Alexa Security Facial Recognition

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State of the Art

State of the Art: Face Detection & Recognition

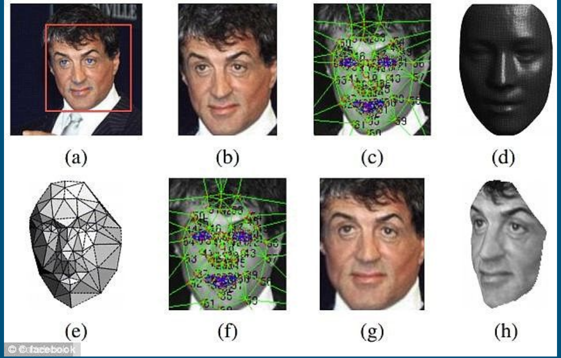
Most Common Methods **PCA, LDA, SVM**	Current New Methods **Convolutional Networks**
● *difficulty detecting faces of different poses/views* ● *limited ability to analyze large data sets*	● *Increased Accuracy* ● *Ability to analyze large data sets with limited computation*

State of the Art: Face Detection & Recognition

Deep Learning Convolutional Networks

DEEPFACE

- 3D Model
- Virtually rotates model to face camera
- Involves more than 120 million parameters
- Uses several locally connected layers without weight sharing



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FACENET

- Optimizes embedding weights
- Uses Triple Loss Function
  - Based off KNN Model
- Much greater representational efficiency
- Achieve state-of-the-art face recognition performance using only 128-bytes per face.

State of the Art: Smart Security Systems

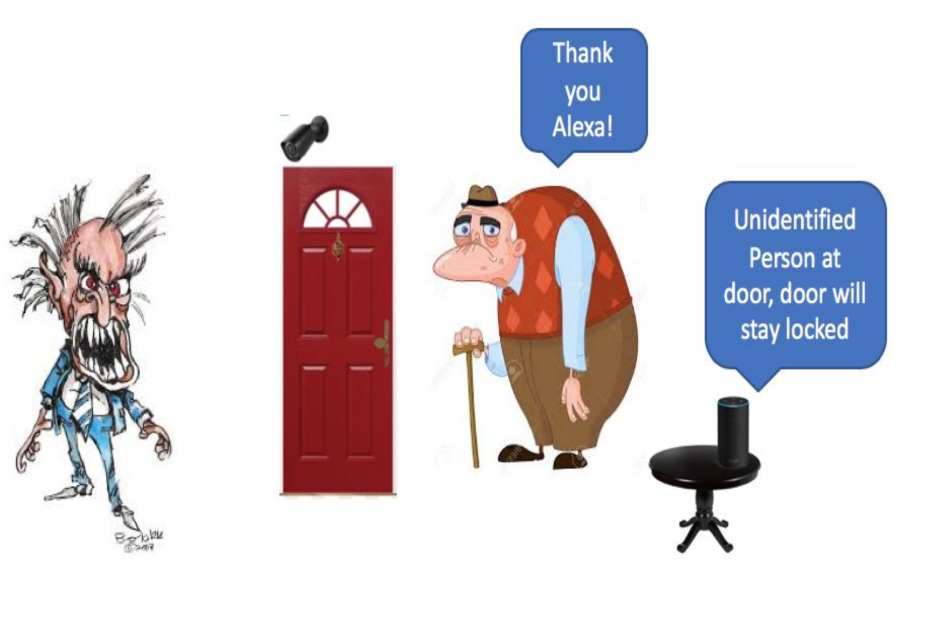
800 × 480

- PCA commonly used
- Video capture or multiple image capture for recognition
- Facial Detection accuracy ~ 98%
- Facial Recognition accuracy ~ 90%
- Common uses: Home Security, National Security, etc.

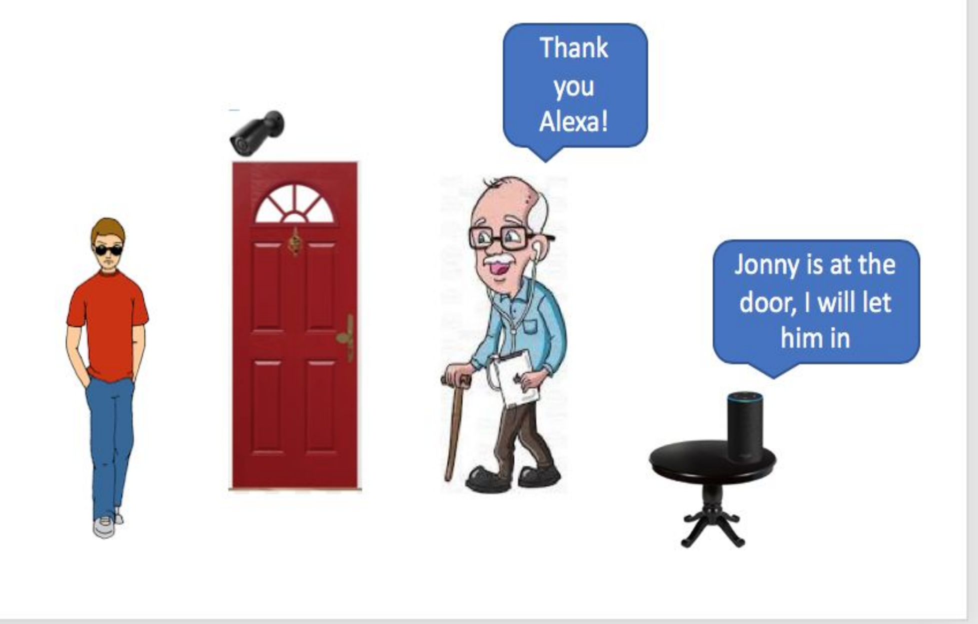
OUR PROJECT

What is It?

Unrecognized

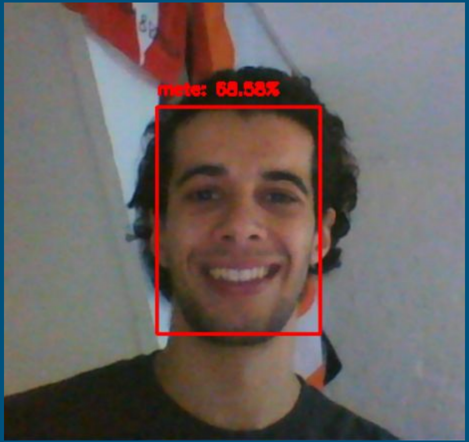


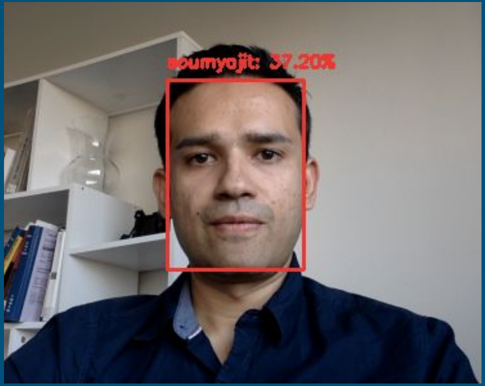
Recognized



Proposed Method

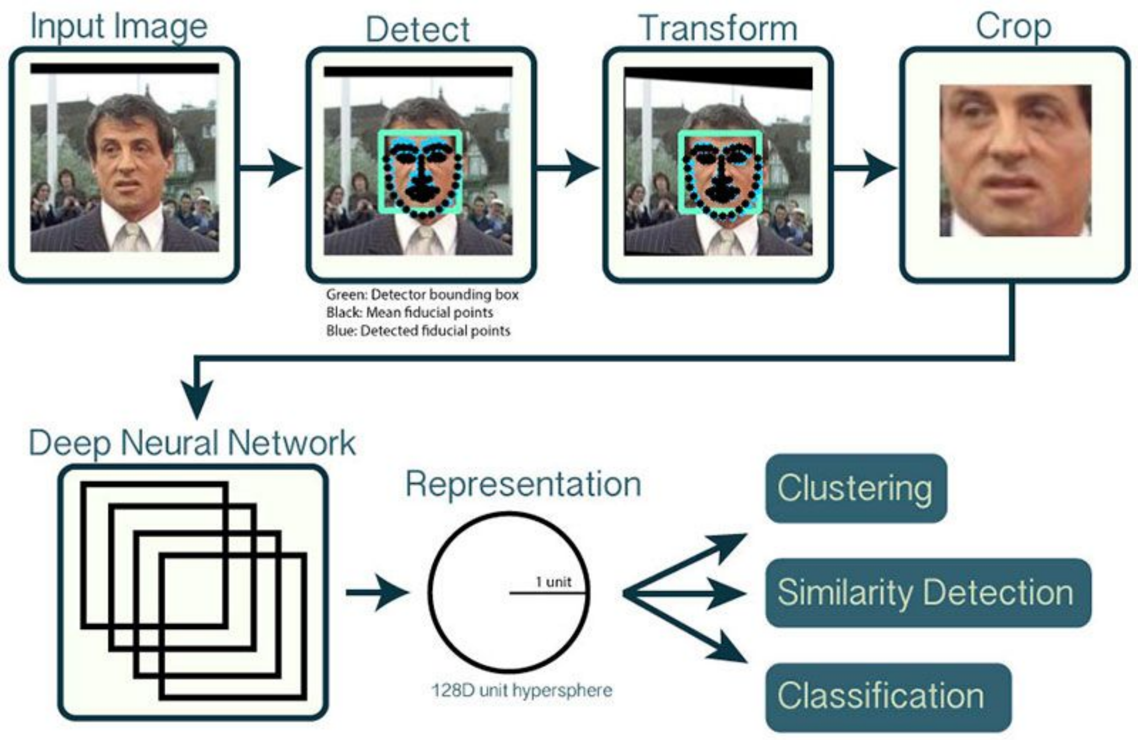
- Detect and Recognize faces via Raspberry Pi
- Subject Announced by Alexa
- Create and give privileges to different categories of users
- Owner prompted to have Alexa open door or not





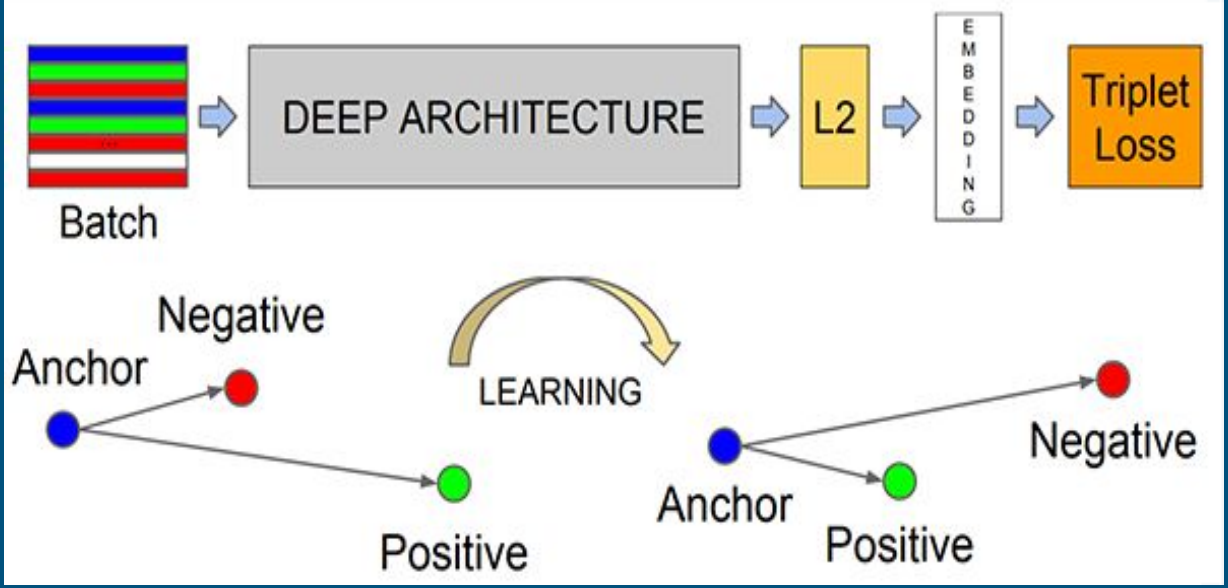
How It Actually Works

- Facial detection and localization - pre-trained deep learning model
- Triplet Loss Function to compute 128-d embeddings
- Recognize faces using a Linear Support Vector Machine (SVM) model



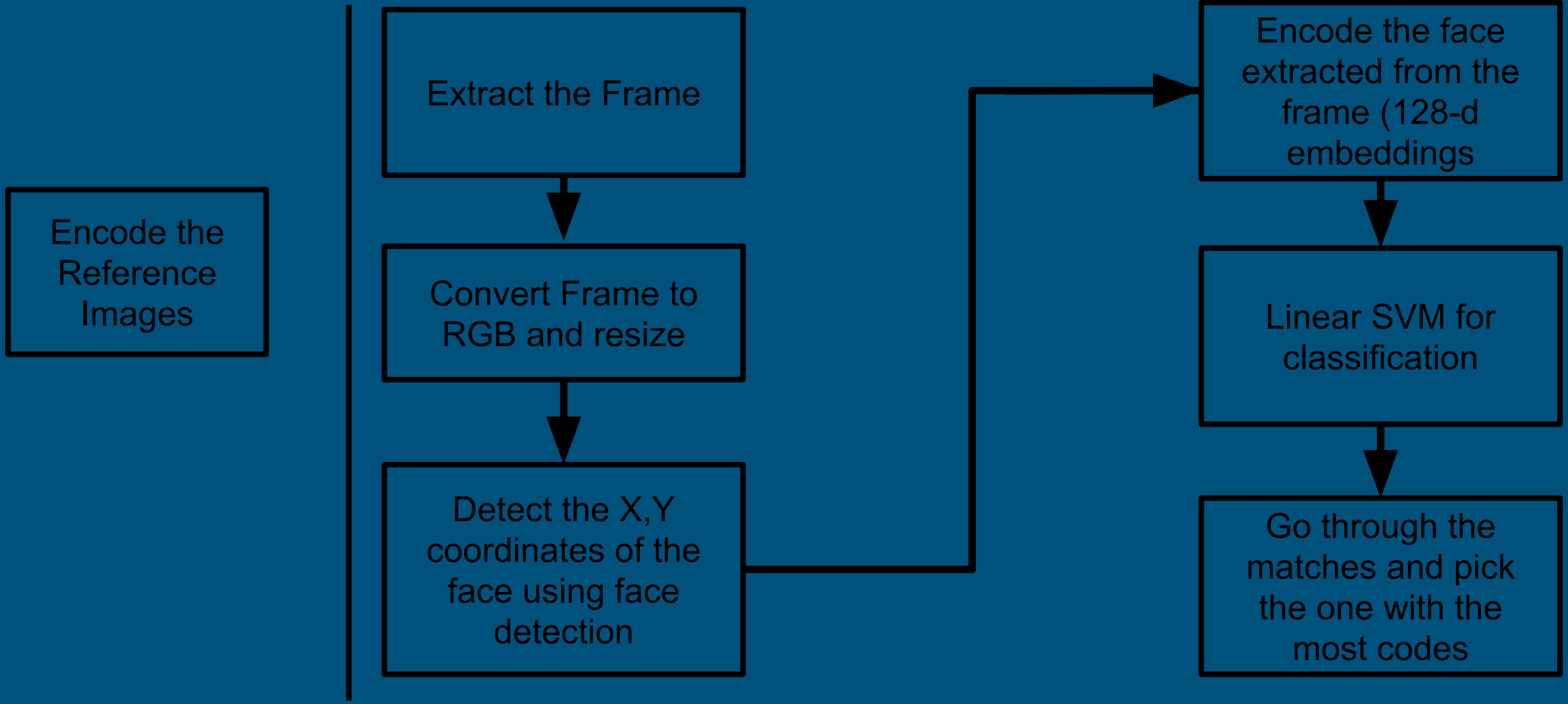
How It Actually Works

Triplet Loss Function



- Update embedding weights due to:
    - Minimizing distance between same person images
    - Maximizing distance between different person images

How it Works



Encode the Reference Images

Extract the Frame

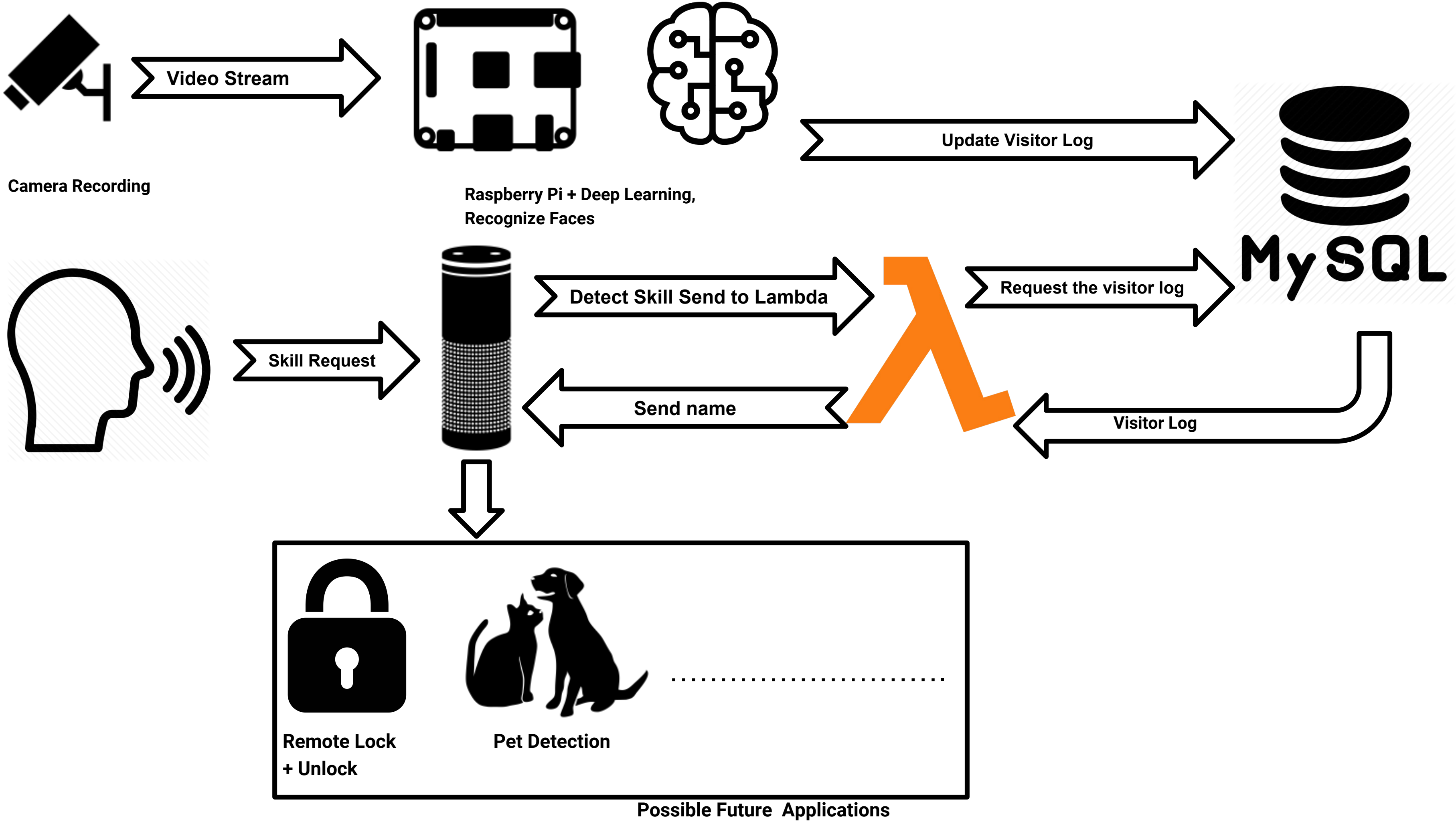
Convert Frame to RGB and resize

Detect the X,Y coordinates of the face using face detection

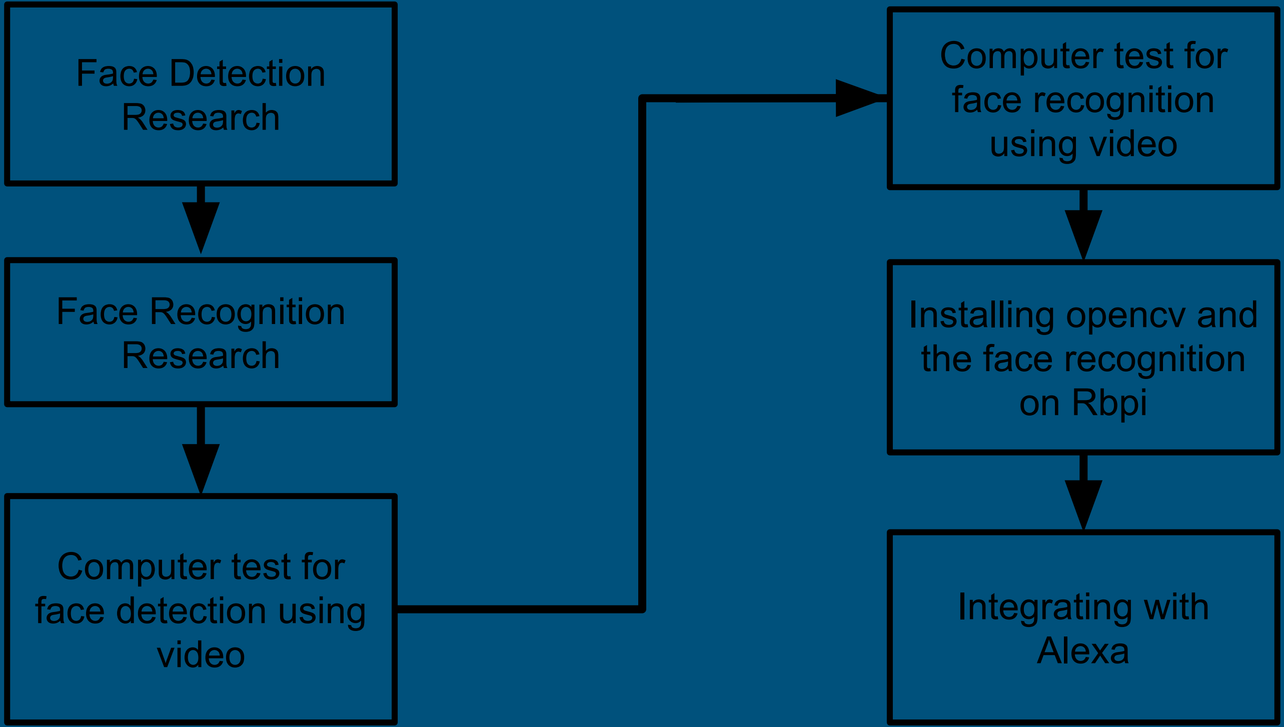
Encode the face extracted from the frame (128-d embeddings

Linear SVM for classification

Go through the matches and pick the one with the most codes


Video Stream
Camera Recording
Raspberry Pi + Deep Learning,
Recognize Faces
Update Visitor Log
MySQL
Detect Skill Send to Lambda
Request the visitor log
Skill Request
Send name
Visitor Log
Remote Lock
+ Unlock
Pet Detection
....
Possible Future Applications

How we developed it



Face Detection Research

Face Recognition Research

Computer test for face detection using video

Computer test for face recognition using video

Installing opencv and the face recognition on Rbpi

Integrating with Alexa

DEMO

Future Work

- Good user system for adding faces to database seamlessly
- Using Facebook Graph API to get the User’s friends pictures and use those for comparison rather than manual uploads
- Learn user preferences for different friends and allow automatic actions
- Training a similar neural network for pet recognition

Thank You!
Questions?

References

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