FACE RECOGNITION FOR ATTENDANCE SYSTEM

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OUTLINE

- BACKGROUND
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- OPEN FACE
- IMPLEMENTATION
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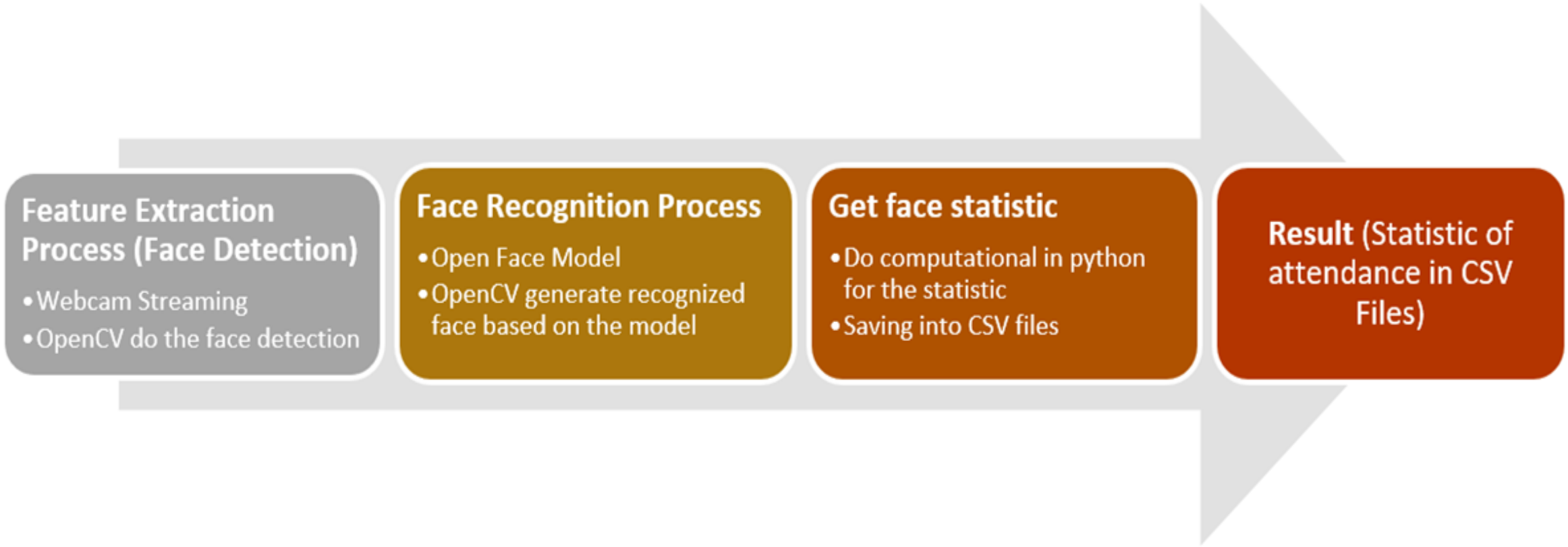
Background

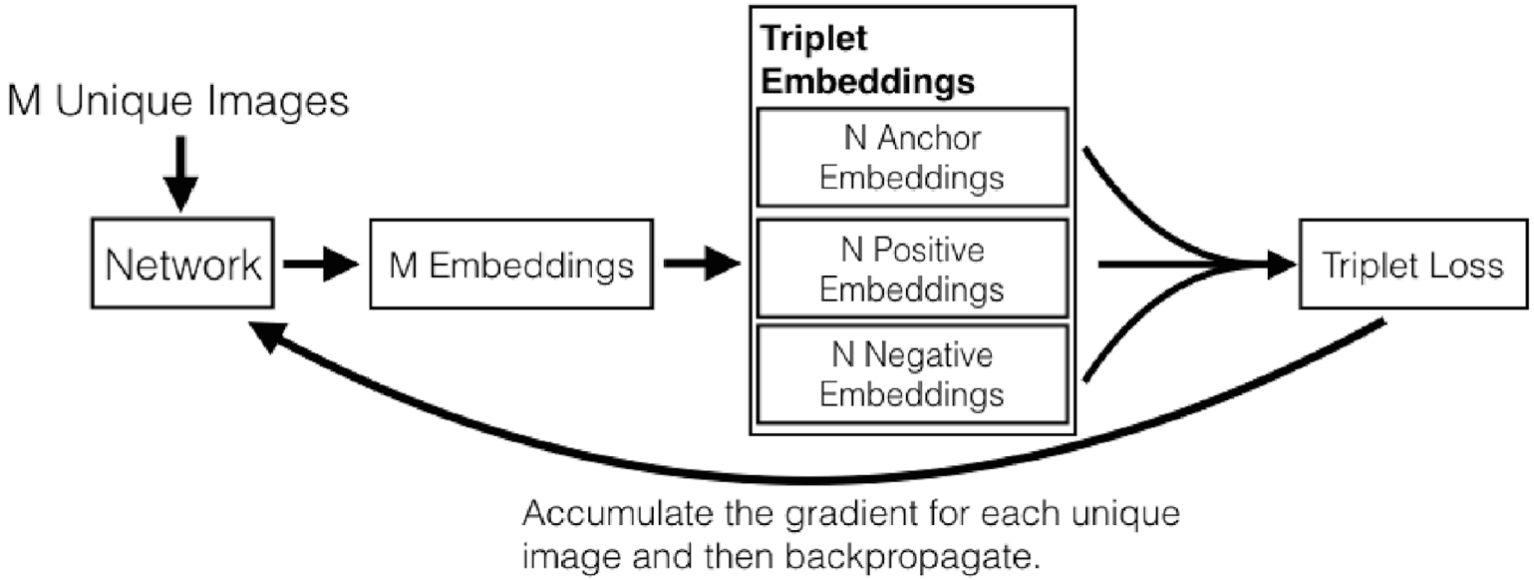
- Biometric Security
- Natural Language Interface
- Internet of Things
- Real-time and Robust

ARCHITECTURE



OPEN FACE

OpenFace is a pre-trained model which use FaceNet from Google

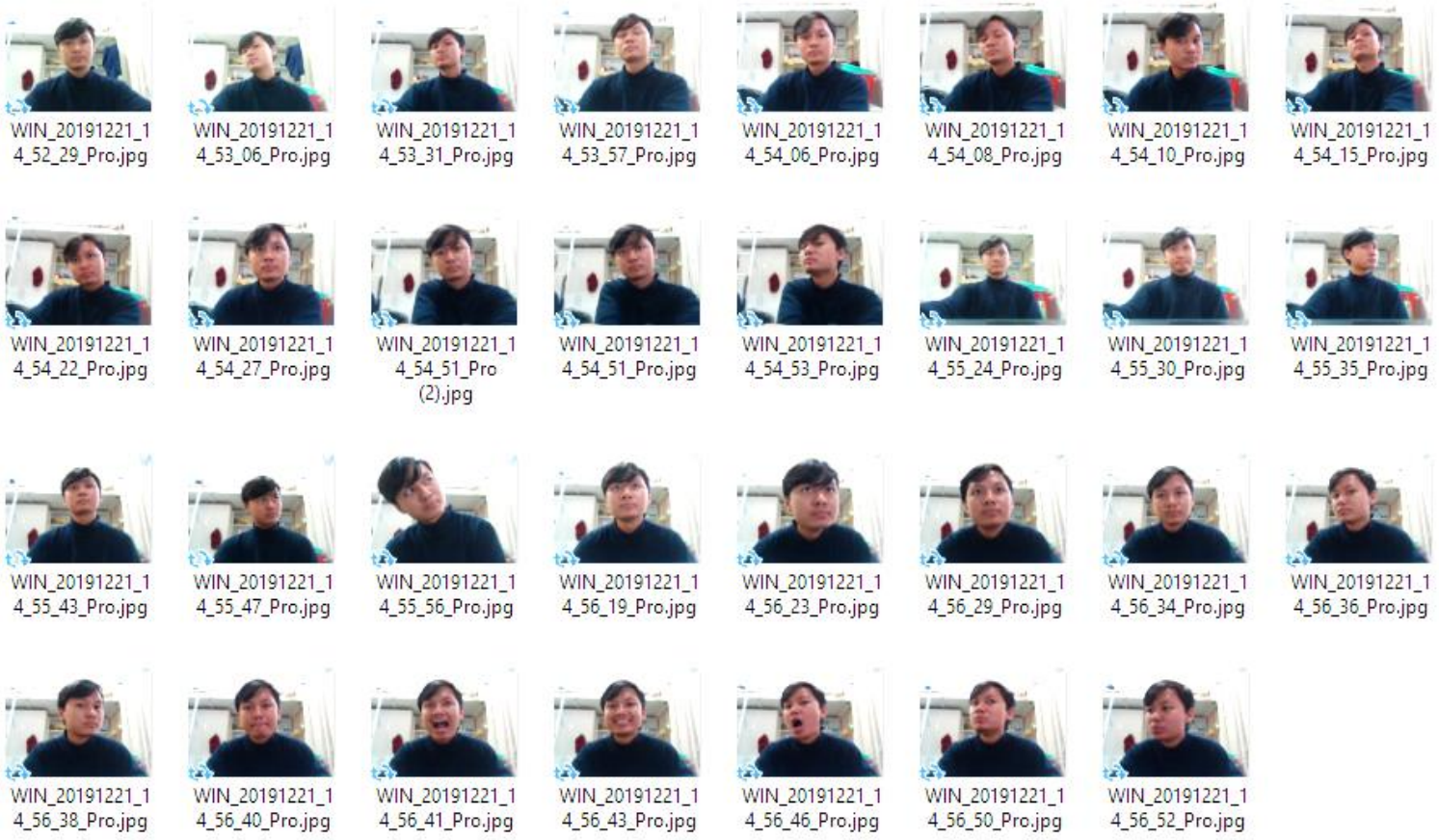


IMPLEMENTATION

ATTENDANCE SYSTEM

CAPTURE DATASET

Use webcam to capture 30 face images of each person with Python and OpenCV



TRAIN FACE DATASET

❖ Extract Embeddings with OpenFace

(Preprocessing input image)

1. **(Preprocessing) Input Image using blob function**

```
    # construct a blob from the image
    imageBlob = cv2.dnn.blobFromImage(
        cv2.resize(image, (300, 300)), 1.0, (300, 300),
        (104.0, 117.0, 123.0), swapRB=False, crop=False)
```

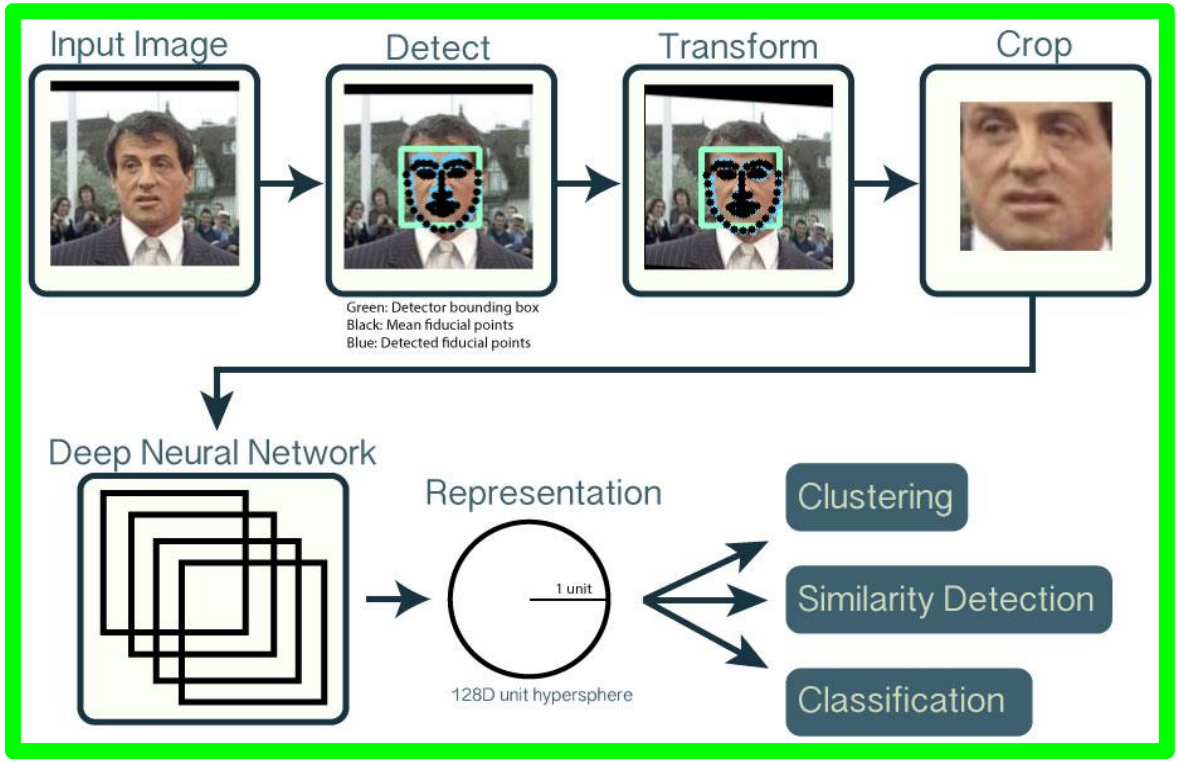
2. **(Preprocessing) Face detector using Resnet caffe model**

```
# load our serialized face detector from disk
print("[INFO] loading face detector...")
protoPath = os.path.sep.join([args["detector"], "deploy.prototxt"])
modelPath = os.path.sep.join([args["detector"],
    "res10_300x300_ssd_iter_140000.caffemodel"])
detector = cv2.dnn.readNetFromCaffe(protoPath, modelPath)
```

3. **Pass the face image through <u>OpenFace</u> model (128-D vector)**

```
# load our serialized face embedding model (openface_nn4.small2.v1.t7)
print("[INFO] loading face recognizer...")
embedder = cv2.dnn.readNetFromTorch(args["embedding_model"])
```

Deep learning feature (OpenFace) extractor to generate a 128-D vector describing a face. All faces **in our dataset will be passed through the neural network to generate embeddings**.



TRAIN FACE DATASET

"Farhan"

"Ivan"

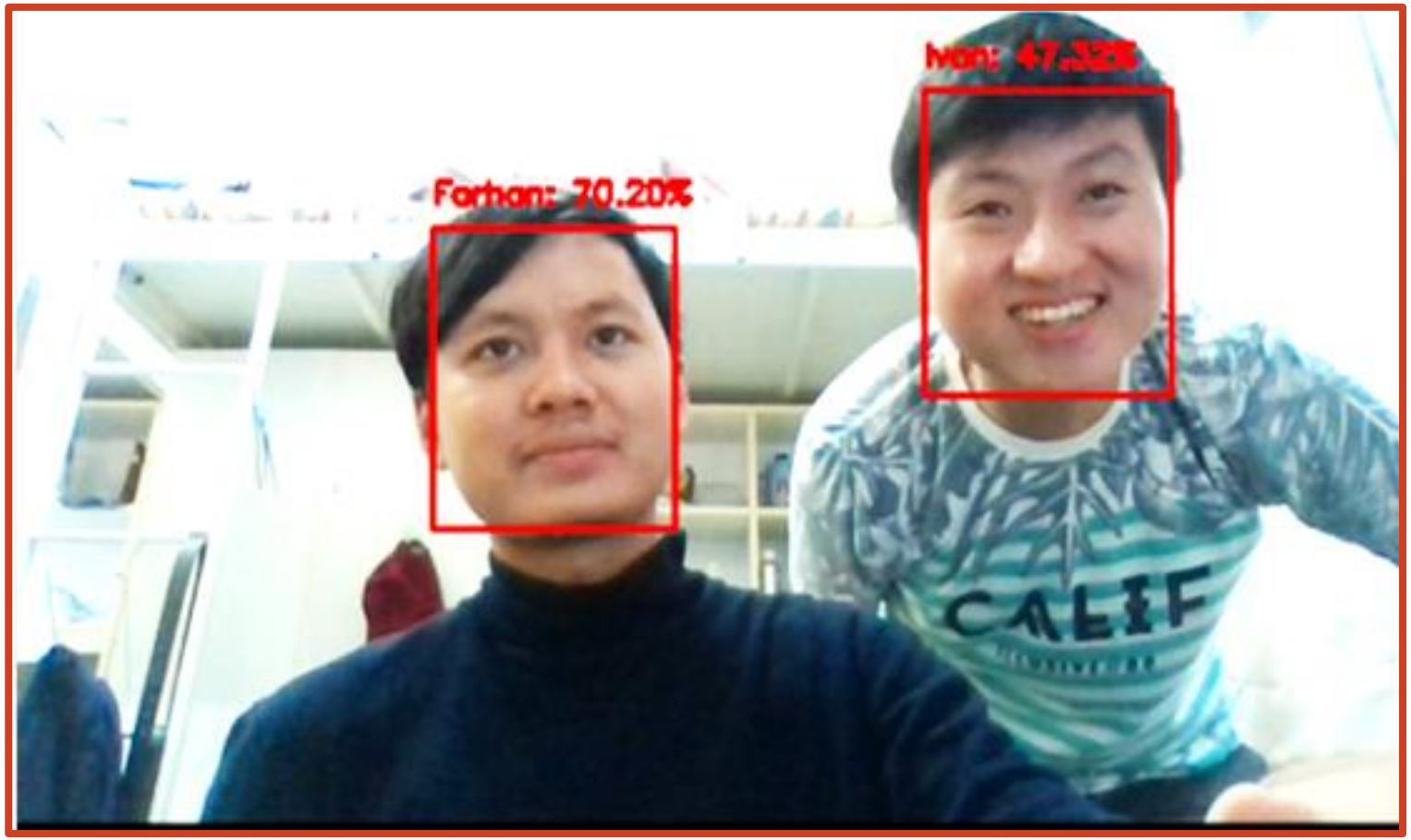
Unknown

❖ **Linear SVC** (Support Vector Classifier) for **classifying the detected faces** to the embeddings data and accept the 128-d embeddings of the face and then **produce the actual face recognition.**

```
30  # train the model used to accept the 128-d embeddings of the face and
31  # then produce the actual face recognition
32  print("[INFO] training model...")
33  recognizer = SVC(C=1.0, kernel="linear", probability=True)
34  recognizer.fit(data["embeddings"], labels)
```

RECOGNIZE FACES

- Recognize faces in frames of a video stream using web camera
- Extract face embedding and query SVM model to determine who is in an image, then draw boxes with its name.



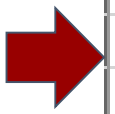
SAVE RECOGNIZED FACES

1. We make the mechanism to save recognized faces by **record the first detection which has the threshold** of above 70% accuracy for 20x frames .
2. We only record attendance within **a certain time frame for entering and leaving** the classroom.

A	B	C	D
Date	Name	Time Sign In	Time Sign Out
16/12/2019	Farhan	10:53:30	
16/12/2019	Farhan	10:53:31	
16/12/2019	Farhan	10:53:32	
16/12/2019	Farhan	10:53:34	
16/12/2019	Ivan		10:54:05
16/12/2019	Ivan		10:54:06
16/12/2019	Ivan		10:54:07
16/12/2019	Farhan		10:54:10
16/12/2019	Ivan		10:54:10
16/12/2019	Farhan		10:54:11

RAW DATA OF ATTENDANCE SYSTEM

A	B	C	D
Date	Name	Time Sign In	Time Sign Out
16/12/2019	Farhan	10:53:30	
16/12/2019	Farhan	10:53:31	
16/12/2019	Farhan	10:53:32	
16/12/2019	Farhan	10:53:34	
16/12/2019	Ivan		10:54:05
16/12/2019	Ivan		10:54:06
16/12/2019	Ivan		10:54:07
16/12/2019	Farhan		10:54:10
16/12/2019	Ivan		10:54:10
16/12/2019	Farhan		10:54:11



A	B	C	D	E
Date Sign In	Name	Time Sign In	Date Sign Out	Time Sign Out
16/12/2019	Farhan	10:53:30	16/12/2019	10:54:10
16/12/2019	Ivan		16/12/2019	10:54:05

FINAL ATTENDANCE SYSTEM DATA

Using Pandas Dataframe for data processing

RAW DATA OF ATTENDANCE SYSTEM

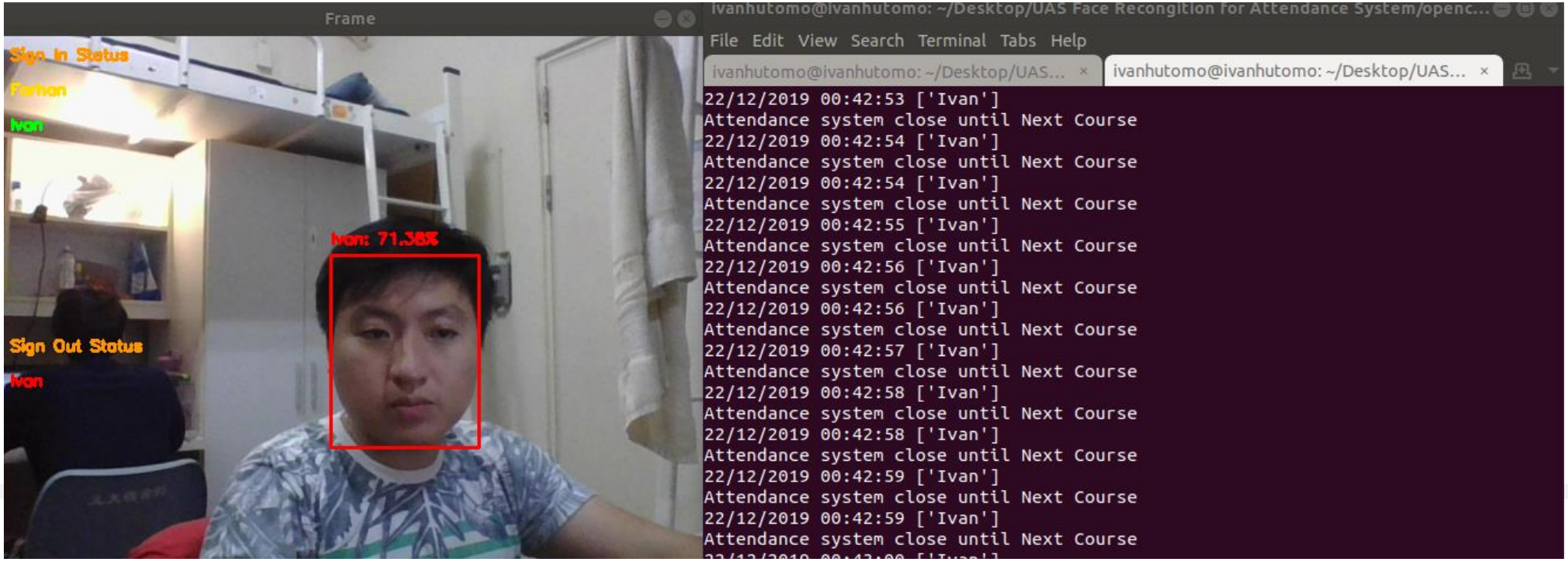
```
270  records = pd.read_csv('attendance-system.csv')
271  deduped = records.drop_duplicates(['Name'], keep='first')
272  deduped =deduped.drop(columns=['Time Sign Out'])
273  signed_out=records.loc[records['Time Sign Out'].notna()]
274
275  deduped_out = signed_out.drop_duplicates(['Name'], keep='first')
276  deduped_out =deduped_out.drop(columns=['Time Sign In'])
277
278  mergedStuff = pd.merge(deduped, deduped_out, on=['Name'],suffixes=(' Sign In', ' Sign Out'))
279  attend_data = mergedStuff[mergedStuff.Name != 'unknown']
280  attend_data.to_csv('attendance-data.csv', index=False)
```

DEMO

ATTENDANCE SYSTEM

HOW THE DEMOS WORK?

- We will demonstrate attendance system using our face
- The face's confidence needed to be recorded as attendance is 70%
- 0s - 15s is period of sign in, otherwise you will not count for sign in.
- 16s - 29s is the period where attendance system is inactive, your face still recognized but you will not count either for sign in and sign out.
- 30s - 45s is the period of sign out, otherwise you will not count for sign out



```
current_hour = datetime.now().second
fps.stop()
waktu=fps.elapsed()

if waktu >= 0 and waktu <= 15 :
    print('Attendance system Open for sign in')
    for a in students:
        write_csv([dt_string,a,hr_string,''])

    records = pd.read_csv('attendance-system.csv') #Records dictionaryin for notification
    deduped = records.drop_duplicates(['Name'], keep='first')
    deduped =deduped.drop(columns=['Time Sign Out'])
    dictionaryin=deduped.set_index('Name').T.to_dict('list')

elif waktu >=30 and waktu <=45:

    for a in students:
        write_csv([dt_string,a,'',hr_string])
    print('Attendance system Open for sign out')

    records = pd.read_csv('attendance-system.csv') #Records dictionaryout for notification
    signed_out=records.loc[records['Time Sign Out'].notna()]
    deduped_out = signed_out.drop_duplicates(['Name'], keep='first')
    deduped_out =deduped_out.drop(columns=['Time Sign In'])
    dictionaryout=deduped_out.set_index('Name').T.to_dict('list')
else:
    print('Attendance system close until Next Course')

print(dt_string,hr_string, students)
```

Code to Record Recognized Face to Dictionary

Code to Put Dictionary to Frame

```
cv2.putText(frame, "Sign In Status", (10, 20),
    cv2.FONT_HERSHEY_SIMPLEX, 0.45, (0, 150, 255), 2)

cv2.putText(frame, "Sign Out Status", (10, 270),
    cv2.FONT_HERSHEY_SIMPLEX, 0.45, (0, 150, 255), 2)


countitem=0
for item in le.classes_:
    coordsy1=50+countitem*30
    countitem=countitem+1
    if item != 'unknown':
        if item in dictionaryin.keys():
            cv2.putText(frame,str(item), (10, coordsy1),
                cv2.FONT_HERSHEY_SIMPLEX, 0.45, (0, 255, 0), 2)
            #os.system('play -nq -t alsa synth {} sine {}'.format(0.1, 500))
        else:
            cv2.putText(frame,str(item), (10, coordsy1),
                cv2.FONT_HERSHEY_SIMPLEX, 0.45, (0, 220, 255), 2)

countitem2=0
for item2 in dictionaryin.keys():
    coordsy2=300+countitem2*30
    countitem2=countitem2+1
    if item2 != 'unknown':
        if item2 in dictionaryout.keys():
            cv2.putText(frame,str(item2), (10, coordsy2),
                cv2.FONT_HERSHEY_SIMPLEX, 0.45, (0, 0, 255), 2)
            #os.system('play -nq -t alsa synth {} sine {}'.format(0.1, 500))
        else:
            cv2.putText(frame,str(item2), (10, coordsy2),
                cv2.FONT_HERSHEY_SIMPLEX, 0.45, (0, 255, 0), 2)
```

CONCLUSION

- We perform face detection, face embedding, face recognition
- OpenFace can perform well in real data using deep metrics learning and SVM
- The network can learn to quantify faces and return highly robust and discriminating embeddings suitable for face recognition
- We can reuse the OpenFace model for our own applications without having to explicitly train it

THANK YOU

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Any Questions?