

IDENTIFICATION OF ABNORMAL OBJECTS IN LIVE FEEDS IN THE ATM ENVIRONMENT

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Abstract— The proposed abnormality identification system is developed to identify and detect abnormalities through a live feed in the banking industry, more specifically in an ATM environment. The research begins with the domain research that is concerned with image processing in terms of identifying the different objects and detecting an abnormal object. The research also covers how the system is to be implemented, the techniques and methods used and how each module is integrated to perform efficiently as a whole. All conclusions are made based on the relevancy to the proposed system and project objectives.

Keywords- *Abnormalities, Image, Identification, Live feed*

I. INTRODUCTION

Banks happen to use a generic CCTV surveillance system on premise, proper live feed technology to identify and detect the human abnormalities and objectives in real time is far from their current technology. The banking industry happens to use a manual live feed surveillance system monitored by one person or a group of people [1]. They are far from using facial recognition systems, Biometric, Motion detection systems and, human or object detection systems to prevent threats. These are the technologies that would maximise security. The banking industry needs to understand that embedding these technologies into their video surveillance systems will help them be proactive in security. The limitation of the current banking industry [1].

- Human action is required for any abnormal event.
- Any Distortion in front of the camera may cause a problem.
- Everything is done manually.
- Processing may take time depending upon the system in use.

Detection of moving objects is usually the first stage of video processing and its result are used by further processing modules. Most video segmentation algorithms usually employ spatial and temporal information to generate a binary mass of objectives [2].

This research considers the live feed to identify and detect multiple activities and objects in real time which is notified by an alert. To identify abnormal objects, image matching methods and Image matching algorithms are often divided into direct and feature-based methods. Some method does not work for scaling or rotation. Labelling of objects in an image using segmentation, this will be especially efficient for large complicated images, 3D and/or *m*-D images [3]. A background modelling-based method suitable for the security surveillance application is proposed by Soumya, to segment the moving object from the poorly illuminated area, using dynamic matrix [4]. It is still a challenging problem for night-time video applications since most of the previous work.

Template-base matching explained using cross correlation or sum of absolute differences. The method is simple to implement and understand, but it is one of the slowest methods. Image matching algorithms are often divided into direct and feature-based methods. In direct methods, such as Lukas-Kanad, a parametric Optic-Flow mapping is sought between two images so to minimize the Sum-Of-Squared Difference between the images [5].

In surveillance systems today, distortions facing the camera may cause problems, human action is required to detect any abnormal behaviour - by viewing it on screen, processing of data may take time depending on the complexity of their system. The solution proposes to run a template matching algorithm to detect any abnormal behaviour in a specific individual in the system.

Over the years, in the Banking industry, there was no proper technology to identifying unusual human behaviors or objects in real time to notify those activities by the alert or notification. Up to now, every suspicious behavior and unusual objects are monitored manually. The banking industry, however, has been developing and conducting many experiments to increase their security and as a result, has installed multiple CCTV surveillance systems to detect anomalies that pose a threat to a bank. Nowadays, most of the banks worldwide are using facial recognition systems, biometric, motion detection systems and human or object

detection systems, etc. To ensure their security, but there is no proper system for identifying threats. There have been a few types of research conducted and proposed methods that automatically recognizes behavior and detects abnormalities without applying any manual labelling. Detect objects by thresholding a motion filter and they propose an unsupervised method that integrates the prototypical image features and classifies a group of behavior patterns either as normal or abnormal [3]. In our research, authors are focusing on a live feed to identify and detect unusual behaviors or objects to prevent threat and notify by the alert as a response.

II. RESEARCH PROBLEM

An important factor in the success of any video surveillance security system is the supervision done by humans. The limitation also is of on human assessment, who may not be entirely reliable since multiple factors such as personal issues, fatigue, professional issues, health, etc.

play important roles in one's cognitive process with the progressive nature of the bank industry, the ability of a security offer to monitor multi-screen consoles leads to the health-related issues. The primary cause of guard fatigue and boredom is constant staring at monitors and the associated glare [6].

Also, lapses in scheduling will have the nodes not being monitored by anyone leading to more threats being missed. At the time of a shift change, even for a few minutes if the security office is left unmonitored, someone could pass through easily.

A famous method of playing with surveillance video feeds, is to take a picture or running recording and place the result in front of the camera allowing the threat to work as needed behind the resulting image/loop. Identification of such tampering done to the live feed needs to be identified and alerted to avoid further losses.

Since multiple humans are to be monitored by just two or three individuals, suspicious behaviors of individuals may be missed as feeds are coming in from different. Individuals assigned to monitoring and operating CCTV systems should not utilize the systems in an inappropriate manner. If evidence is provided that an individual is tampering with the system, action needs to be taken the managing authority should take appropriate measures to eliminate or minimize the risk of re-occurrence and must monitor every activity of the surveillance system without missing out on identifying suspicious behaviors [7].

III. RESEARCH OBJECTIVES

A. Main objectives

With the new innovations in digital technology and surveillance, the objective is to create a solution for financial institutions such as banks to implement and to

tighten security and surveillance within the organization. The solution is to identify and alert staff on any abnormalities in operations of the organizations, to identify any objects that are prohibited within the organization, to allow for human, object identification and analysis, and to ensure the video feed is not being tampered with. The solution also hopes to use available resources as effectively and efficiently as possible.

B. Specific objectives

Apart from the main objective, abnormal object identification and detection specific objectives are, once live feed records are broken down into low-level frames, need to follow to identify abnormal behavior.

Use Feed data - abnormal objects for example gun, knife and must feed normal situation inside ATM so select the relevant image then upload.

Develop Item configuration - abnormal objects, for example, for example, gun have different types so the name of that sub mapping must save (gun-pistol, ak47).

Implement Prepare identifier - First, identify features of feed data then must feed those features by using image processing and machine learning.

Implement Object identifier - by using fed features must identify abnormalities.

Implement Incident data - If abnormal object detects then send email alert to control staff to avoid the abnormal incident.

IV. METHODOLOGY

In the component methodology the way the research project is managed, and its development process will be defined. In this section the development process, implementation process and outcome will be described.

After designing the abnormality identification and detection in live feeds in the banking industry hierarchy consists of classes and relationships for the selected abnormal object identification domain that system should be implemented. Accord.NET framework is used, the framework is comprised of multiple libraries and offers many techniques, such as machine learning, pattern recognition and for kernel functions, authors have used this framework and to send alert used C# SMTP mail function.

It's like image classification sample application, first must identify features then feed features finally detect abnormal objects. Methods used to compute the Bag Of Visual Words (BOW) with the training images. The threshold value used to extract feature points in an image.

For standard clustering used clustering algorithm is Speed Up Roust Features (SURF) that is based on Euclidean distances. A good algorithm used for clustering codewords is the (Kernel Support Vector Machines) Binary Split variant of the K-means algorithm. Iterative Model is chosen as the methodology in developing and implementing a solution for the captured research problem.

Initially extract feature points using SURF (Standard Clustering Algorithm), using threshold value it's extracts feature points from object image folder then it's matched with the live feed. If 80% extract feature from observed image matched, then it's used KNN classifier (K-Nearest Neighbor) easy to understand machine learning algorithm but doesn't perform any learning at all. Then BF matcher is to match key point descriptors. BF matcher match methods which finds the best match for each descriptor from the query image. Python had used to create a haarcascade file to train the images (XML).

Haarcascade is basically a classifier which is used to detect the object for which it has been trained for, from the source. The haarcascade is by super imposing the positive image over a set of negative images. The training is generally done on a server and on various stages. Better results by using high quality images and increasing the amount of stages for which the classifier is trained.

Finally create the homography matrix is a perspective transformation. Map 3-D points on to 2-D image planes using the transformation matrix.

After had identified abnormal object it sends a screenshot of that detection through mail alert.

V. TESTING AND IMPLEMENTATION

A. Testing

After the implementation procedure the testing of the component is compulsory. Testing eliminate most of the errors in the developed component. The developed system is tested for the selected news domain.

There are 3 types in testing. Unit testing is performed regarding to each individual component. Unit testing is performed under white -box testing approach. Unit testing helps developers to decide that the individual units of the program are working as per requirement and are error free, thus making the overall system error free.

Integration testing is to test errors in the integrated modules. Even if the units of the software are working fine individually, there is a need to find out if the units integrated together would also work without errors. In here the testing will be done in the Black -Box testing approach. System testing will be done finally. The software product is compiled as a product and then it tested. This can be accomplished by using one or more of the following tests.

Functionality Testing:

Testing of all the functionalities of the software against the requirement. Performance Testing:

To estimate how efficient the product in performance testing can be used. The system will be pushed to higher and lower limits and the defects will be identified. It measures the effectiveness and average time taken by the software to do the desired tasks.

Security and Portability Testing:

This test is done when the software is meant for work on various platforms and accessed by a number of persons.

B. Implementation

In this phase, the above designed model is implemented as a working system. Implementation of image processing and machine learning functionality. So, it was developed using Accord.NET framework and the programming language C# smtp email function in the visual studio used to implement for sending an email alert.

Image Classification: -First just loads the image datasets into memory. Seed the number generator with a fixed number so results are replicable across application runs. Used random data splits. Open resources folder creates an image list to load images into an array for used to store guns features for individual object identification for example guns identification. Then start loading the images from the image folder and put them in the appropriate containers. Authors use dictionaries so can map each file name to their respective bitmap object for every class folder, authors used this to train images to the system by categories them label the images and group. Create list view groups for each class. Load the images from the dictionary that contains images for each class. For each file in the class folder create an image file (Bitmap), use the tag object to store the class label of each image, it will recover it from here later. Use this for storing image feature details (Tag). In here authors store identified features in separate list. This for individual object detection in later step. Save image data to database, load item configuration, load incident data finally stop loading icon. Identify Features: -Methods computes the Bag-Of-Visual-Words with the training images, take threshold value used to extract feature points in an image. Authors will use SURF, so authors can use a standard clustering algorithm that is based on Euclidean distances. A good algorithm for clustering codewords is the Binary Split variant of the K-

Means algorithm. Create a Binary -Split clustering algorithm. Create bag-of-words (BOW) with the given algorithm by default this will use SURF algorithm. Compute the BOW codebook using training images only.

Now that authors have already created and computed the BOW model, authors will use it to extract representations for each of the images in both training and testing sets. Extract features for all images, get item image, and convert image type if not match. Then apply grey scale filter, apply edge filter.

Get a feature vector representing this image. represent it as a string so authors can show it onscreen, show it in the visual grid. Retrieve the class labels, that authors had stored in the tag, now use the tag to store the feature vector too. In here authors store identified features in the separate list this is for individual object detection in a later step. Create an object from data to save database then save data to the database. Assign generated a list to the global class. Feed Features: -Creates the Support Vector Machines that will identify images based on their Bag-Of-Visual-Words feature vector representation. Get the chosen kernel, extract training parameters from the interface. Create the support

vector machine learning algorithm. Get the input and output data. Prepare to start learning, train the machines. It should take a while. Compute the training error (accuracy also known as zero-one-loss) used equation is,

$$\text{Approximate size in bytes} = \text{number of support vectors} * \text{number of doubles in a support vector} * \text{size of double}$$

Populate the information tab with the machines. Calculate the Approximate size in bytes. The mMethod generates value for the complexity parameter. Extract inputs. Recover the class label and the feature vector that had been stored in the rows tag objects. Get the selected kernel from UI. Set loader while loading data.

```
// So we can map each filename to their respective Group objects.
// For every class folder
foreach (DirectoryInfo classFolder in path.EnumerateDirectories())
{
    string name = classFolder.Name;
    //we used this to train images to system by categories them
    //label the images and and group
    int currentClassLabel;
    switch (name)
    {
        case "Guns":
            currentClassLabel = 0;
            break;
        case "Knife":
            currentClassLabel = 1;
            break;
        case "Normal":
            currentClassLabel = 2;
            break;
        default:
            currentClassLabel = -1;
            break;
    }
    ListViewGroup trainingGroup = new ListViewGroup();
    // Create list view groups for each class.

    trainingGroup = listView1.Groups.Add(name + ".train", name + ".train");
}
```

Fig. 1. Label the image and group, part of the code segment

Proceed: -Identify picture types, identify anomaly objects, test image path, get files to the array, loop through images, clear initial image data, take an image from a file, set the image to box. Covert image if not in the correct format, apply grey scale effect, apply edge filter. Let the application to set images to the picture box. Get a feature vector representing this image. Represent it as a string so authors can show it on screen. Now use the Tag to store the feature vector too. Classify in to one of the classes, this is used to identify exact image matching when identifying image class example gun, knife. Decide what the identified image class is. Identify exact matching image from identified image class, here authors use image class folder image list for the gun, knife. Clear image box data after processing then populate the grid with newly identified data.

Save configuration data to database (mapping), Item Configuration - (Mapping – Sup mapping). Display item config data from the database, display incident data from the database - Identified abnormal data. Save images path and names in the initial step. Take existing images data from the database, take file path, get files from image class folders, save path data to each file. Load image in data feed

screen. Save the image to the data base and file storage. Check if the file already exists in the database.

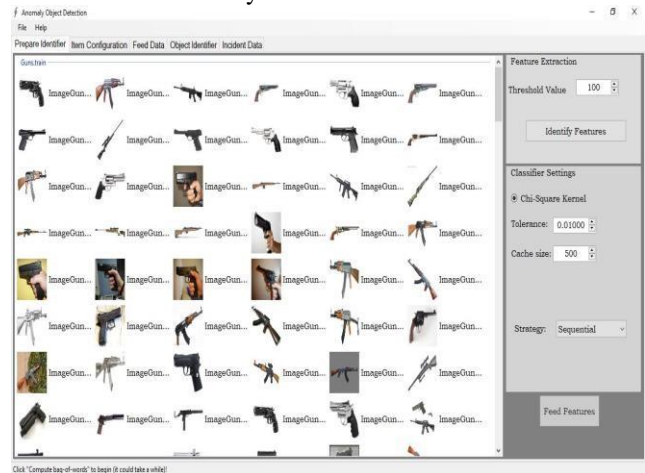


Fig. 2. Image training interface

Email alert: -Used C# SMTP mail function. Create SMTP client object (host and port are on the internet) then setting for SMTP client. Email message object. Body html used to render our message content as html. Finally, call the SMTP message sending method.

To run the system steps to follow: Click Identify features to identify all image features and threshold value 100 gives better result then Click Feed features to train the system finally Proceed to detect an abnormal object and to send an alert email.

Identify Features -> Feed Features -> Proceed

Used separate classes to implement the system, static class: GlobalClass and other Classes: Surffeatures, FeatureMatch, ResultFeature, DataMapper, MappingData, DataHelper, EmailSender.

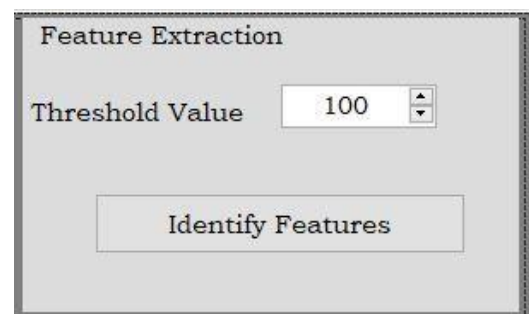


Fig. 3. Feature extraction settings

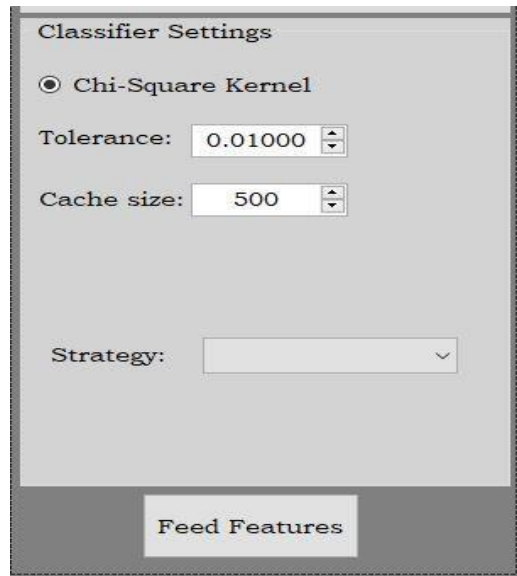


Fig. 4. Classifier settings

VI. RESEARCH FINDINGS

The main target of this project was to identify and detect anomaly objects in live feeds in the banking industry, our scope to consider inside ATM room, by using image processing and machine learning it had done. So as a component main objective of this component is to identify and detect anomaly objects in the live feed. Therefore, from the research done throughout the process accurate and efficient ways to design, develop and implement process consist of classes, relationships and individuals which represent a specific selected domain was identified. And ways of the feature extracting information from fed data, processing them into a structured format and using them to detect the abnormal. Suitable algorithms are identified for standard clustering, clustering code words. It's like image classification sample application, first have to identify features then feed features finally detect abnormal objects. Furthermore, to developed accord framework and SMTP function was identified from the research done. So, the findings from the research done which are mentioned above paved the way to build an accurate and efficient system. And finally, could give a better system to detect anomaly object.

VII. RESULTS

The purpose of this research project is providing efficient and effective protection for people and personal properties inside ATM. I encountered 4 major problematic parts such as,

- Identify Features from fed data
- Feed features – Train the system
- Proceed to identify and detect
- If anomaly detect then send an email alert

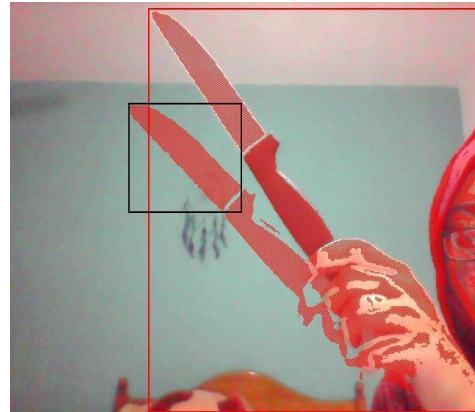


Fig. 5. Knife detected

I came up with a solution for these major problems and this system provide efficient, effective, accurate and reliable security inside ATM. Finally, as the developer's authors are binding to update the system on time.

In using of various techniques for image processing, it is important to acquire the best mix of techniques to implement Due to security constraints the team was not able to test the system under actual ATM environment conditions. Until the team gets to test the system in an actual ATM environment, authors are unable to produce results that are of 100% accuracy related to the scenario. So far, all the tests have been carried out in an environment that simulated an actual ATM environment up to 75%, and authors were able to get results that captured our objectives. Future researches will be focused on the tracking of suspicious individuals outside the ATM premises after they are detected inside. Current solution could also be scaled and used within the bank premises where transactions take place

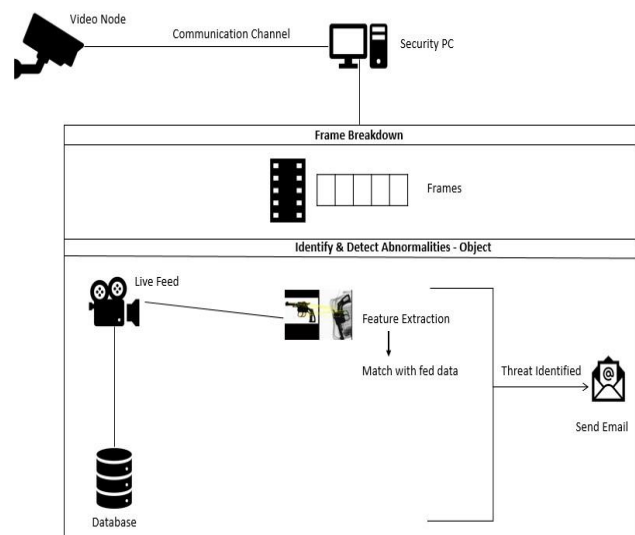


Fig. 6. High level diagram

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