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Intruder Detection and Alerting Mechanism Using CNN and Iot

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ABSTRACT-In modern era, surveillance system plays an important security role. Intruder cause great deal of loss through robbery and theft in various location such as banks, homes, etc. Hence there is an immediate need to come up with a solution that can help us to prevent kind of scenario. The architectural implementation in this project makes an attempt to solve the issue with the help of CNN technology. This technology has gained popularity in the field of image classification with the upcoming architecture such as Inception, ResNet-50 etc. The problem faced by many surveillances system is fixed by building Intruder Detection System with PIR sensor and Raspberry Pi, detect the intruder whenever comes in front of PIR sensor and activates camera, and sends it to registered email id.

Keywords:CNN, Raspberry Pi, PIR sensor, Camera, Image classification.

I. INTRODUCTION

As we know that, there are different face recognition algorithms have been created. And over the last few years, algorithms of machine learning like Convolutional Neural Networks have been applied in numerous smart devices/systems and used for speech recognition, image processing, etc. Speech recognition includes applications like Apple has Siri, Google assistant from Google, Microsoft has Cortana, Alexa from Amazon, etc. Image processing includes applications like object detection, face recognition, character recognition, etc.The purpose of the project is to improve security level of the premises like, academic institutions, malls, bus or railway stations, hotels, roads, etc. Human recognition should be possible from their fingerprints, face, iris, palm prints, palm veins, etc. For detecting individual, the most appropriate biometric parameter is face data.In this system, we used a PIR sensor that detects the intruder and activates the camera through Raspberry Pi, which sends the captured image to users registered email id. When the captured image is mismatched with the stored image in the system, the algorithm recognize face using face recognition technique. OpenCV library helps in the face recognition and face comparison through captured images.Modelwill be pre-trained with number of users face, then neural network technique first extract feature mapped by operations known convolution and pooling. Alerting message is sent with the captured image of intruder to the owner's email id.Using the intruder identification and email notification system user can get alert and avoid such incident before its happening.

1.1 PURPOSE

Real time detection of person with human detection system are very important for security, surveillance and also for biometric applications. There are different methods where we identify, track and recognize objects and individuals in our surrounding like, shopping malls, offices, institutions, hotels, bus or railway stations, etc. The project helps in avoiding such intrusion before it happensto monitor threats, avoid and examine any criminal activities by sending email to owner of the system with alerting message and captured images of intruder.

II. SYSTEM DESIGN

System Design consists of the Raspberry Pi kit, PIR sensor and Camera, Raspberry Pi given an input supply of 5Volt DC with amicro-USB connector, 5V DC with a GPIO header and Power over Ethernet (PoE) enabledwhich requires separate PoE HAT.

2.1 Raspberry Pi kit

In Raspberry Pi 3 range Model B+ is the newest product, having a 64-bit quad core processor with speed of 1.4GHz, and Wi-Fi connectivity of 2.4Ghz and 5GHz LAN, Bluetooth connectivity of 4.2, faster Ethernet, and PoE capability via a separate PoE HAT.

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The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market.Figure 1 shows the components of Raspberry Pi 3 Model B+. This Raspberry Pi kit preserves the same mechanical mark as both the Raspberry Pi version 2 and 3 of Model B.

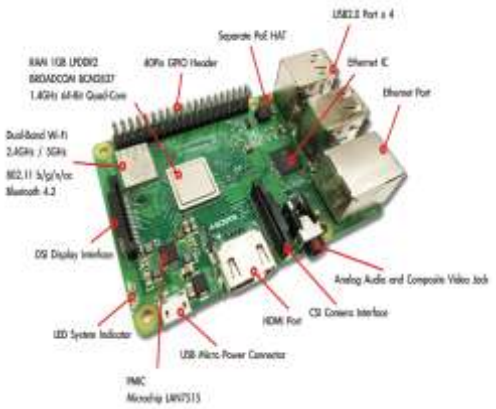

Figure 1. Raspberry Pi kit

2.2 PIR sensor

A passive infrared sensor (PIR sensor) is an electronic sensor that measure infrared (IR) light radiating from objects in its field of view. PIR sensors are used in thermal sensing applications, such as security and motion detection. They are most often used in PIR-based motion detectors.

The PIR motion sensor module is an automatic control module based on infrared technology. Humans can't see IR, hence designing of electronic detection devices helps to pick up these signals. They are commonly used in security alarms, motion detection alarms, and automatic lighting applications. Figure 2 shows the PIR motion sensor connected to the Raspberry kit.

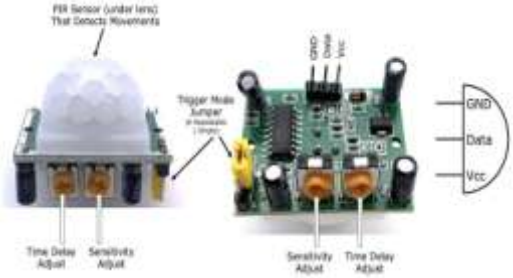

Figure 2. PIR sensor

2.3Camera

The camera module is used for taking high-definition video or capturing still images. The camera module has 20-megapixel sensor. It is connected to Raspberry Pi kit via ribbon cable to the CSI port. Figure 3 shows the camera module connected with Raspberry Pi 3 Model B+ kit.

Figure 3. Camera

Figure 4 shows the block diagram of intruder detection and notification system with PIR sensor, Camera connected to Raspberry Pi 3 Model B+ kit.

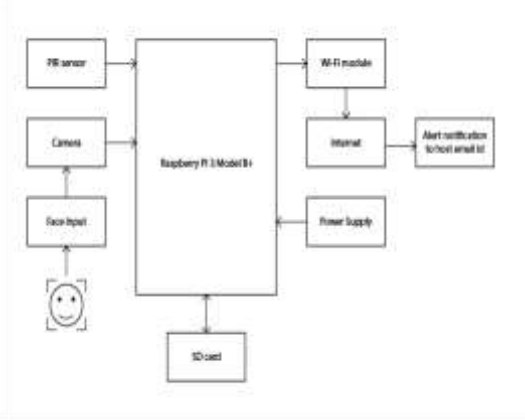

Figure4. Block diagram of intruder detection and notification system

III. LITERATURE SURVEY

In [1] "An Experimental Analysis of The Power Consumption of Convolutional Neural Networks for Keyword Spotting" the authors **R. Tang, W. Wang, Z. Tu** and **J. Lin** describe project work on spotting keyword with neural networks quantify model mark in relations of the number of parameters and multiply procedures for a feedforward inference pass. These values are, however, proxy measures since empirical performance in actual deployments is determined by many factors. Author learns the power consumption of a family of convolutional neural networks for spottingkeyword on a Raspberry Pi. Author find that both proxies are good predictors of energy usage, although the number of multiplies is more predictive than the number of model parameters. Author also confirm that models with the highest accuracies are, unsurprisingly, the most power hungry.

In [2] "Adaptive Background Mixture Models for Real-Time Tracking" the authors

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Stauffer, Chris and **W. Eric L. Grimson** describe project on Adaptive Background Mixture Models for Real-Time Tracking describes a mutual method for real-time breakdown of moving regions in image sequences contains background subtraction or thresholding the error between an estimate of the image without moving objects and the current image. The numerous approaches to this problem differ in the type of background model used and the procedure used to update the model. Author discusses modelling each pixel as a mixture of Gaussians and using an on-line approximation to update the model. The Gaussian distributions of the adaptive mixture model are then assessed to determine which are most likely to result from a background process. Each pixel is classified based on whether the Gaussian distribution which represents it most effectively is considered part of the background model. The results in a stable, real-time outdoor tracker which reliably deals with lighting changes, repetitive motions from clutter, and long-term scene changes. This system has been routed for almost uninterruptedly for month of 16, in a day for about 24 hours and through rain and snow.

In [3] "Improved Adaptive Gaussian Mixture Model for Background Subtraction" the authors **Zivkovic** and**Zoran** explains "The Improved Adaptive Gaussian Mixture Model for Background Subtraction" project is on background subtraction is a common computer vision task. Author analyse the usual pixel-level approach. Author develop an efficient adaptive algorithm using Gaussian mixture probability density. Recursive equations are used to constantly update the parameters and but also to simultaneously select the appropriate number of components for each pixel.

In [4] "Multiple Tracking of Moving Objects with Kalman Filtering andPca-Gmm Method" the authors **Noureldaim, Emadeldeen, Mohamed Jedra** and **Nouredine Zahid**projected to combine ancohesive method, the PCA-GMM method that generates a relatively better segmentation outcome as compared to conventional GMM with Kalman Filtering (KF). The collective new method PCA-GMM-KF attempts following multiple moving objects; the size and position of the objects along the sequence of their images in dynamic scenes. The produced experimental results successfully illustrate the followingtheseveral moving objects based on this robust mixture.

IV. METHODOLOGY

4.1Platform used

a) Machine Learning

Machine Learning (ML) isunderstandingthe computer algorithms which can be improvedinevitably through understanding and by the usage of data. It is perceived as a part of artificial intelligence and its algorithms build a model based on sample data also called training data, in order to make predictions or decisions deprived of explicitly programmed. Machine Learning algorithms are used in variety of applications, like medicines, filtering of email, and computer vision, where it can be difficult to create conventional algorithms to perform the required tasks.

The main work of machine learning provides various approaches to clarify computers to realize tasks where no fully satisfactory algorithm is available. In cases where huge numbers of potential answers exist, one approach is to label some ofcorrect answers as valid. This can be used as training data forcomputer to improve its algorithms by uses to determine correct answers. For example, to make learningof a system for digital recognition, the MNIST dataset where handwritten digits used.

b) Django Web Framework

Django is open-source web framework which is based on python follows the model-template-views architectural pattern. The primary goal is to ease creation of complex, database-driven websites. The framework emphasizes reusability and "pluggability" of components, less code, low coupling, fast development, and the principle of don't repeat yourself. Python is used throughout, even for settings, files, and data models. Django also provides an optional administrative create, read, update and delete interface that is generated vigorously through introspection and configured via admin models.Despite having its own nomenclature, such as naming the callable objects generating the HTTP answers views, the core Django framework can be seen as an MVC architecture. It consists of an object-relational mapper (ORM) that mediates between data models (defined as Python classes) and a relational database like Model, a system for processing HTTP requests with a web templating system like View and a regular-expression-based URL dispatcher such as Controller.

c) Keras ML Framework

Keras is an open-source software library which provides interface of Python for artificial neural networks. It acts as an interface for library inside TensorFlow. It contains number of implemented and commonly used neural network for software blocks like layers, objectives, activation functions, optimizers and host tools which make working with image and text data easier to simplify coding necessary for writing deep neural network code. In addition, Keras has support for convolutional neural network and recurrent neural network.

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Keras supports other common utility layers such as dropout, batch normalization, and pooling.It allows users to create deep models on smartphones, web, or on the Java Virtual Machine. Also, allows use of distributed training of models on clusters of Graphics Processing Units (GPUs) and Tensor Processing Units (TPUs).

4.2High Level Design and Algorithms

a) CNN (Convolutional Neural Network)

CNN is a representative algorithm in Deep Learning. It is essentially a multi-layer perceptron that simulates local observation to achieve an input-to-output mapping. It extracts the features of the data at different scales through multiple convolutions and pooling.The unique in the CNN network is the way used in local connections and shared weights. On the one hand, it reduces the number of weights which makes the network easy to optimize, and on the other hand, it reduces the risk of overfitting. CNNs are generally composed of three mutually supported levels, namely convolutional layer, pooling layer, fully connected and SoftMax layer. In the convolutional process, we get local features. Since one of the convolution layers is composed of multiple convolution units, in the calculation process, in order to extract more features about the input parameters, it is necessary to obtain more complex feature correction values from subordinate convolutional layers through multi-level cascading.

V. RESULTS

The algorithm is trained to detect the captured image is user or intruder.Users inside the system are already stored their image and shownas captured image is user.The stranger image is captured and shows that detected image is intruder. At last, when intruder is detected alert notification sent to host email id, so that host avoid such incident before its happening. Figure 5 detects that captured image is user.

Figure 5. User detected

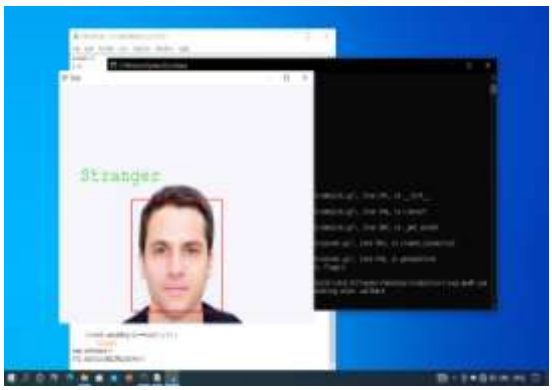

Figure 6. Intruder detected

Figure 6 shows that detects that the captured image is intruder. Figure 7 shows the alert notification sent to host email id when intruder detected.

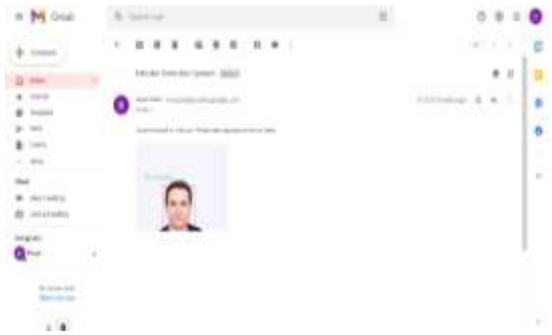

Figure 7. Alert notification sent to host email id when intruder detected

VI. CONCLUSION

The system will be ableto detectintruder and capture image through camera with the help of PIR sensor attached to it. In this paper the deep learning algorithm i.e.,CNN is used to detect the intruder in the surveillance system. The CNN also able to show better result when more images are trained and added to image folder belonging to user's system. The movement design of object can be enhancedmore and included in future algorithm. Also, the system will beable, if any impostor that may want to evade the camera.

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