Nick White

Titus Lungu

Robert Marshall

Mark Heller

Andrew Fisher

Brahm Powell

Cerebro Real-time Security

Built on a Distributed Cloud Architecture, Powered by Computer Vision Machine Learning Algorithms

Motivation

Actual CSU Email

The following is a message from Cleveland State University on Feb 24th

"A robbery was reported today to the Cleveland Police Department at approximately 7:20 pm on East 24th Street between Euclid and Prospect Avenue. "

"A female CSU student had her cell phone taken from her while she was talking on it."

"She was pushed to the ground while the suspects attempted to unsuccessfully take her purse. "

"One suspect was wearing an orange hoodie. The second suspect was wearing a white or gray hoodie or jacket. "
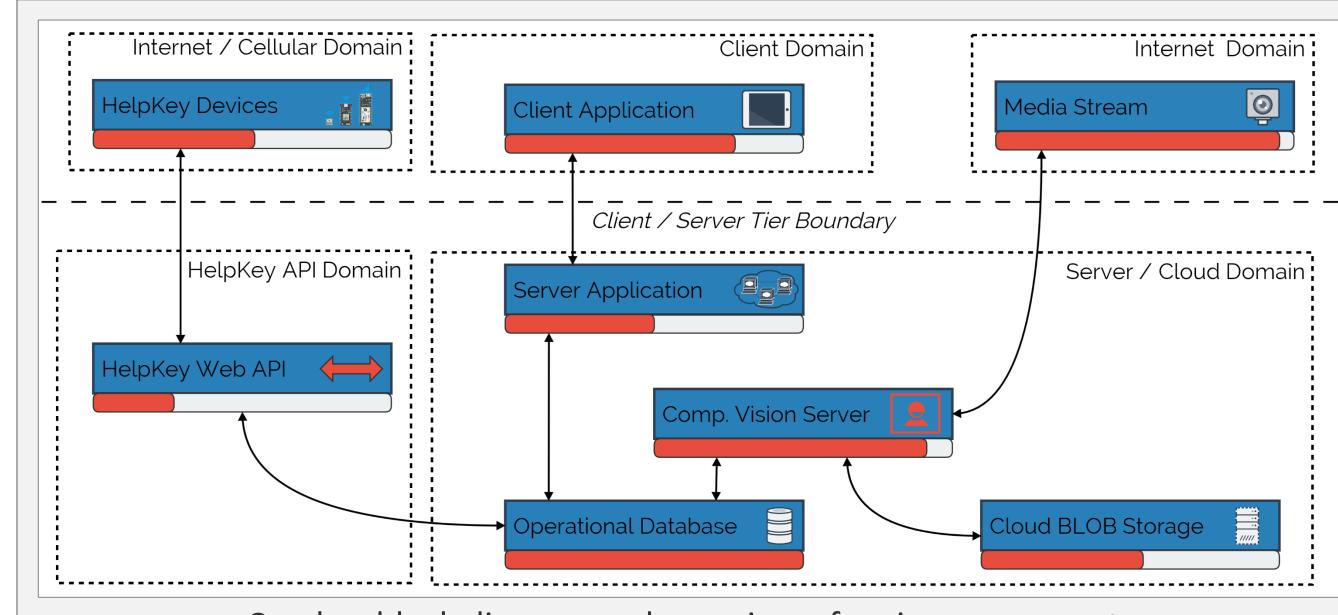
"Both suspects ran east on Euclid Avenue. No further information is available at this time."

What is Cerebro?

Overview

Cerebro uses a innovative human detection and recognition algorithm, based on a Computer Vision Machine Learning algorithm, to detect humans in the video streams of hundreds or thousands of cameras within a specified area. Using this algorithm, crimes can be detected in real time. As a crime is committed, the suspect is tagged in the system, and they are then tracked from camera to camera as they attempt to flee. Their location is reported to police in real-time, and is displayed on tablets in police cruisers as both video and as a pin on a map interface. Using this, police can track the suspect, update information about the chase, and apprehend the suspect both quicker and more efficiently than ever.

System Architecture – Software Solution

Internet / Cellular Domain — HelpKey Devices
Client Domain — Client Application
Internet Domain — Media Stream
Client / Server Tier Boundary
HelpKey API Domain — HelpKey Web API
Server Application
Server / Cloud Domain
Comp. Vision Server
Operational Database
Cloud BLOB Storage

Cerebro block diagram and overview of major components

Solutions

Cerebro Solutions

Hardware

Software & Data

HelpKey

CV Algorithm

Applications

Cerebro HelpKey - Hardware Solution

1. User Holds Button
2. API Request Made
3. Cerebro Initiates GPS
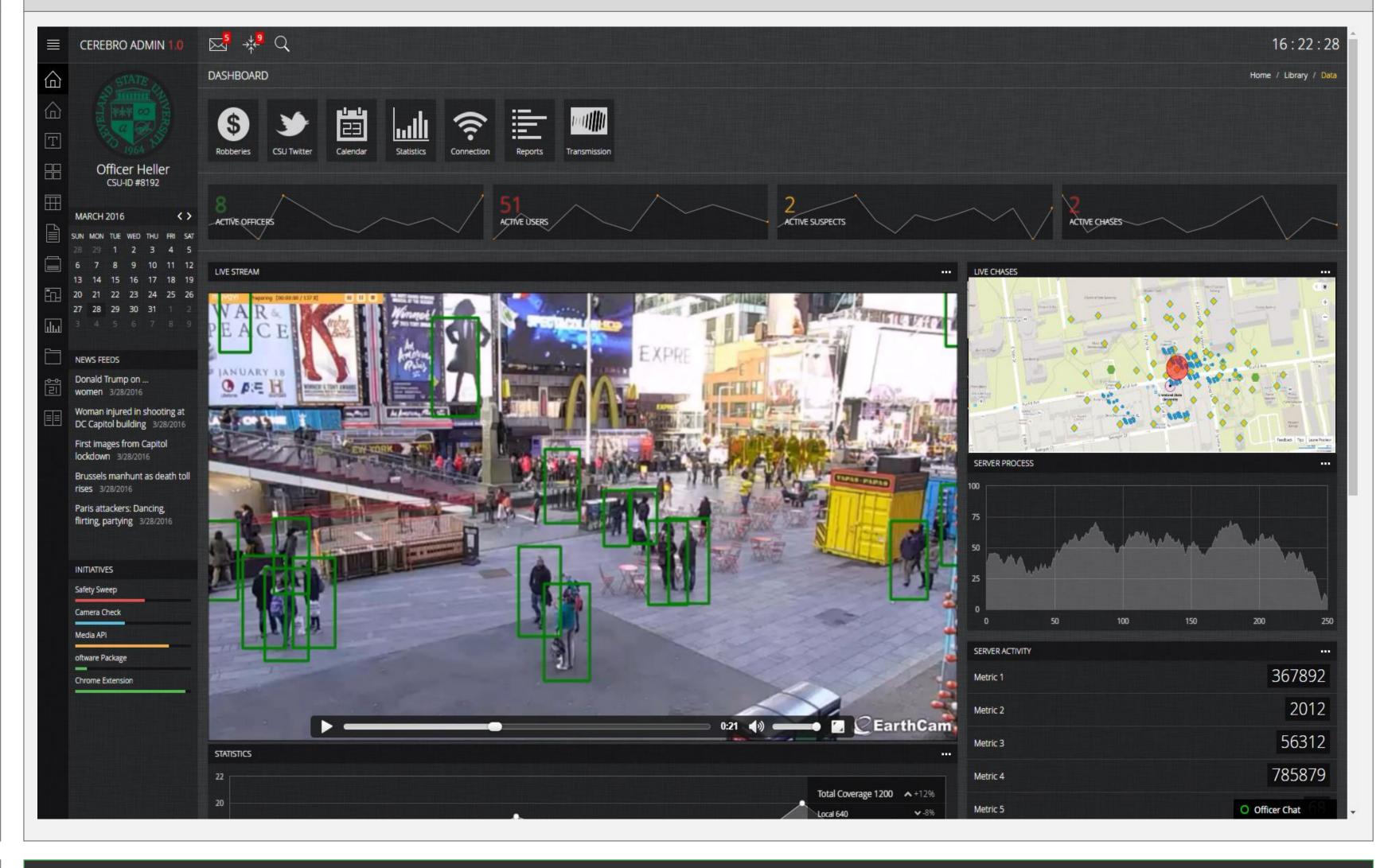
Technology and Innovation

Computer Vision Algorithm

Our proprietary algorithm makes detecting and tracking unique humans both fast, efficient, and accurate:

1. Individuals are detected using a Histogram of Oriented Gradients and a pre-trained Support Vector Machine which identifies humans in video frames.
2. Certain key identifying features such as location, RGB pattern, and unique feature vectors are extracted for every detected person and stored in our cloud database.
3. In successive frames, the detected people are compared to the previously detected ones in order to find matches and track them over multiple cameras.
4. Using this data, individuals cannot escape from local police, as they are tracked from camera to camera – having their location reported in real-time.

We plan to improve our algorithm by continuing to make use of state-of-the-art artificial intelligence techniques and by re-training the Support Vector Machine on a recently acquired dataset of over 3 million unique pictures of people.

Front-end Application

Real-time Feedback

Using the mobile application on police tablets (developed by our team), police can add suspects to a chase, initiate a chase, view camera feeds, and perform many other tasks which give them eyes in nearly every corner of the city.

Acknowledgements

The goal of Cerebro is to utilize what we have learned as STEM students to create a scalable web based security system that will first and foremost secure campuses, cities , and eventually the world.