ARTIFICIAL INTELLIGENCE-BASED DETECTION OF SUSPICIOUS ACTIVITY IN ATM USING YOLO ALGORITHM

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***Abstract*— In our daily life, we see a lot of crimes and theft taking place which is not known properly. The major crimes are happening at the ATM. Developing several security and cops isn't an effective answer to conquer the existing issue on the ATMs that the general population who are not engaged in criminal exercises will not feel free to use ATMs and social services. In this project, we use artificial intelligence techniques to detect abnormal events that occur in the ATM. In this project weapon detection and monitoring have major applications of computer vision to tackle various problems. Due to the growing demand for the protection of safety, security, and personal properties, the need and deployment of video surveillance systems that can recognize and interpret the scene and anomaly events play a vital role in intelligence monitoring. Knife or certain pattern detection is the identification of irregular, unexpected, unpredictable, unusual events or items, which is not considered as a normally occurring event or a regular item in a pattern or items present in a dataset and thus different from existing patterns. This project implements automatic knife, and gun detection in ATMs using a yolo algorithm. Our Proposed implementation uses a dataset of pre-labeled images with objects of interest. The algorithms achieve good accuracy, but their application in real situations can be based on the trade-off between speed and accuracy.**

Keywords— ATM, R-CNN, Retina-Net, and Single-Shot MultiBox Detector (SSD)

I. INTRODUCTION

Detection of crimes and abnormal events is very difficult. Prediction of a crime scene can ease the job of law enforcement agencies. We see a lot of CCTV cameras being installed to monitor a certain area. But, the increasing number of CCTV cameras is problematic, as we need to monitor all the cameras manually. So, we use image processing techniques to detect the abnormal activities that occur in the ATMs.

Life would be easier if computers can predict crime scenes by processing CCTV camera's videos. The increasing demand for artificial intelligence (AI) in the security sector is a must because it can be used to train machines for normal and abnormal activities. According to the news published in the Times of India, the detective department claimed to crack the great Kolkata ATM fraud case with the arrest of a Romanian after a dramatic auto chase through Delhi lanes. The arrest came only exactly eight days after the gang struck the city and siphoned the money from the accounts of over 71 ATM users.

As Deep Neural Network which is also known as deep learning can give outstanding performance on image classification focused on the problems of object localization in the image and automatically detects the objects in the ATM. It is easy to detect crime when we use deep learning techniques. The neural network is used for weapon detection in the ATM.

Automatic feature representation gives better performance than manual features and an unsupervised approach can give very close results to the supervised approach. Using the YOLO algorithm, we can detect the images of the weapon. The images or videos are processed by using Digital Image Processing Toolbox for monitoring and detecting the abnormal events at ATMs

II. OBJECTIVE

- The main objective of this project is easy to detect the weapon when we use artificial intelligence. The YOLO algorithm is used for weapon detection in the ATM.

- To detect abnormal situations by implementing detection of certain vital parameters like knives, and guns.
- To develop an intelligent system using the YOLO algorithm to help the investigation team in finding the culprits in ATM

III. LITERATURE SURVEY

1. Y. Liu, D. Hu, J. L. Fan, F. P. Wang Multi-feature fusion for crime scene investigation image retrieval. 2018

Crime scene investigation (CSI) image is an important part of the information collected at crime scenes. Classification and retrieval of CSI images provide important clues and play an important role in solving serial crimes. Therefore, there is an urgent need for automatic and effective image classification and retrieval system to quickly find relevant images from a large number of CSI images to improve the efficiency of the investigation while saving human power and material resources.

2. Y. Liu, Y. Huang, S. Zhang, D. S. Zhang, N. Ling Integrating object ontology and region semantic template for crime scene investigation image retrieval,2019

The author proposes to combine low-level features of image dominant color descriptors as color features, gray-level co-occurrence matrix as texture features, and the edge feature obtained by gradient vector flow to improve CSI image retrieval performance. The disadvantage is that the computation is complex and slow.

3. C. Y. Wen, C. C. Yu Image Retrieval of Digital Crime Scene image,2020.

Currently, there are few studies on CSI image retrieval. Existing CSI image retrieval technologies can be divided into two categories: CSI image retrieval based on low-level features and that based on high-level semantics. CSI image retrieval technology based on low-level features uses a content-based image retrieval (CBIR) framework to extract low-level features of the image (such as color histogram, gray level co-occurrence matrix, Gabor features, wavelet texture features, etc.) or to fuse different low-level features, which confirms the feasibility of CBIR technology in CSI image retrieval

4. A. Parab, A. Nikam, P. Mogaveera and A. Save, "A New Approach to Detect Anomalous Behaviour in ATMs," 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2020, pp. 774-777.

proposes a system for anomalous behavior detection in ATMs using CNN and LSTM on the surveillance videos. The system utilizes anomaly as well as a non-anomaly dataset which is fed to a machine and trained to identify abnormal behavior. Classifying the video is quite difficult as it contains spatial as well as temporal data. Remembering the temporal data is what is needed for the successful classification of videos. Therefore, this system has proposed a method to identify and classify whether it is abnormal behavior or not. As it is becoming very crucial for well beings of our society.

5 A. Khaleghi, M Moin, "Improved Anomaly Detection in Surveillance Videos Based on A Deep Learning Method "Artificial Intelligence and Robotics (IRAN OPEN), 2018, pp. 73-81.

An anomaly detection system using low-level features is described in which dense motion field and statistics are computed in each frame. Then motion directional PCA technique is used to extract useful principle features in the time span. Finally, one-class SVM discriminates the anomaly from normal events.

6. Kuldeep MarotiraoBiradar, Ayushi Gupta, Murari Mandal, Santosh Kumar Vipparthi, "Challenges in Time-Stamp Aware Anomaly Detection in Traffic Videos", Vision Intelligence Lab, Malaviya National Institute of Technology Jaipur, 11 June 2019

For whatever particular context, there may be an idea of the thing that constitutes typical conduct technique Furthermore conversely, abnormal conduct technique. Interestingly, abnormal or surprising designs would some way or another those "interesting" things that make the consideration by mankind's spectators Furthermore need aid frequently all the exactly simple on identity. Such practices would thereabouts in view they need aid unique about the general examples in that connection. Accordingly, anomalies are temporal or spatial outlier occasions not adjusting to scholarly patterns. Essentially, there is a critical destination to model both that presence And Progress by typical occasions with recognizing the vicinity of and recognizing the spatial area of the aberrance introduced in the scene.

IV. PROBLEM STATEMENT AND SOLUTION

A. EXISTING SYSTEM

- In this existing work, we address the problem of analyzing the data gathered at a crime scene through the use of object detection.
- By detecting the objects present in the shreds of evidence found at a crime scene, it is not possible to extract some intelligence or relations.
- We evaluate the MP-CNN multi-part weighted convolutional neural network on two datasets. One is the shoe-print identification database (SPID). The other is the footwear impression database (FID).
- The extending our framework to other tasks such as the sketch-based image retrieval problem occurred.

B. PROPOSED SYSTEM

- Weapon detection is the identification of irregular, unexpected, unpredictable, unusual events or items,

which is not considered a normally occurring event or a regular item in a pattern or items present in a dataset and thus different from existing patterns.

- Proposed implementation focuses on accurate detection and classification of the knives, gun by using your algorithm.
- Our proposed system is highly concerned with accuracy since a false alarm could result in adverse responses.
- Choosing the right approach is required to make a proper trade-off between accuracy and speed.
- The methodology of such detection using the YOLO algorithm in AI. Frames are extracted from the input video. Frame differencing algorithm is applied and a bounding box will be created after the detection of certain objects and patterns.

C. *INTERPRETATION OF THE SOLUTION*

- It classifies the images with high efficiency since it uses a non-parametric classification method.
- It also uses keypoint descriptors for additional precision in the process of image processing.

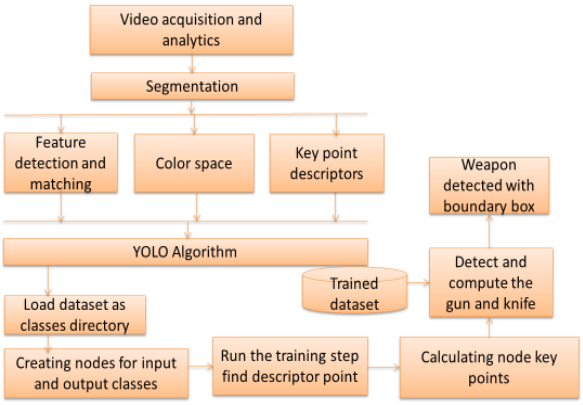

Fig 1.1 Architecture of the proposed system

D. *SYSTEM MODULES*

There are six modules in this system

- Video acquisition and analytics module
- Detection Module
- Color space module
- Keypointnt Detection and matching Module
- Comparison of Pre-labeled images module
- Output prediction module

E. *MODULE DESCRIPTION*

- **Video acquisition and analytics module**

In this module, the camera will obtain the real-time video and implement video analytics to perform further steps in the procedure. Then the video will be segmented as individual frames for processing.

- **Detection Module**

In this module, the yolo algorithm is used to implement the detection technique to identify the region of interest in the acquired images.

- **Color space module**

In this module, the images will be processed under color conversions like RGB to HSV and to Grayscale images to differentiate the desired pattern from the unnecessary regions in the image.

- **Keypointnt Detection and matching Module**

In this module, the system will describe the node key points in the detected region of interest (gun and knife) and match them with the reference images to identify the weapon.

- **Comparison of Pre-labeled images module**

In this module, the detected and key point marked images will be compared with the pre-stored and labeled images in the dataset to identify and find the matches in those images. If the match is found, the person with such possessions can be identified by getting the label of the matched image in the dataset. Also, the presence of a knife and gun in the acquired image will be detected by comparing the input image with dataset images having a knife and gun as reference.

- **Output prediction module**

In this module, the output results will be displayed in the window after the detection of certain parameters that are pre-set in the system such as gun and knife.

V. SYSTEM SPECIFICATION

HARDWARE SPECIFICATION

- Processor: INTEL i5 (7th generation)
- RAM: 8 GB RAM
- Hard disk: 1TB
- Monitor: 20’ color monitor

SOFTWARE SPECIFICATION

- Front end : pyqt5
- Back end : python 3.9
- Software tool used : PyCharm
- Platform : Windows 8

YOLO ALGORITHM

YOLO is an algorithm that uses neural networks to provide real-time object detection. This algorithm is popular because of its speed and accuracy. It has been used in various applications to detect traffic signals, people, parking meters, and animals.

The YOLO algorithm for object detection and explains how it works. It also highlights some of its real-life applications.

Object detection consists of various approaches such as fast R-CNN, Retina-Net, and Single-Shot MultiBox Detector (SSD). Although these approaches have solved the challenges of data limitation and modeling in object detection, they are not able to detect objects in a single algorithm run. YOLO algorithm has gained popularity because of its superior performance over the aforementioned object detection techniques.

YOLO

YOLO is an abbreviation for the term 'You Only Look Once. This is an algorithm that detects and recognizes various objects in a picture (in real-time). Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images.

YOLO algorithm employs convolutional neural networks (CNN) to detect objects in real-time. As the name suggests, the algorithm requires only a single forward propagation through a neural network to detect objects.

This means that prediction in the entire image is done in a single algorithm run. The CNN is used to predict various class probabilities and bounding boxes simultaneously.

The YOLO algorithm consists of various variants. Some of the common ones include tiny YOLO and YOLOv3.

YOLO ALGORITHM IS IMPORTANT

YOLO algorithm is important because of the following reasons:

- **Speed:** This algorithm improves the speed of detection because it can predict objects in real-time.
- **High accuracy:** YOLO is a predictive technique that provides accurate results with minimal background errors.
- **Learning capabilities:** The algorithm has excellent learning capabilities that enable it to learn the representations of objects and apply them in object detection.

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YOLO ALGORITHM WORKS

YOLO algorithm works using the following three techniques:

1. Residual blocks
2. Bounding box regression
3. Intersection Over Union (IOU)

1. Residual blocks

First, the image is divided into various grids. Each grid has a dimension of S x S. The following image shows how an input image is divided into grids.

2. Bounding box regression

An abounding box is an outline that highlights an object in an image.

Every bounding box in the image consists of the following attributes:

- Width (BW)
- Height (bh)
- Class (for example, person, car, traffic light, etc.)- This is represented by the letter c.
- Bounding box center (bx, by)

INTERSECTION OVER UNION (IOU)

Intersection over Union (IOU) is a phenomenon in object detection that describes how boxes overlap. YOLO uses IOU to provide an output box that surrounds the objects perfectly.

Each grid cell is responsible for predicting the bounding boxes and their confidence scores. The IOU is equal to 1 if the predicted bounding box is the same as the real box. This mechanism eliminates bounding boxes that are not equal to the real box.

SEGMENTATION

Image segmentation is a prime domain of computer vision backed by a huge amount of research involving both image processing-based algorithms and learning-based techniques.

In conjunction with being one of the most important domains in computer vision, Image Segmentation is also one of the oldest problem statements researchers pondered upon, with the first works involving primitive region growing techniques and optimization approaches developed as early as 1970-72.

Image segmentation is a sub-domain of computer vision and digital image processing which aims at grouping similar regions or segments of an image under their respective class labels. Since the entire process is digital, a representation of the analog image in the form of pixels is available, making the task of forming segments equivalent to that of grouping pixels.

Image segmentation is an extension of image classification where, in addition to classification, we perform localization. Image segmentation thus is a superset of image classification with the model pinpointing where a corresponding object is present by outlining the object's boundary.

KEY POINT DESCRIPTOR

A SIFT descriptor of a local region (key point) is a 3-D spatial histogram of the image gradients. The gradient at each pixel is regarded as a sample of a three-dimensional elementary feature vector, formed by the pixel location and the gradient orientation.

Binary image descriptors encode patch appearance using a compact binary string. The hamming distance in this space is designed to follow a desired image similarity measure typically sought to be invariant to scene illumination and viewpoint changes.

A feature descriptor is an algorithm that takes an image and outputs feature descriptors/feature vectors. Feature descriptors encode interesting information into a series of numbers and act as a sort of numerical "fingerprint" that can be used to differentiate one feature from another.

VI. CONCLUSION

We can successfully detect weapons based on artificial intelligence. The wrong data is reduced which makes our model very efficient for this task compared to other models. To implement a system that employs a Yolo algorithm to serve the purpose of the system. The results are given in percentage for each of the objects we want to detect. Predicting a weapon by detecting threatening objects can have a far-reaching impact on the computer vision field. For our datasets, the test accuracy is 99.2 % which is very competitive with the systems we have seen so far.

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