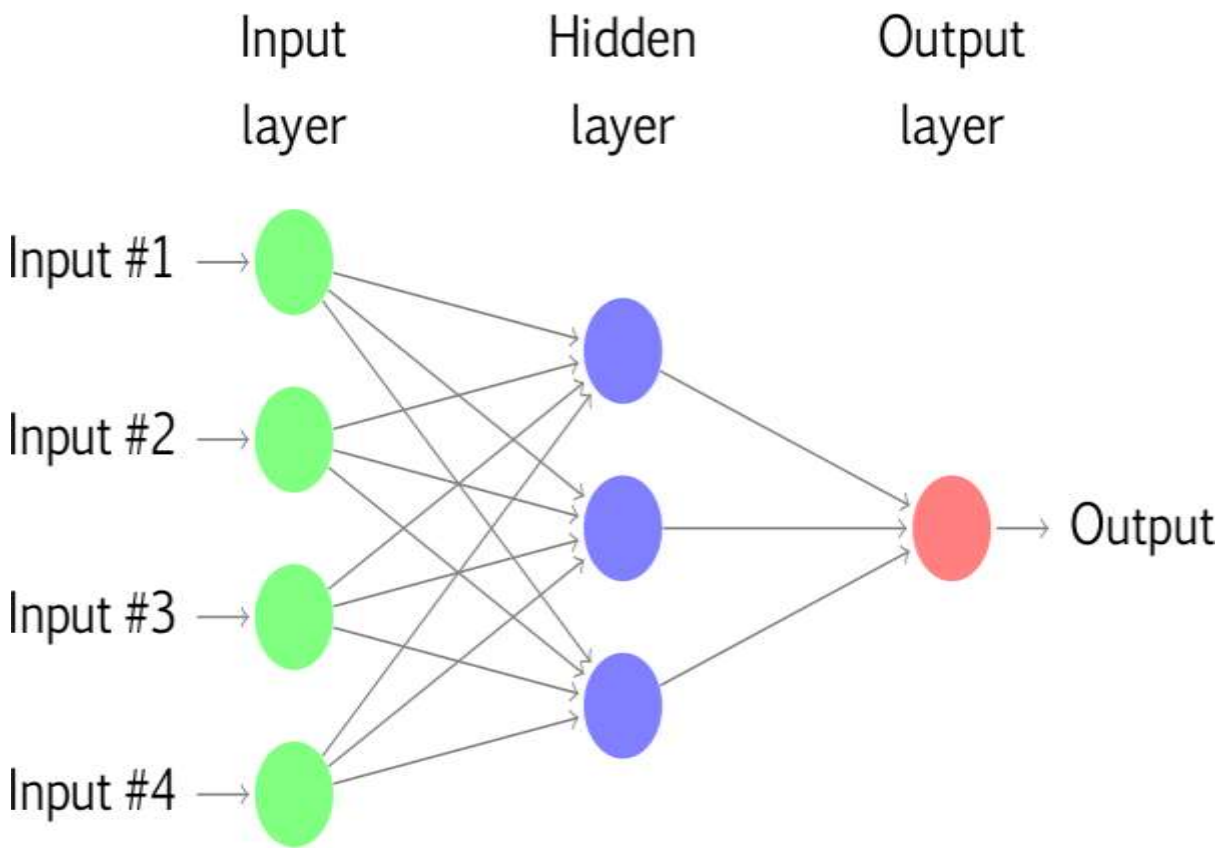

Fig : 4.1.1 Layer in CNN

To predict image class multiple layers operate on each other to get best match layer and this process continues till no more improvement left.

4.1.2 VGG -16 ALGORITHM

VGG16 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 ILSVRC-2014. Itmakes 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. VGG16was trained for weeks and was using NVIDIA Titan Black GPU's.

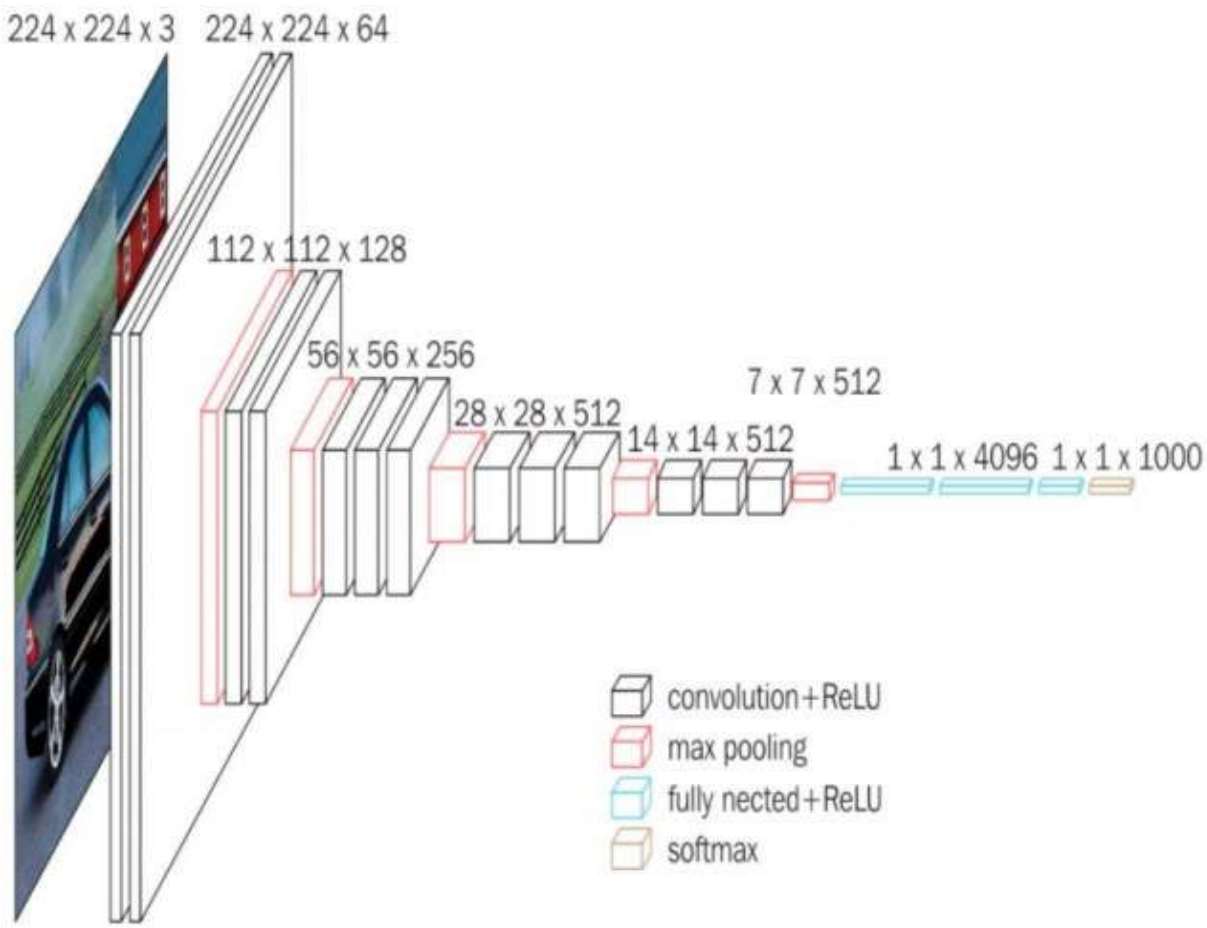

Fig : 4.1.2 VGG – 16 Model

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4.1.3 RESNET- 50

Deep residual networks like the popular ResNet-50 model is a convolutional neural network (CNN) that is50 layers deep. A residual neural network (ResNet) is an artificial neural network (ANN) of a kind that stacks residual blocks on top of each other to form a network. This article will walk you through what you need to know about residual neural networks and the most popular ResNets, including ResNet-34,ResNet-50, and ResNet-101

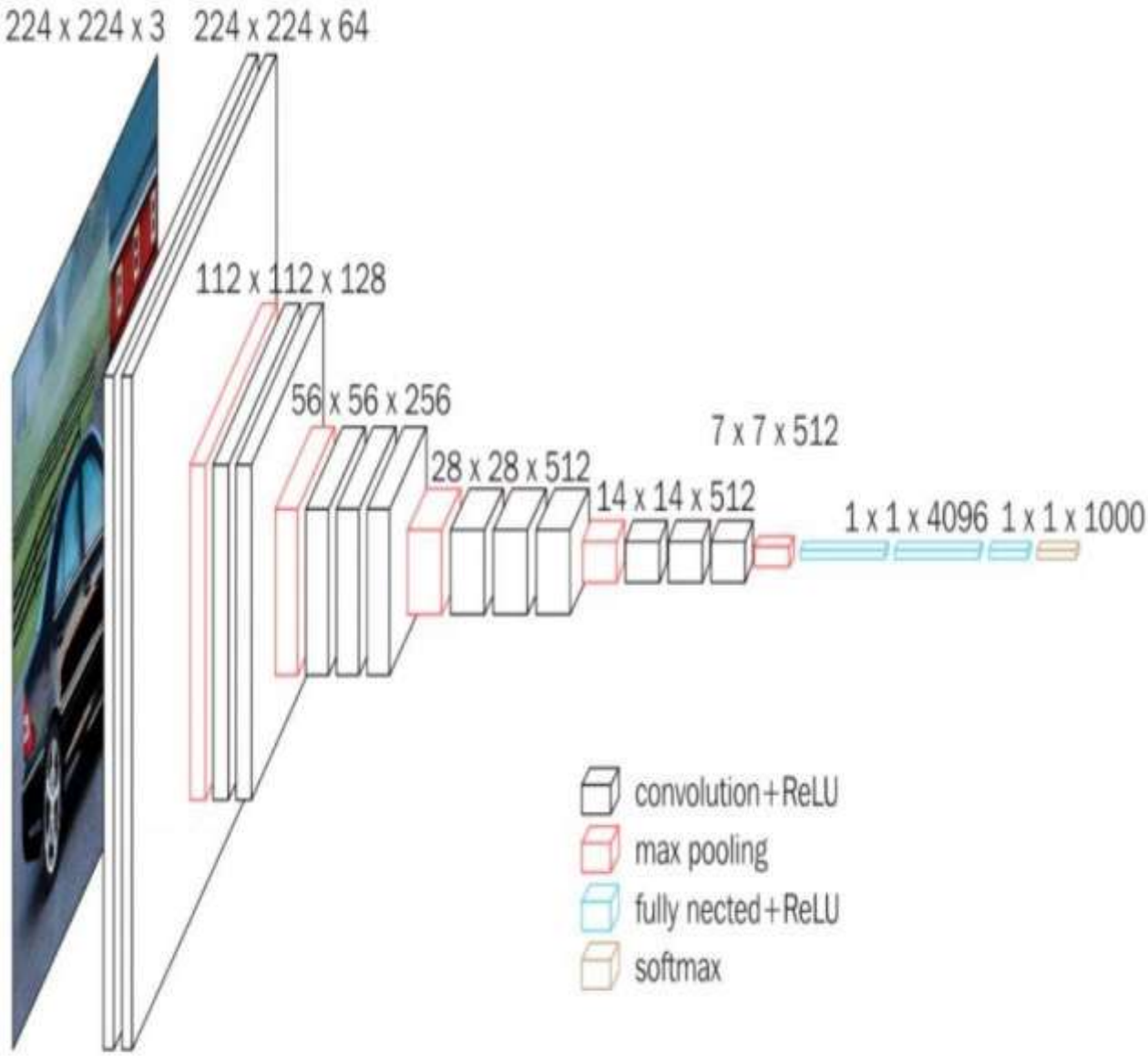

Fig : 4.1.3 RESNET – 50 Model

CODE IMPLEMENTATION

```
from django.shortcuts import render
from django.template import RequestContextimport pymysql
from django.http import HttpResponsefrom django.conf import settings
from django.core.files.storage import FileSystemStorageimport datetime
import os import cv2
import numpy as np
from keras.utils.np_utils import to_categoricalfrom keras.layers import MaxPooling2D
from keras.layers import Dense, Dropout, Activation, Flattenfrom keras.layers import Convolution2D
from keras.models import Sequential
from keras.models import model_from_json


global indexindex = 0
global missing_child_classifierglobal cascPath
global faceCascade


def index(request):
if request.method == 'GET':
return render(request, 'index.html', {})


def Login(request):
if request.method == 'GET':
return render(request, 'Login.html', {})def Upload(request):
```

```
  if request.method == 'GET':
return render(request, 'Upload.html', {})


def OfficialLogin(request):
if request.method == 'POST':
username = request.POST.get('t1', False)password = request.POST.get('t2', False)
if username == 'admin' and password == 'admin':
context= {'data':'welcome '+username}
return render(request, 'OfficialScreen.html', context)else:
context= {'data':'login failed'}
return render(request, 'Login.html', context)


def ViewUpload(request):
if request.method == 'GET':
strdata = '<table border=1 align=center width=100%><tr><th>Upload Person Name</th><th>Child Name</th><th>Contact No</th><th>Found Location</th><th>Child Image <th>Uploaded Date</th><th>Status</th></tr><tr>'
con = pymysql.connect(host='127.0.0.1',port = 3306,user = 'root', password = 'root', database = 'MissingChildDB',charset='utf8')
with con:
cur = con.cursor()
cur.execute("select * FROM missing")rows = cur.fetchall()
for row in rows:


strdata+='<td>'+row[0]+'</td><td>'+str(row[1])+'</td><td>'+row[2]+'</td><td>'+row[3]+'</td><td><i
mg src=/static/images/'+row[4]+' width=200 height=200></img></td><td>'
strdata+=str(row[5])+'</td><td>'+str(row[6])+'</td></tr>'context= {'data':strdata}
return render(request, 'ViewUpload.html', context)
```

```
def UploadAction(request):global index
global missing_child_classifierglobal cascPath
global faceCascade
if request.method == 'POST' and request.FILES['t5']:
output = ''
person_name = request.POST.get('t1', False)child_name = request.POST.get('t2', False) contact_no = request.POST.get('t3', False) location = request.POST.get('t4', False) myfile = request.FILES['t5']
fs = FileSystemStorage()
filename = fs.save('C:/Users/ssnaik/Desktop/Missing Child Identification System using Deep Learningand Multiclass SVM/MissingChildApp/static/images/'+child_name+'.png', myfile)
#if index == 0:
cascPath = "haarcascade_frontalface_default.xml" faceCascade = cv2.CascadeClassifier(cascPath)
#index = 1
option = 0;
frame = cv2.imread(filename)
gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY) faces = faceCascade.detectMultiScale(gray,1.3,5) print("Found {0} faces!".format(len(faces)))
img = ''
status = 'Child not found in missing database'if len(faces) > 0:
for (x, y, w, h) in faces:
img = frame[y:y + h, x:x + w]option = 1
if option == 1:
with open('model/model.json', "r") as json_file:loaded_model_json = json_file.read()
missing_child_classifier = model_from_json(loaded_model_json)
missing_child_classifier.load_weights("model/model_weights.h5")
```

```
missing_child_classifier._make_predict_function()img = cv2.resize(img, (64,64))
im2arr = np.array(img)
im2arr = im2arr.reshape(1,64,64,3)img = np.asarray(im2arr)
img = img.astype('float32')img = img/255
preds = missing_child_classifier.predict(img)if(np.amax(preds) > 0.60):
status = 'Child found in missing database'now = datetime.datetime.now()
current_time = now.strftime("%Y-%m-%d %H:%M:%S")filename = os.path.basename(filename)
db_connection = pymysql.connect(host='127.0.0.1',port = 3306,user = 'root', password = 'root', database
='MissingChildDB',charset='utf8')
db_cursor = db_connection.cursor()
query = "INSERT INTO
missing(person_name,child_name,contact_no,location,image,upload_date,status)
VALUES('"+person_name+"','"+child_name+"','"+contact_no+"','"+location+"','"+filename+"','"+str(cu
rrent_ time)+"','"+status+"')"
db_cursor.execute(query) db_connection.commit() print(db_cursor.rowcount, "Record Inserted")
context= {'data':'Thank you for uploading. '+status}return render(request, 'Upload.html', context)
```

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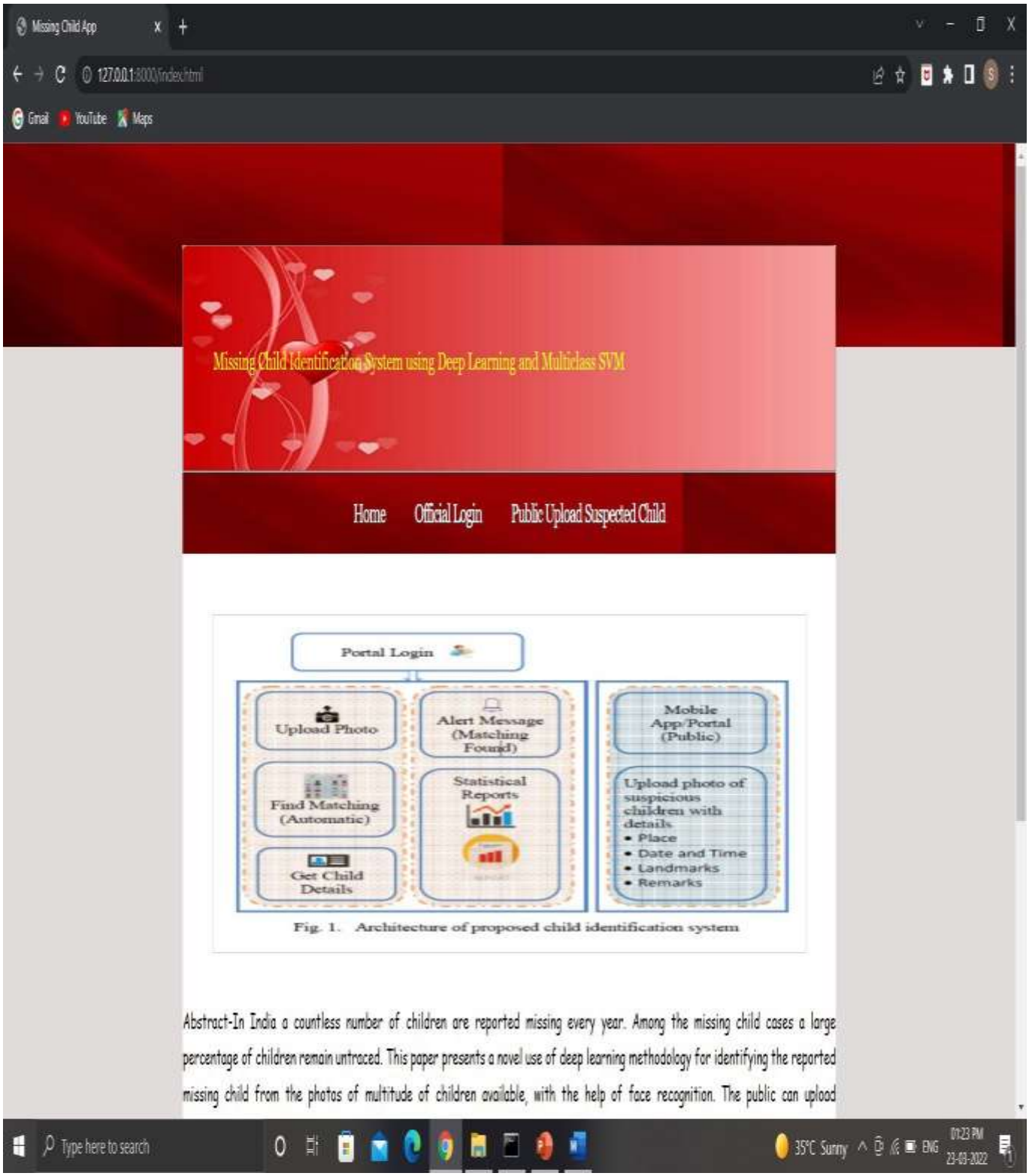
RESULT



5.1 Fig : Portal Login

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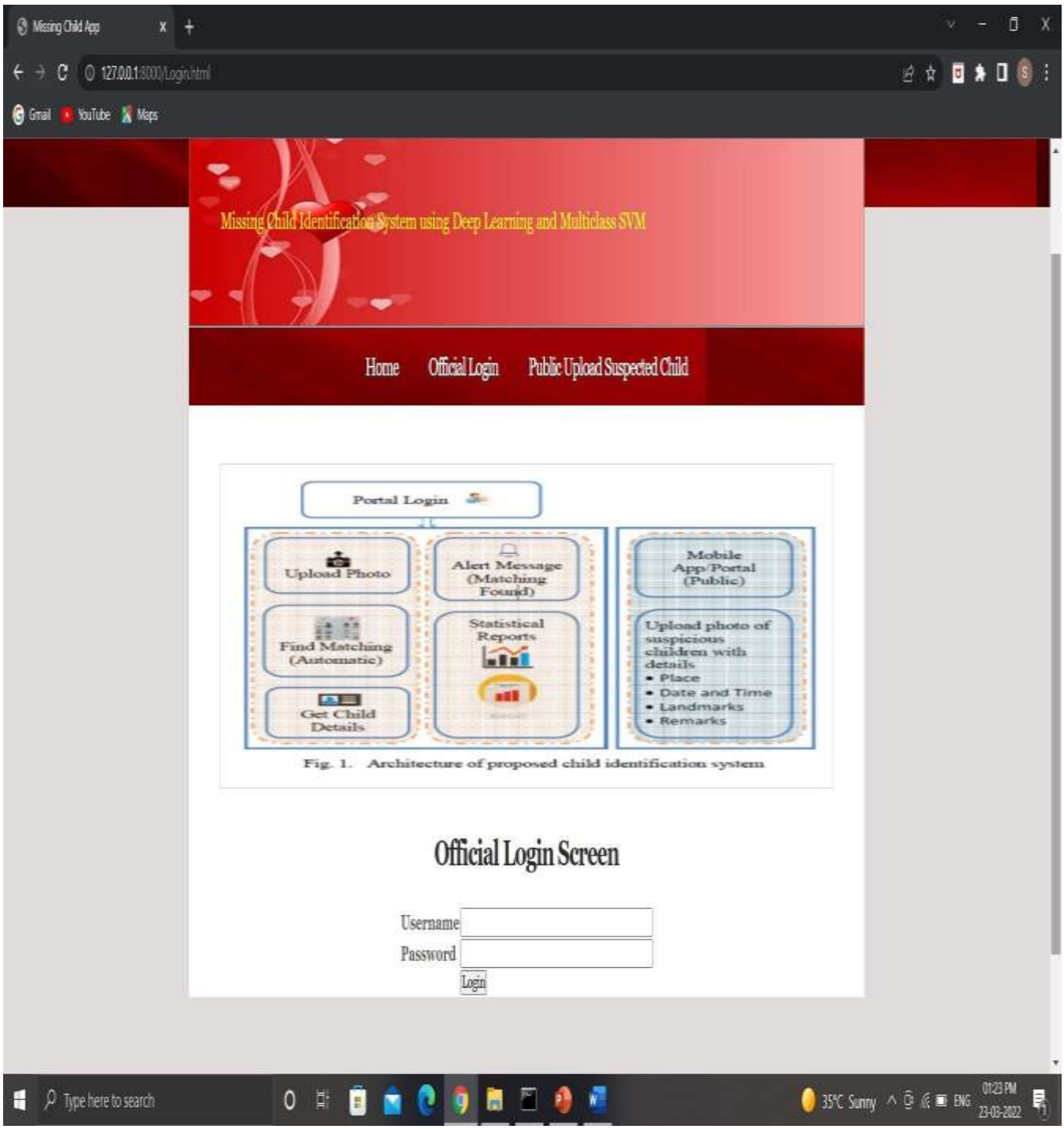

5.2 Fig : Official Login Screen

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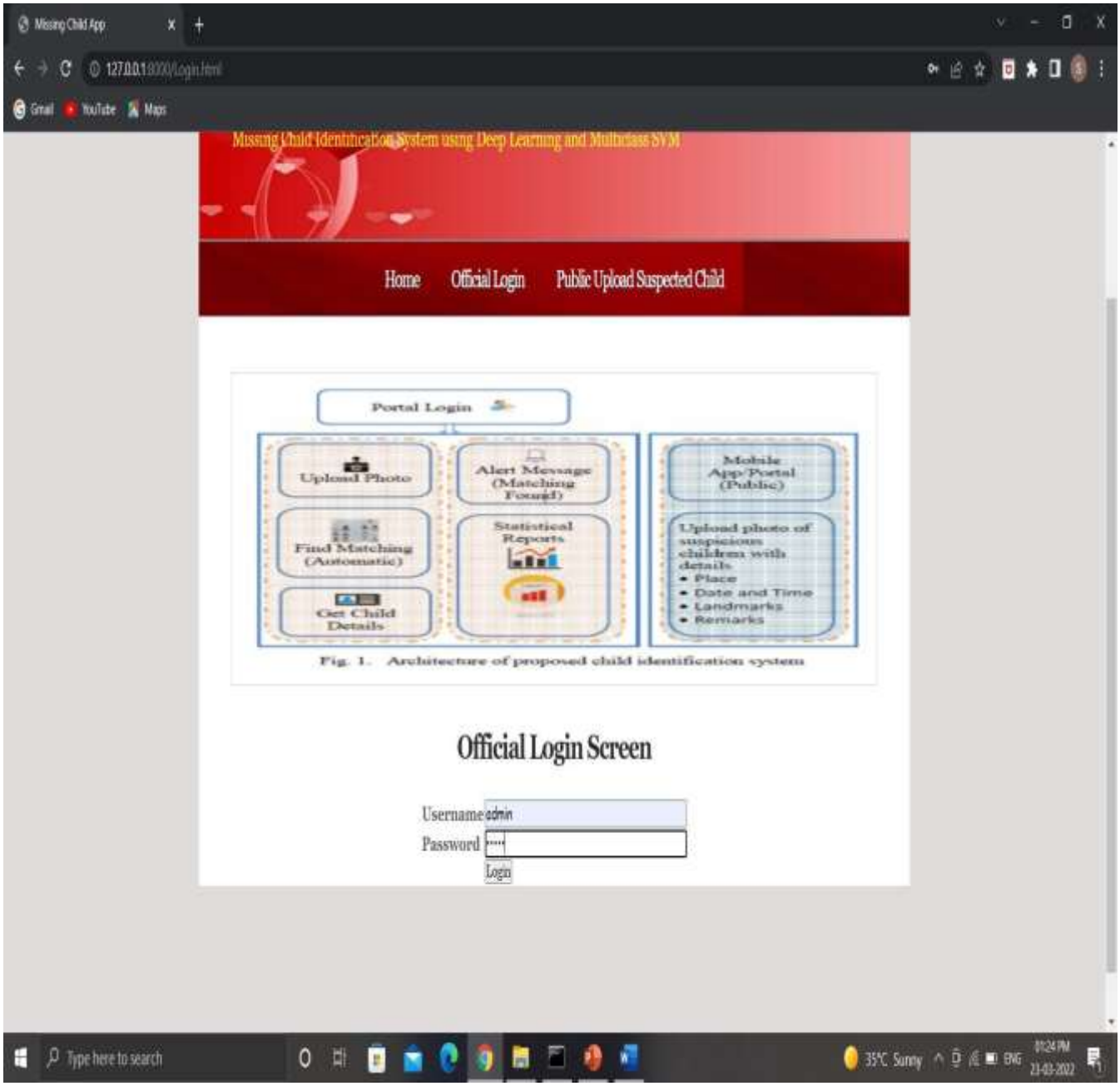

Fig. 1. Architecture of proposed child identification system

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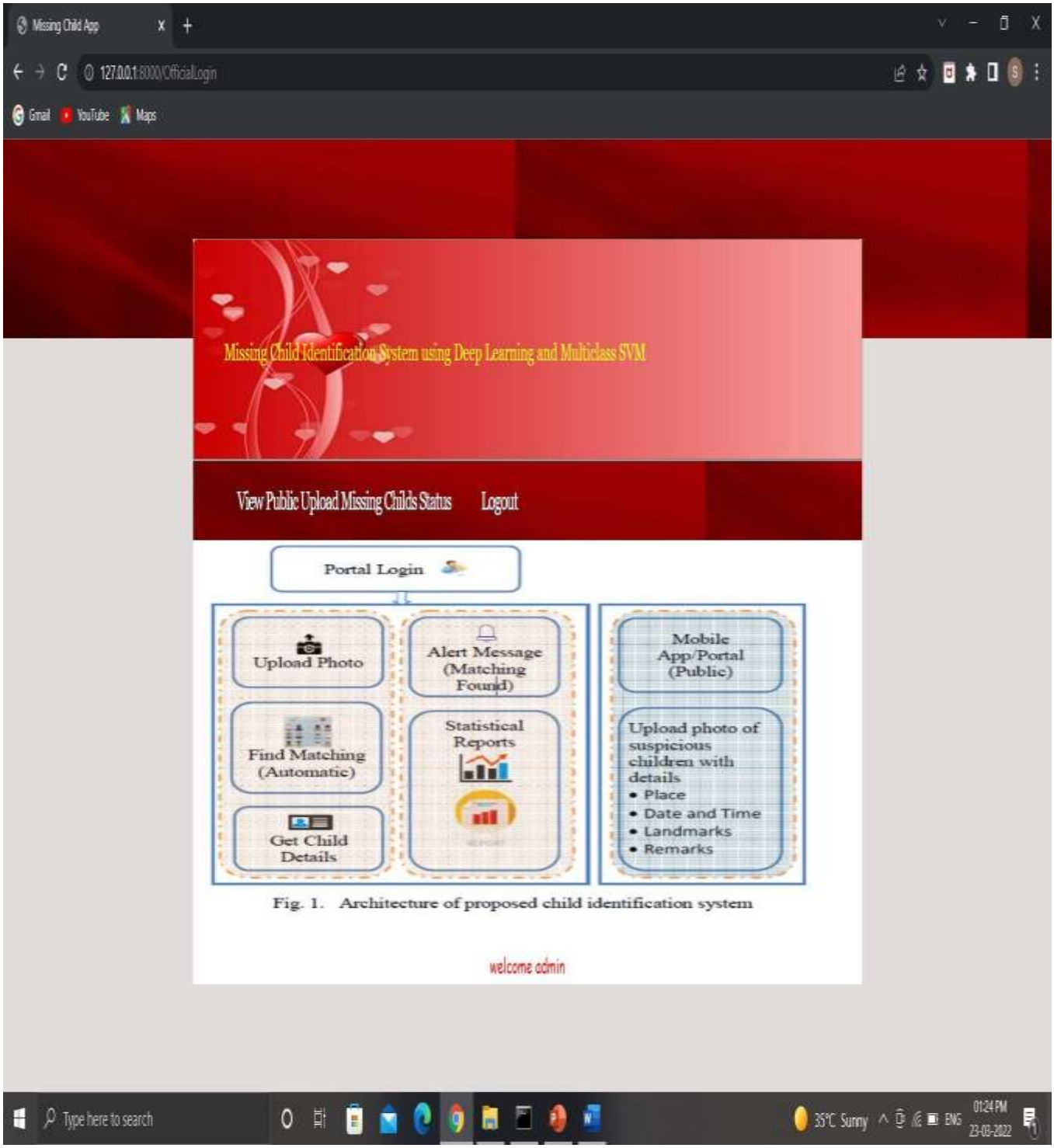

5.3 Fig: Welcome Page After Login

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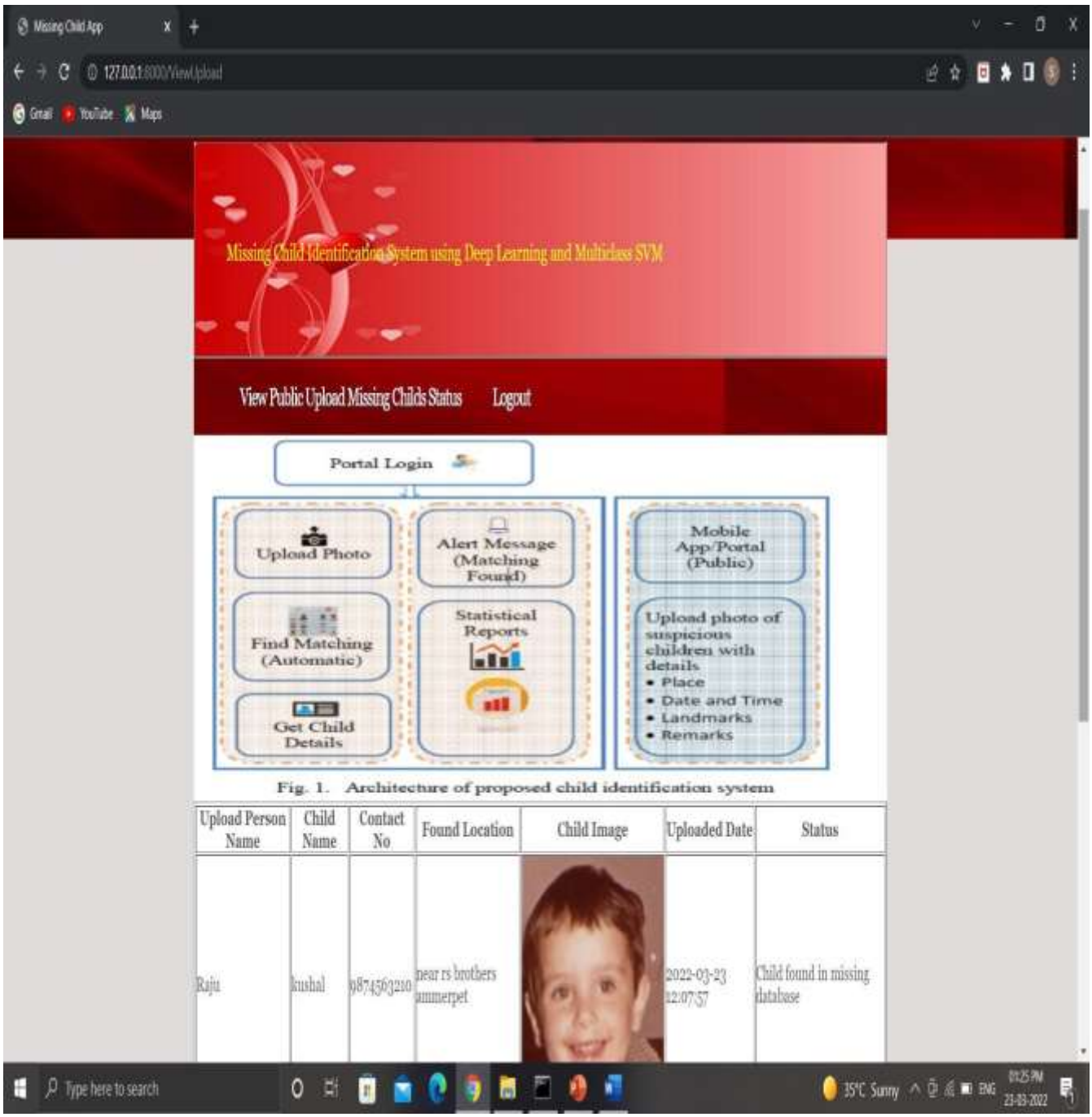

Fig. 1. Architecture of proposed child identification system

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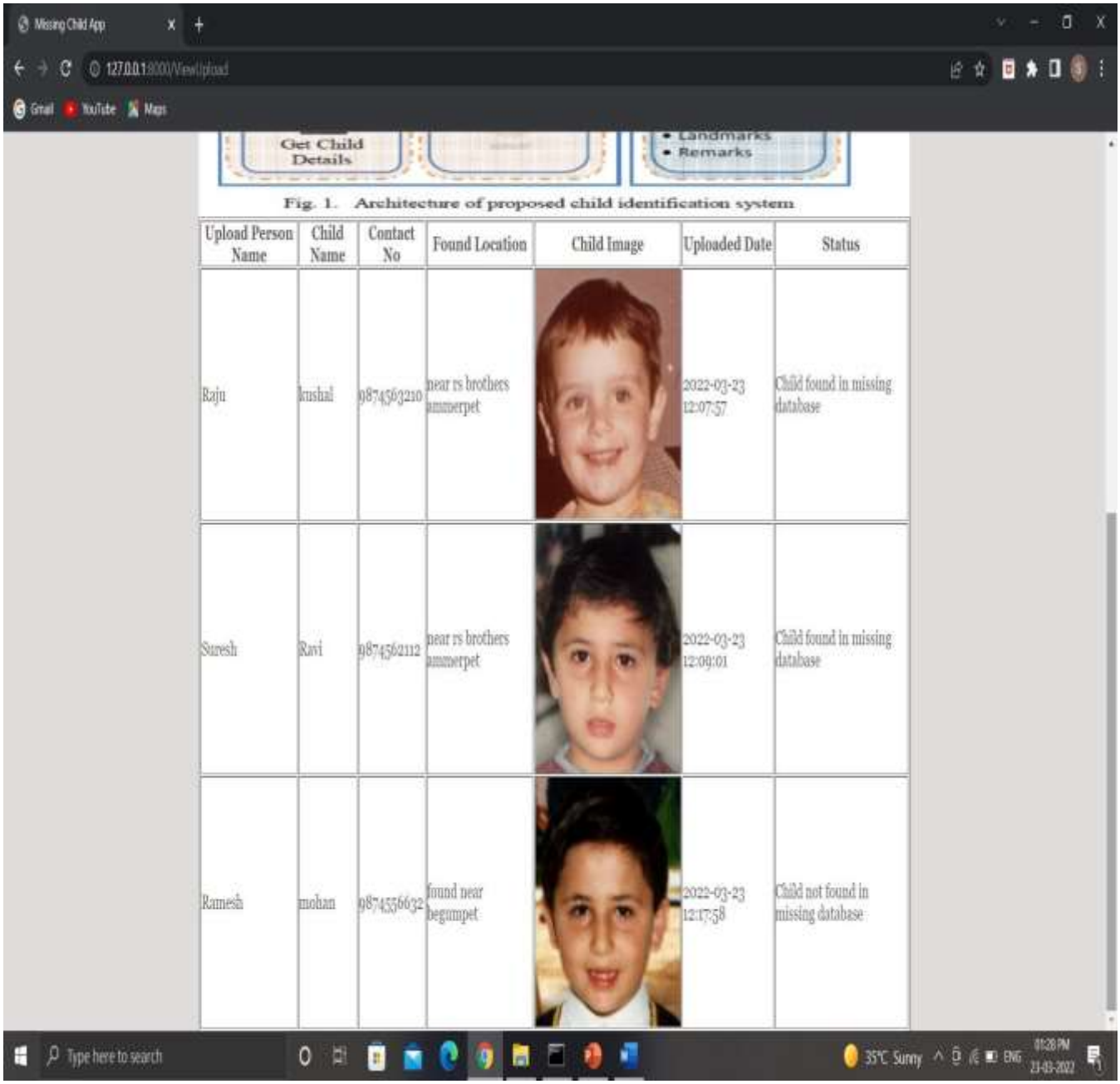

5.4 Fig: Details Missing Child

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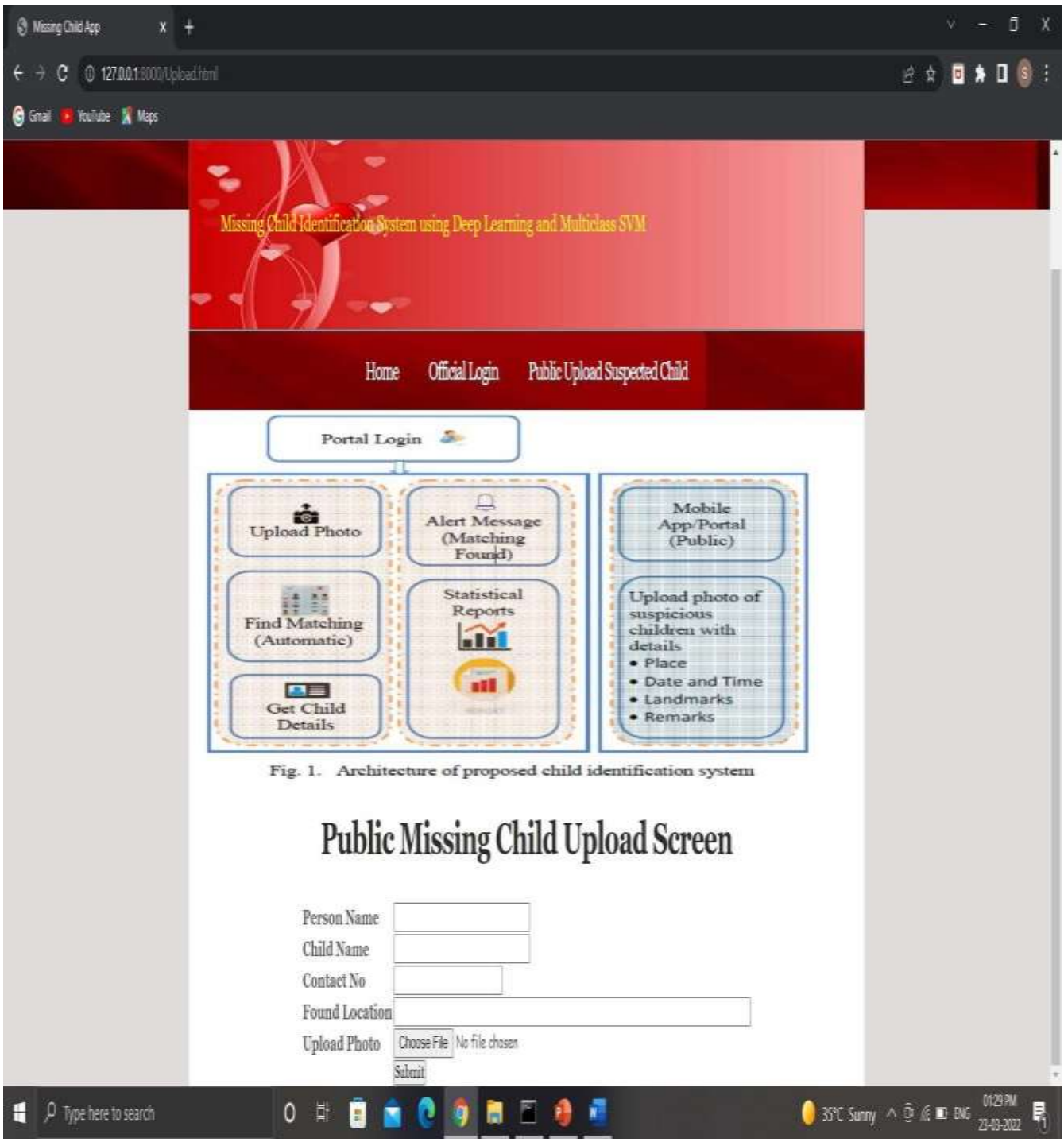

Fig. 1. Architecture of proposed child identification system

5.5 Fig: Public Missing Child Upload Screen

CONCLUSION

A missing child identification system is proposed, which combines the powerful CNN based deep learningapproach 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 soft max 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, noisesand 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. In missing child project student asking to implement RESNET 50 and VGG 16 andcompare their accuracy with CNN

EXTENSION PROJECT

In missing child project student asking to implement RESNET 50 and VGG 16 and compare their accuracy with CNN.
Graph with increasing epoch all algorithms accuracy is getting better and better and in above graphgreen line represents RESNET and blue line represents VGG 16 and orange line represents CNN accuracy.

FUTURE SCOPE

Future Enhancement is being planned to further analyze and enhance the protocol to identifymissing child with advance features image classification.

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