VIDEO BASED SURVEILLANCE SYSTEM AND

PATH PREDICTION

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **"VIDEO BASED SURVEILLANCE SYSTEM AND PATH PREDICTION "** is the bonafide work of "P.POOJA (211417104187) and S.OMEZHILE (211417104175)" who carried out the project work under my supervision.

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EXTERNAL EXAMINER

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to our respected Secretary and Correspondent **Dr.P.CHINNADURAI, M.A., Ph.D.** for his kind words and enthusiastic motivation, which inspired us a lot in completing this project.

We would like express our deep sense of gratitude and sincere thanks to our Directors **Tmt.C.VIJAYA RAJESWARI, Dr.C.SAKTHIKUMAR, M.E., Ph.D.,** and **Tmt. SARANYASREE SAKTHIKUMAR B.E.,M.B.A.,** for providing us with the necessary facilities for completion of this project.

We also express our gratitude to our Principal **Dr.K.Mani, M.E., Ph.D.** for his timely concern and encouragement provided to us throughout the course.

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TABLE OF CONTENTS

ABSTRACT

As an important branch of Security and surveillance systems, face recognition technology has the characteristics of convenient acquisition and high reliability that is widely used in the fields of information security, national security, traffic monitoring, security cameras and organisations like school, college.

This project is to Detect Unknown or specified given person(criminal) in Surveillance camera at Traffic signals and predicting his probability path further then reporting to their nearby controlled rooms

CHAPTER 1

1 INTRODUCTION

1.1 OVERVIEW

In this project , we first define visual tracking of a particular person, say criminal. Subsequently we present another background algorithm for face recognition.

Once the criminal is detected in the camera an alert message is passed to all the nearby control rooms. And even if the criminal tries to escape he cannot, because his path is also predicted in our project .

1.2 PROBLEM DEFINITION

Anti-theft Security Systems need the use of software parts . Firstly, the software part will be used as Telegram.

System will start surveillance function and capture photos sent to administrator to notify him with Telegram when a stranger tries to enter.And later it predicts the direction of the thief and send another alert to the administrator

CHAPTER 2

2. LITERATURE SURVEY

LITERATURE SURVEY

Title : Intelligent video surveillance: a review through deep learning techniques for crowd analysis

Authors : G.Sreenu , M.A Saleem Durai

Abstract : Among the widespread examples of big data, the role of video streams from CCTV cameras is equally important as other sources like social media data, sensor data, agriculture data, medical data and data evolved from space research. Surveillance videos have a major contribution in unstructured big data. CCTV cameras are implemented in all places where security has much importance. Manual surveillance seems tedious and time consuming. Security can be defined in different terms in different contexts like theft identification, violence detection, chances of explosion etc. In crowded public places the term security covers almost all types of abnormal events. Among them violence detection is difficult to handle since it involves group activity. The anomalous or abnormal activity analysis in a crowd video scene is very difficult due to several real world constraints. The paper includes a deep rooted survey which starts from object recognition, action recognition, crowd analysis and finally violence detection in a crowd environment.

Title : Human Action Recognition and Prediction: A Survey

Authors : Yu Kong, Yun Fu

Abstract : Derived from rapid advances in computer vision and machine learning, video analysis tasks have been moving from inferring the present state to predicting the future state. Vision-based action recognition and

prediction from videos are such tasks, where action recognition is to infer human actions (present state) based upon complete action executions, and action prediction to predict human actions (future state) based upon incomplete action executions. These two tasks have become particularly prevalent topics recently because of their explosively emerging real-world applications, such as visual surveillance, autonomous driving vehicle, entertainment, and video retrieval, etc.

Title : Video-Based Motion Trajectory Forecasting Method for Proactive Construction Safety Monitoring Systems

Authors : Shuai Tang, Mani Golparvar-Fard, A.M.ASCE, Milind Naphade and Murali M. Gopalakrishna

Abstract : Falls, struck-bys, and caught-in/betweens are among the most common types of fatal accidents on construction sites. Despite their significance, the majority of today's accident prevention programs react passively to situations in which workers or equipment enter predefined unsafe zones. To support systems that proactively prevent these accidents, this paper presents a path prediction model for workers and equipment. The model leverages the extracted video frames to predict upcoming worker and equipment motion trajectories on construction sites. Specifically, the model takes
two-dimensional (2D) tracks of workers and equipment from visual data—based on computer vision methods for detection and tracking—and uses a long short-term memory (LSTM) encoder-decoder followed by a mixture density network (MDN) to predict their locations. A multihead prediction module is introduced to predict locations at different future times. The method is validated on an existing dataset, TrajNet, and a new dataset of 105 high-definition videos recorded over 30 days from a real-world construction site.

Title : Video-Based Surveillance Systems
Authors : Paolo Remagnino, Graeme A. Jones, Nikos Paragios
Abstract: Monitoring of public and private sites has increasingly become a very sensitive issue resulting in a patchwork of privacy laws varying from country to

country -though all aimed at protecting the privacy of the citizen. It is important to remember, however, that monitoring and visual surveillance capabilities can also be employed to aid the citizen. The focus of current development is primarily aimed at public and corporate safety applications including the monitoring of railway stations, airports, and inaccessible or dangerous environments.

CHAPTER 3

3. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Based on the research found, there are some project works related to face recognition on security systems. Through a research paper “Web-based online embedded door access control and home security system based on face recognition” written by Sahani, M., Nanda, C., Sahu, A.K. and Pattnaik, B..

The strength and weakness of their product can be identified after analysis. The strength of their product is they used wireless network technique ZigBee based. The ZigBee module combine with electromagnetic door lock module to operate the door accessibility

3.2 PROPOSED SYSTEM

The proposed system is designed with wireless access control so the lock module can be added easily if needed. Email and SMS are used to notify the house owner when a stranger faces. It helps to reduce the need of the server so the user can directly login and control the embedded system in real time. Users can control the system with SMS, email and website. However, it still can be improve from it weaknesses

. The face recognition can be bypassed with a photo of the owner's face. The system can be improved with add on password authentication, sound recognition or fingerprint authentication. The product cost can be lower with reducing the SMS module and using the WIFI module as replacement. Since our phone always connected to internet and the latency should be lower if compare with GSM network

3.3 REQUIREMENT

ANALYSIS AND SPECIFICATION

3.3.1 INPUT REQUIREMENTS

➔ System with 8GB RAM ,above i5(9th gen),with Graphic processor-NVIDIA.

➔ Visual studio C (to code)

➔ A dataset to encode and train

3.3.2 OUTPUT REQUIREMENTS

➔ Camera with 16MP

3.3.3 FUNCTIONAL REQUIREMENTS

Step 1: Enroll and Encode the faces(common faces and specified person's face)in a Database

Step 2: Train the Given set of faces

Step 3: Then to detect that specified person among common people

Step 4: If it matches with the specified person ,It send alert notification to the master control room

Step 5: It send 5 sec of the captured video and along with the predicted map in Telegram

3.4 TECHNOLOGY STACK

HARDWARE:

SURVEILLANCE CAMERA-To capture and detect the specified person

MONITORING SCREEN-To monitor the movement of capturing video

SOFTWARE:

★ Opencv to train images

★ Window 10-operating system

★ Python language

★ API to send messages

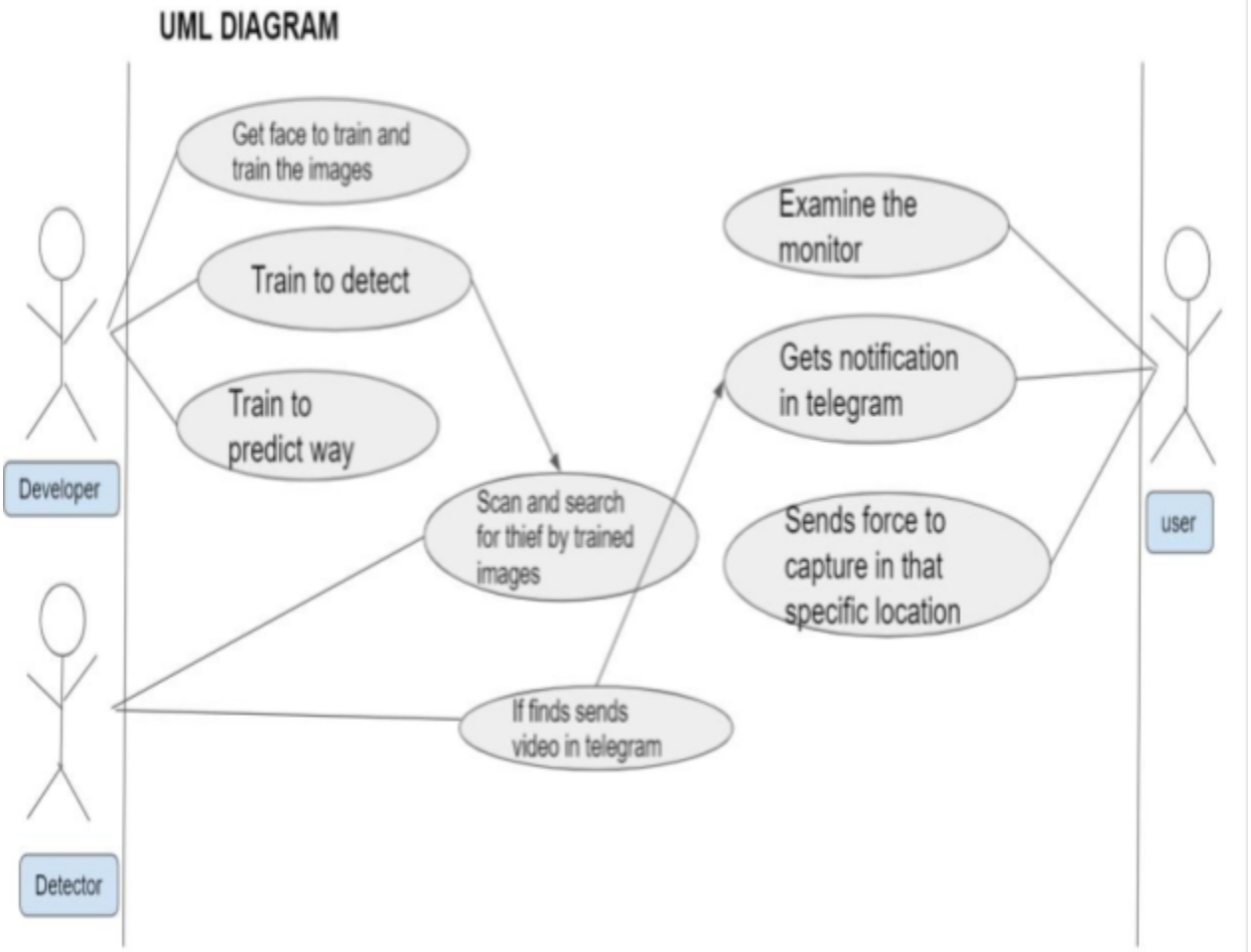
★ Algorithm-CNN

★ Telegram

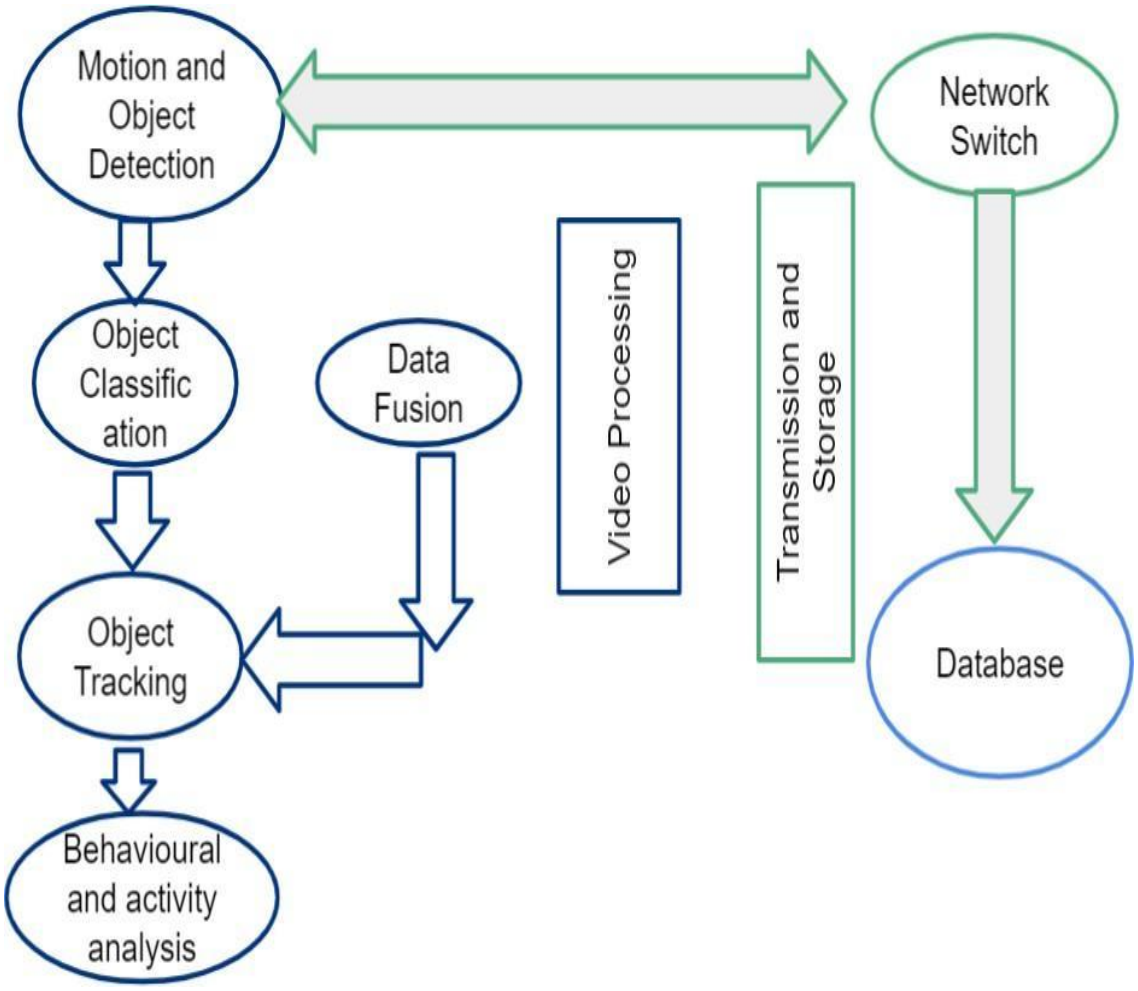
CHAPTER 4

4.SYSTEM DESIGN

4.1 UML DIAGRAM

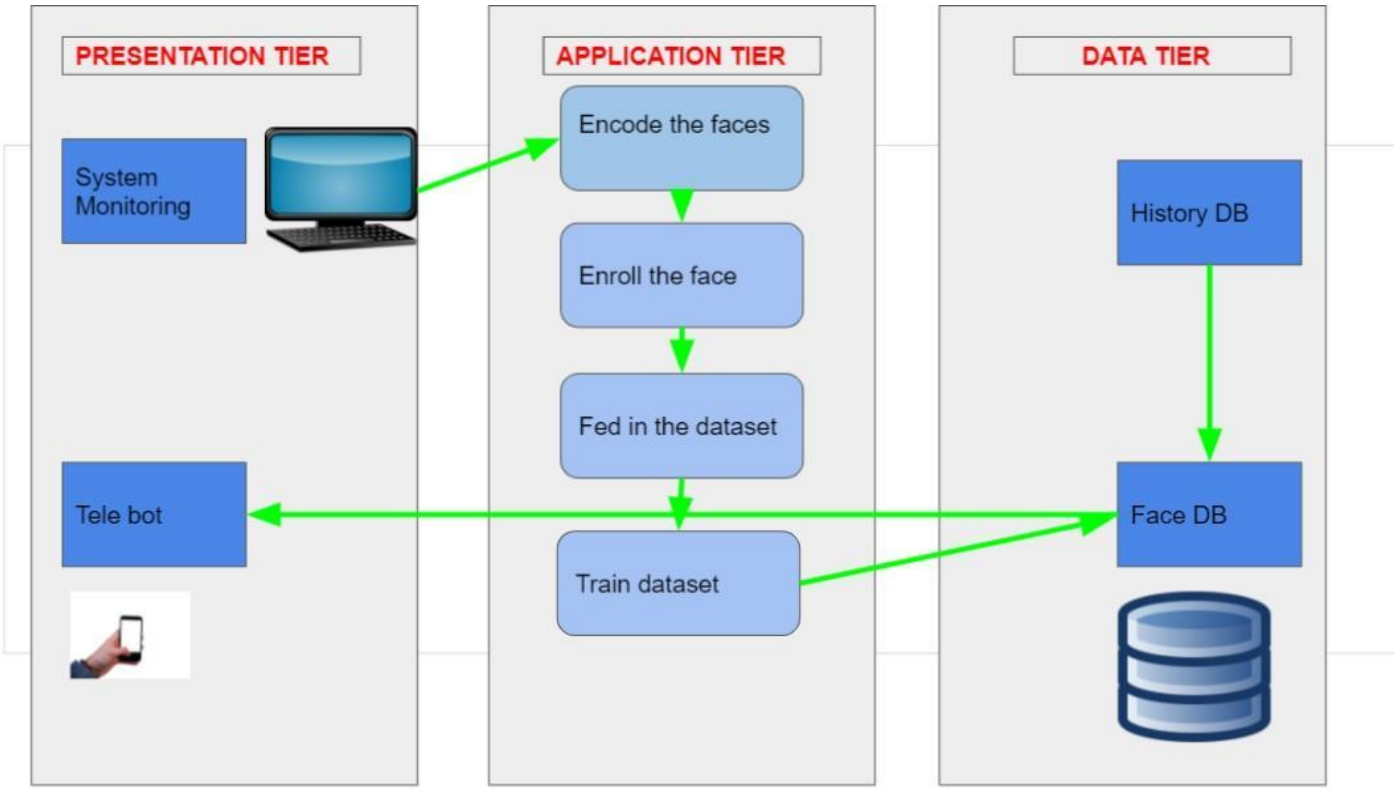


4.2 WORKFLOW DIAGRAM

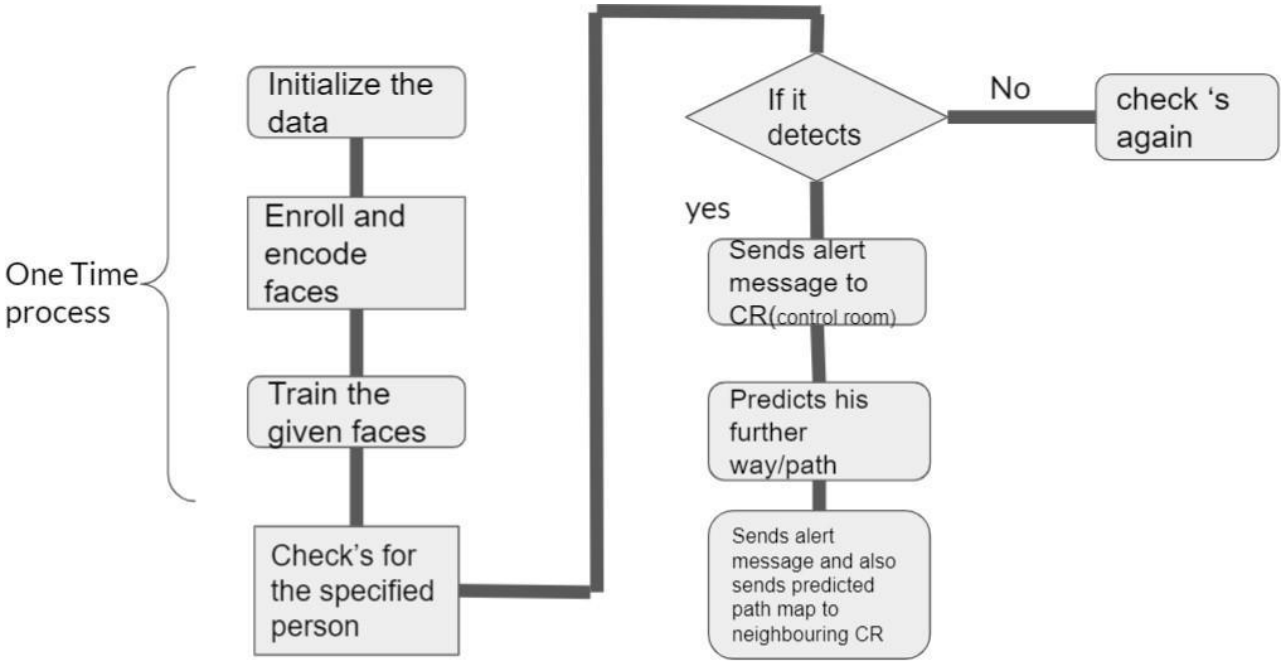


CHAPTER 5

4. SYSTEM ARCHITECTURE

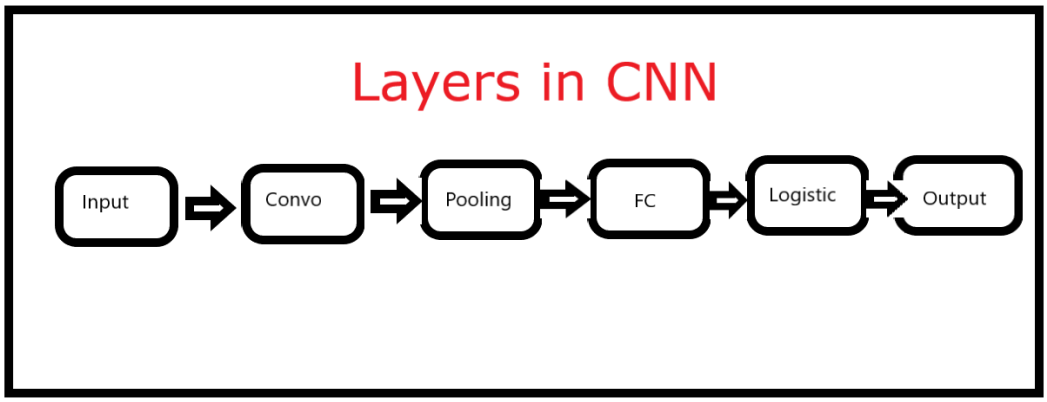


4.1 ARCHITECTURE OVERVIEW



5.3 PROGRAM DESIGN LANGUAGE

A.TYPES OF LAYERS



A.1. Input layer

Image data should be included in the CNN input layer. As we saw earlier, image data is represented by a three-dimensional matrix. You must resize it to fit into a single column. If you have a 28 x 28
= 784 image, you must convert it to 784 x 1 before feeding it into the input. If you have "m" training instances, the input dimension would be "m" (784, m).

A.2. Convo Layer

The Convo layer is also called the Feature Extractor Layer because it extracts features from the image. To begin, a portion of the image is connected to the Convo layer, which performs the convolution operation we saw earlier as well as calculating the dot product between the receptive field (a local region of the input image the same size as the filter) and the filter.The operation yields a single integer representing the output volume. Then we use a Stride to slide the filter over the next receptive field of the same input image and repeat the procedure. We'll keep repeating the process until we've gone through the entire image. The output would be the next layer's input.

ReLU activation is also present in the Convo layer, which reduces all negative values to zero.

A.3. Pooling Layer

A pooling layer is used to reduce the spatial volume of the input signal. It's used in the middle of two convolution layers. It would be computationally costly to apply FC after the Convo layer without using pooling or max pooling, which we do not want. As a result, the only way to reduce the spatial volume of the input image is to use maximum pooling.

You can observe the 4 x 4 dimension input is reduced to 2 x 2 dimension.

The pooling layer has no parameters, but it does have two hyperparameters: Filter(F) and Stride (S). In general, if we have W1 x H1 x D1 as input dimensions, then

W2 =

(W1−F)/S+1 H2

= (H1−F)/S+1

D2 = D1

W2, H2, and D2 are the output width, height, and depth, respectively.

A.4. Fully Connected Layer

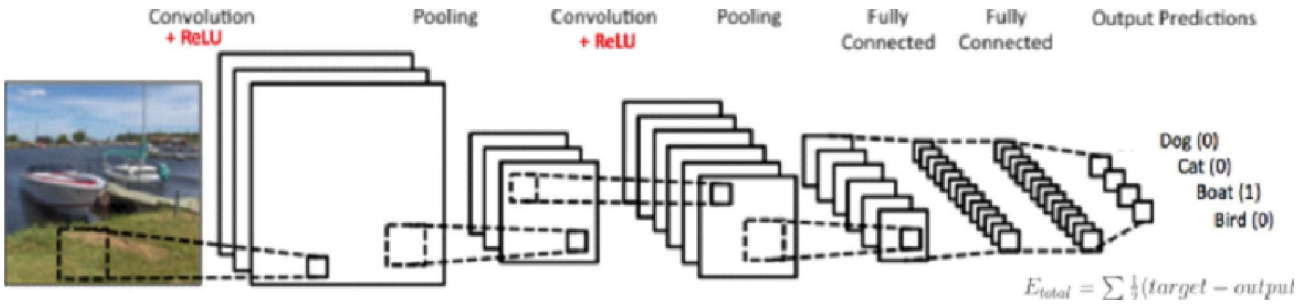
Weights, biases, and nerves are all part of the completely connected layer. It binds neurons from one layer to those from another. It is used to train people to identify images into various categories.

A.5. Logistic Layer

The last layer of CNN is the logistic layer. It is located at the bottom of the FC layer. Softmax is used for multi-classification and logistic is used for binary classification.

A.6. Output Layer

Output layer contains the label which is in the form of one-hot encoded.Now you have a good understanding of CNN. Let's implement a CNN in Keras.



CHAPTER 6

6 SYSTEM IMPLEMENTATION

6.1SERVER SIDE CODING

INITIALIZE THE DATA

```
import cv2

cam = cv2.VideoCapture(0)
cam.set(3, 640) # set video width
cam.set(4, 480) # set video height
face_detector = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
# For each person, enter one numeric face id
face_id = input('\n enter user id end press <return> ==> ')

print("\n [INFO] Initializing...")
# Initialize individual sampling face count
count = 0

while(True):

    ret, img = cam.read()
    img = cv2.flip(img, 1) # flip video image vertically
    gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
    faces = face_detector.detectMultiScale(gray, 1.3, 5)

    for (x,y,w,h) in faces:

        cv2.rectangle(img, (x,y), (x+w,y+h), (255,0,0), 2)
        count += 1

        # Save the captured image into the datasets folder
        cv2.imwrite("dataset/Sampled Image." + str(face_id) + '.' + str(count) +
".jpg", gray[y:y+h,x:x+w])
```

```
        cv2.imshow('image', img)

    k = cv2.waitKey(1) & 0xff # Press 'ESC' for exiting video
    if k == 27:
        break
    elif count >= 30: # Take 30 face sample and stop video
         break

# Do a bit of cleanup
print("\n [INFO] Image Captured")
cam.release()
cv2.destroyAllWindows()
```

FACE TRAINING

```
"""
Training Multiple Faces stored on a DataBase:
        ==> Each face should have a unique numeric integer ID as 1, 2,,
        ==> LBPH computed model will be saved on trainer/ directory. (if it does
not exist, pls create one)
'''


import cv2
import numpy as np
from PIL import
Image import os
# Path for face image database
path = 'dataset'

recognizer = cv2.face.LBPHFaceRecognizer_create()
detector = cv2.CascadeClassifier("haarcascade_frontalface_default.xml");

# function to get the images and label data
def getImagesAndLabels(path):

    imagePaths = [os.path.join(path,f) for f in os.listdir(path)]
    faceSamples=[]
    ids = []

    for imagePath in imagePaths:

        PIL_img = Image.open(imagePath).convert('L') # convert it to grayscale
        img_numpy = np.array(PIL_img,'uint8')

        id = int(os.path.split(imagePath)[-1].split(".")[1])
        faces = detector.detectMultiScale(img_numpy)

        for (x,y,w,h) in faces:
            faceSamples.append(img_numpy[y:y+h,x:x+w])
```

```
        ids.append(id)

    return faceSamples,ids
print ("\n [INFO] Training faces. It will take a few seconds. Wait ...")
faces,ids = getImagesAndLabels(path)
recognizer.train(faces, np.array(ids))

# Save the model into trainer/trainer.yml
recognizer.write('trainer/trainer.yml') # recognizer.save() worked on Mac, but not
on Pi

# Print the number of faces trained and end program
print("\n [INFO] {0} faces trained. Exiting
Program".format(len(np.unique(ids))))
```

FACE RECOGNITION

```
""
Real Time Face Recognition
	==> Each face stored on dataset/ dir, should have a unique numeric integer
ID as 1, 2,,
	==> LBPH computed model (trained faces) should be on trainer/ dir


'''

import cv2


recognizer = cv2.face.LBPHFaceRecognizer_create()
recognizer.read('trainer/trainer.yml')
cascadePath = "haarcascade_frontalface_default.xml"
faceCascade = cv2.CascadeClassifier(cascadePath);

font = cv2.FONT_HERSHEY_SIMPLEX

#initiate id counter
id = 0

# names related to ids: example ==> Marcelo: id=1, etc
names = ['None', '1', '2']

# Initialize and start realtime video capture
cam = cv2.VideoCapture(0)
cam.set(3, 640) # set video width
cam.set(4, 480) # set video height

# Define min window size to be recognized as a face
minW = 0.1*cam.get(3)
minH =
```

```
0.1*cam.get(4) while

True:

    ret, img =cam.read()
    img = cv2.flip(img, 1) # Flip vertically
    gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
    faces = faceCascade.detectMultiScale(
        gray,
        scaleFactor = 1.2,
        minNeighbors = 5,
        minSize = (int(minW), int(minH)),
       )

    for(x,y,w,h) in faces:

        cv2.rectangle(img, (x,y), (x+w,y+h), (0,255,0), 2)

        id, confidence = recognizer.predict(gray[y:y+h,x:x+w])

        # Check if confidence is less than 100 ==> "0" is perfect match
        conf=round(100 - confidence)
        if (conf > 50):
            id = names[id]
            confidence = " {0}%".format(conf)
        else:
            id = "unknown"
            confidence = " {0}%".format(conf)

        cv2.putText(img, str(id), (x+5,y-5), font, 1, (255,255,255), 2)
        cv2.putText(img, str(confidence), (x+5,y+h-5), font, 1, (255,255,0), 1)

    cv2.imshow('camera',img)

    k = cv2.waitKey(1) & 0xff # Press 'ESC' for exiting video
```

```
    if k == 27:
        break

# Do a bit of cleanup
print("\n [INFO] Exiting Program and cleanup stuff")
cam.release()
cv2.destroyAllWindows()
```

TO START THE CAMERA

```
import cv2
cap = cv2.VideoCapture(0)

cap.set(3, 640) # set video width
cap.set(4, 480) # set video height

while(1):
    #read the frame
    ret, frame = cap.read()
    if ret==True:
        frame = cv2.flip(frame,0)
        #show the frame
        cv2.imshow('frame',frame)

        k = cv2.waitKey(1) & 0xff # Press 'ESC' for exiting video
        if k == 27:
            break
    else:
        break

# Release everything if job is finished
cap.release()
cv2.destroyAllWindows()
```

CHAPTER 7

7 SYSTEM TESTING

7.1 UNIT TESTING

TABLE I. DATA SET CREATIONS

Images	DataSet Creation time	Training time
100 images per person	31 sec	4 sec
150 images per person	56 sec	4 sec

TABLE II. COMPARISON OF THREE DIFFERENT METHODS

Algorithm	Accuracy of detection
CNN	93

7.2 INTEGRATION TESTING

```
validation_loss:0.1634,95.3000
training_loss:0.1696,95.1083
validation_loss:0.1515,95.5200
training_loss:0.1572,95.3450
validation_loss:0.1387,95.8600
training_loss:0.1466,95.7533
validation_loss:0.1312,96.0800
(28, 28, 1)
8
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
(28, 28, 1)
```

CHAPTER 8

8 CONCLUSION

8.1 CONCLUSION AND FUTURE

ENHANCEMENTS CONCLUSION

This project is used to implement face recognition. Face recognition nowadays has been widely used in many areas especially on security. The house security can be improved with the implementation of this product. It is designed with low cost and efficient material. The improvement of technology has made the internet of things no longer an expensive stuff and it can be modified and customized depending on our needs.

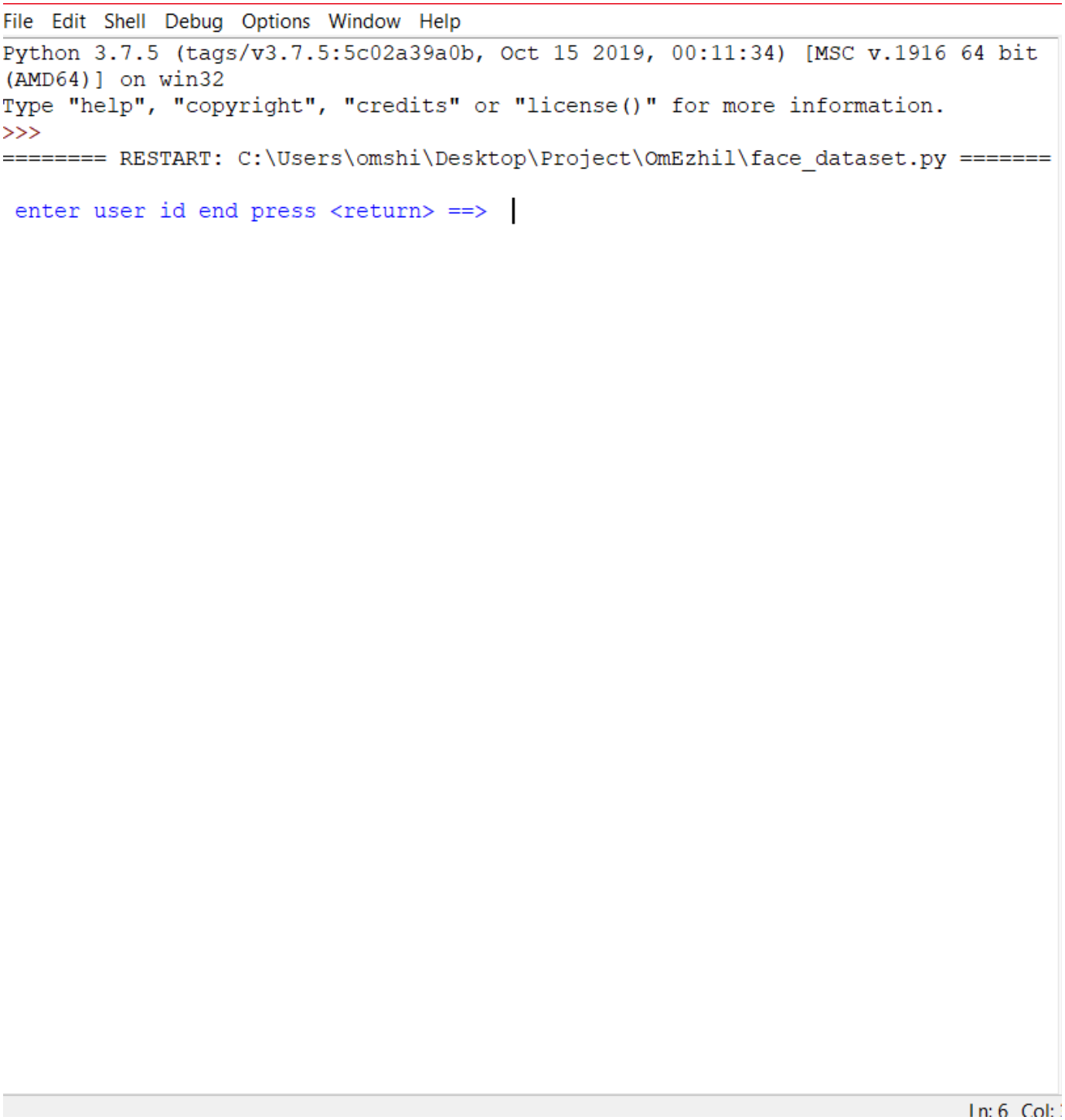
FUTURE ENHANCEMENTS

The future enhancement of this project is to develop the hardware module to be used in the camera which provides extra efficiency and precision scale to detect the thief with less effort and time.

And also to use a tribrid algorithm for better extraction and high efficiency which works only on the deep scale extraction and layer conversion.

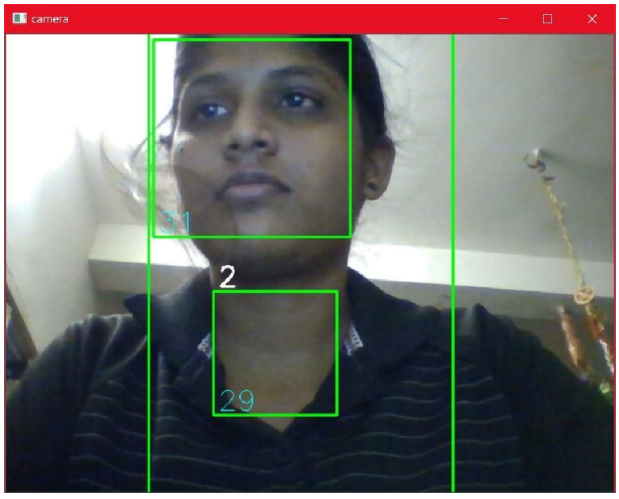
APPENDICES

A.1 SAMPLE SCREENS



```
35
3%
37
36
39
40
41
42
43
44
45
4%
47
46
49


52
53
54


57




%2
%3
%4


67
```

```
[INFO] Exiting Program and cleanup stuff
```




```
INr04                and cleanup stuff

====== RESTART: C:\Users\omshi\Desktop\Project\OmEzhil\Surveillance.py =======
ieo based surveillance system and path prediction
```

surveillance system,is Active Now

Surveillance system
Tracked Something!!!

Hold on please for 10

sec Recoding

Completed

Uploading video

Predicting path please wait
Predicted Path person Moving Left direction

A.2 PUBLICATIONS

Video based surveillance system and path prediction

Published in : Journal of emerging technologies and innovative research

video based surveillance system and path prediction - Journal of …

REFERENCE FOR PUBLICATION

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VIDEO BASED SURVEILLANCE SYSTEM AND PATH PREDICTION

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***Abstract*- In this paper,We propose a method to Find and detect the criminal using facial recognition and find his further movement by predicting his path.As an important branch of Security and surveillance system,face recognition technology has the characteristics of convenient acquisition and high reliability that is widely used in the fields of information security, national security,Traffic monitoring and security and organisations like school, college. This project is to Detect Unknown or specified given persons(criminal) in Surveillance cameras at Traffic signals and predicting his probability path further then reporting to their nearby located control rooms ,We used a CNN Algorithm to better accuracy and precision and open source for path prediction.**

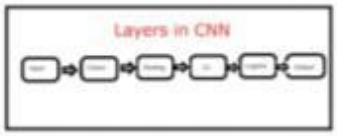
***Keywords*-Artificial intelligence,IOT,Convolutional neural network(CNN),path prediction.**

1.INTRODUCTION

Artificial intelligence paves the way for computers to think like humans. Machine learning makes the way more even by adding training and learning components. The availability of huge dataset and high performance computers lead the light to deep learning concepts, which automatically extract features or the factors of variation that distinguish objects from one another. Among the various data sources which contribute to terabytes of big data, video surveillance data is having much social relevance in today's world. The widespread availability of surveillance data from cameras installed in residential areas, industrial plants, educational institutions and commercial firms contribute towards private data while the cameras placed in public places such as city centers, public conveyances and religious places contribute to public data. Analysis of surveillance videos involves a series of modules like object recognition, action recognition and classification of identified actions into categories like anomalous or normal. This survey gives specific focus on solutions based on deep learning architectures. Among the various architectures in deep learning, commonly used models for surveillance analysis are CNN, auto-encoders and their combination and path prediction by open source for better enhancement in security and surveillance domain.

2.CNN WORKS

A.TYPES OF LAYERS



A. 4. F u II y Co nnec Ccd L ay er

A. 3. Pos lin g La ye r

A. S. Log ‹sï ic La ye r

A. 6.0 u ï pu t La yer

3. TELEGRAM 4 BOT

Artificial Intelligence may be used to manipulate

multimedia messages to and from one another. There are a lot of messenger apps out there, but what makes this one stand out is the fact that it

```
message m = bot.getUpdates();
if (m.chat_id !=0 ){
  bot.sendMessage(m.chat_id, m.tex
}
```

Data encryption and the ability to encrypt are also security features.

Programming allows you to build Telegram Bots , with a variety of functions.

The Telegram Bot API is used in this code.

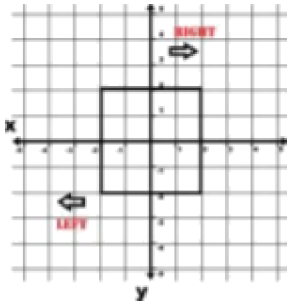
J] Telegram bat- A ToJzgram bol is a <orzyluter

*j TcMgram If<a APJ: Ttuz 7cfegzaoz Ben .4Pt is a series of functions that allows you to @—— Tckgraos £l4as izsiz g jxograzzauog Maguag<s like 3as x, fi L"- —.. TTx• Tctcgzwn B<K dve A•h tbc rules Inn " uW ottB•z Telegram Bots and individual users.

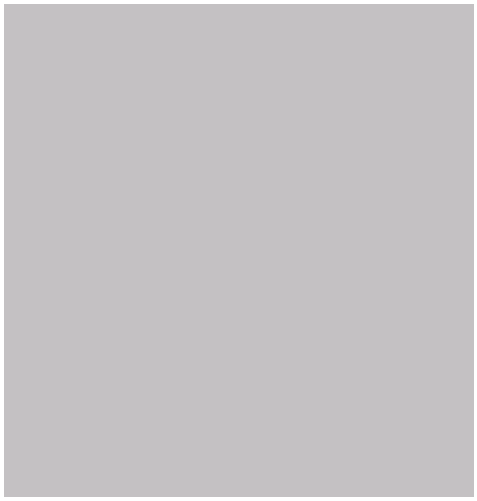
4. PATH PREDICTION

moves Left or Right.

down of the face movement and for the Horizontal movement it uses -X and +X



4.5system Architecture



BMVC2001,Manchester, England, September 2001.

S.CONCLUSIOLt

This project is used to implement face recognition. Face recognition nowadays has been widely used in many areas especially on security. Traffic security can be improved with the implementation of this Idea. The improvement of tic hnolu«ts hJ> mzJc the interns-i ol" thtnu> n-u Iun¿•cr use c xpczt>iY"c Ihtne: azuJ ii can be modified and customized Jcpcnr1iJiq us uuz nccsJ».

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Developing countries like China Encourage Face Recognition system in CCTV to defend themselves from theft and criminal activities.

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5.Path Detection
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