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Automated Intelligent Surveillance using Human Behavior Analysis in Shopping Malls

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Abstract **- Our paper aims to develop a completely automated, multiple camera surveillance and intelligent monitoring system that detect theft in the shopping mall using human behavior analysis that finds the activity of persons who have mischief intentions. These systems generate warnings if they detect a suspicious person or unusual activity before the actual activity takes place. It also generates alert for such events and sends message of observed activities through Wi-Fi to a human operator for immediate action and response decision.**

Keywords **- Abnormality Detection, Surveillance System, Behavior Analysis, Sensor Cameras, Intent Recognition, Intelligent surveillance, Ambient Intelligence**

I. INTRODUCTION

Today's reconnaissance frameworks differ in multifaceted nature, proficiency and exactness. Numerous observation frameworks oblige the utilization of a more noteworthy number of Polaroid's. The work force viewing the screens are still loaded with recognizing an unusual demonstration or condition indicated on one of the screens, figuring out which Polaroid, and which relating zone of the secured range is recording the anomalous occasion. Our point is to give a mechanized insights feature reconnaissance framework which finds the robbery proposition of a specific individual in a shopping center utilizing conduct examination and alert is initiated through Wi-Fi from the remote sensor Polaroid controller to summon a manager to promptly see the apropos feature pictures demonstrating the clear burglary in advancement and access its exactness.

II. OBJECTIVES

To create and convey a completely mechanized, different Polaroid observation and observing framework that identifies burglary in the shopping center utilizing human conduct examination that finds the pernicious aim of persons. Framing an observation framework which conquers the issues of the former reconnaissance frameworks that screens human exercises by sensors that could give early cautioning of burglary exercises before ruinous moves make place and to caution watched exercises by Wi-Fi to a human administrator for reaction and choice. In this manner fabricating the remote Polaroid robotized reconnaissance wherein human recognition is not needed.

III. NEED FOR THE STUDY

Shoplifting speaks to a significant issue for retailers in shopping centers. Retailers lose more than $13 billion in stock every year because of shoplifting, as indicated by the National Association for Shoplifting Prevention. Most present feature reconnaissance frameworks require a human administrator to always screen them. Hence the feature from these Polaroids is typically observed sparingly or not in any way; actually it is regularly utilized just as a record to inspect an episode once it is known to have occurred. Trouble can happen if one administrator need to screen various Polaroid sees in the meantime, as the ideal fixation compass for an individual is about 25-30 minutes. Considering all these actualities, another era of observation frameworks with ongoing information preparing is required where the vast majority of the work burden would be carried out by workstation.

Thusly, a programmed observation framework is required for discovering and dissecting human conduct by which burglary could be controlled. Reconnaissance Polaroid's are a significantly more helpful device if rather than inactively recording footage they can discover occasions obliging consideration as they happen, and make a move (for instance caution a human manager) continuously. This is the objective of programmed visual observation: to acquire a portrayal of what is occurring in an observed zone, and afterward to make suitable move focused around feature footage.

IV. EXPECTED OUTCOMES

The fundamental effect of the paper is required to be on the mechanical level, with progressions in three headings:

a) Understanding of the client requirements for programmed location of strange conduct in swarms and new meanings of and routines for portraying such conduct.

b) Methods and calculations for strange conduct location focused around feature and acoustic sensors.
c) Real time streamlining for industrially accessible ease equipment, including an online exhibit of capacities at shopping center.
A robotized Polaroid reconnaissance framework outlined that distinguishes robbery in the shopping center utilizing human conduct investigation to discover the pernicious plan of persons and caution through Wi-Fi to human controller. Utilizing human practices examination, it lessens the dullness and making it workable for one administrator to exactly and mindfully watch vast amounts of screens. It Increases conceivable outcomes to quit stealing before real moves make place. Such reconnaissance framework is operational day and night and does not oblige "constant" perception by human work force.

V. LITERATURE REVIEW

There is a substantial amount of research on the video surveillance using human behavior analysis has been done both national level and globally, an extensive review of those researches has been consolidated in this section.
a) Implementation in current world
b) Patents for inventions in sensor camera using artificial intelligence
c) Technologies used to track people

A. *Implementations of Intelligent Video Surveillance throughout World*:

• [David G. Aviv] invented a surveillance system having at least one primary video camera for translating real images of a Zone into electronic video signals at first level of resolution; Which are indicative of individuals having a criminal intent; activating at least one secondary sensor and associated recording device being in response to determining that the individual has a predetermined level of criminal intent.

• Alexander Kolarow tested intelligence video surveillance at a local airport to find theft. In order to evaluate the saving of time provided by the system, they reenacted a theft scenario on an airfield: Person A removed a radio receiver from a small aircraft standing in a hangar (Fig. A) and put it into a briefcase. He left the hangar, met with person B and handed over the loot (Fig. B). Afterwards they split up and person Btried to leave the airfield with the radio receiver through the main entrance (Fig. C). The operator suspects person B of a theft and wants to reconstruct the course of actions, based only on the 40 minutes of video recordings, comprising almost30 persons.

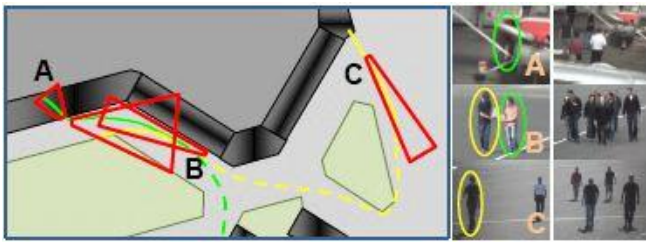

Fig 1The theft scenario in an airfield.

The path of personA is marked green, the path of person B is marked yellow (both walking from left to right) and the viewports of all four cameras are shown as red trapezoids. The key scenes are shown in three images: the removal of the radio receiver (A), the handover (B) and person B at the main entrance (C). The operator had to pick these scenes out of a lot of video footage with several other people walking around

• [Paulidis, I] has designed co-operative camera network which is an indoor application surveillance system that consists of a network of nodes. Each node is composed of a PTZ camera connected to a PC and a central console to be used by the human operator. The system reports the presence of a visually tagged individual inside the building by assuming that human traffic is sparse (an assumption that becomes less valid as crowd levels increase). Its purpose is to monitor potential shoplifters in department stores.
• [JogileKuklyte] in his paper propose a general purpose framework for detection of unusual events. A trolley being dragged outside the window when the area in the shop was unnoticed. It was detected only by the sensor cameras and alerted the human controller
• [Stauffer and Grimson] proposed detection of unusual activities like thieving unattended objects in shopping complex by statistically learning the common patterns of individuals' activities over time.
• [Ricquebourg and Bouthemy] proposed tracking people who may be potential thieves by exploiting a new technique called spatiotemporal slices and to identify abnormal activities in lesser time.
• [Tao Xiang] was proposed novel framework is developed for automatic behavior profiling and online anomaly sampling/detection without any manual labeling of the training data set. With that, the persons who came to mall with malicious intention can be stopped by automatic behavior prediction
• [Hadi Aliakbarpour1et al] express the idea to use such a sensor network in order to detect the normality or abnormality of the scenes in terms of whether a robbery is happening or not in ATM. In the context of the ATM scenario, they defined the robbery state as when the robber waits in ATM's area, approaches a person who is taking money from the machine, steals the money and then rapidly escapes.

• [Panagiota] implemented an idea where the videos with normal behaviors illustrate a person entering the room, buying a ticket, browsing and looking around for several minutes and exiting the room using a preset path. The abnormal behaviors consist of running, abrupt motion or unexpected trajectory. This was accurately detected by the system

• [Panagiota Antonakaki a, Dimitrios Kosmopoulos] have simulated a protected exposition room, where only one visitor is allowed and he or she has to follow a certain path for entering and exiting. An artificial barrier inserted in the scene does not allow entering the experiment area from a certain side and there also exists an "emergency exit". When someone visits areas which are not allowed, they consider having a case of abnormal activity.

• The Knight system is one in a number of other surveillance-related projects. Recently, they augmented Knight to help the Orlando police department with automated surveillance and installed it at four locations in the downtown Orlando area.

• ADABTS Automatic Detection of Abnormal Behavior and Threats in crowded Spaces ADABTS aims to facilitate the protection of EU citizens, property and infrastructure against threats of terrorism, crime and riots by the automatic detection of abnormal human behavior.

B. *Patents for inventions in sensor camera using artificial intelligence:*

• US. Pat. No. 4,737,847 issued to Araki et al. discloses an improved abnormality surveillance system Wherein motion sensors are positioned Within a protected area to first determine the presence of an object of interest, such as an intruder. In the system disclosed by US. Pat. No. 4,737,847, Zones having prescribed "Warning levels" are defined Within the protected area. Depending on which of these Zones an object or person is detected in, moves to, and the length of time the detected object or person remains in a particular Zone determines Whether the object or person entering the Zone should be considered an abnormal event or a threat

C. *Technologies used in tracking people*:

• In [Rehg et al.], a smart kiosk is proposed that can detect and track moving people in front of a kiosk by using face detection, color, and stereo.

• [Stauffer and Grimson] used an adaptive multimodal background subtraction method for object detection that can deal with slow changes in illumination, repeated motion from background clutter, and long-term scene changes. They also proposed detection of unusual activities by statistically learning the common patterns of activities over time. They tracked detected objects using a multiple hypothesis tracker.

• [Ricquebourg and Bouthemy] proposed tracking people by exploiting spatiotemporal slices. Their detection scheme involves the combined use of intensity, temporal differences between three successive images, and comparing the current image to a background reference image, which is reconstructed and updated online.

• [Chun-hao Wang] presents an approach for object detection and action recognition in video surveillance scenarios. This system utilizes a Histogram of Oriented Gradients (HOG) method for object detection, and a Hidden Markov Model (HMM) for capturing the temporal structure of the features. Decision making is based on the understanding of objects motion trajectory and the relationships between objects' movement and events.

• [David Nicholas Olivieri proposed] such software based upon a spatio-temporal motion representation, called Motion Vector Flow Instance (MVFI) templates that capture relevant velocity information by extracting the dense optical flow from video sequences of human actions.

• [Tao Xiang] was proposed novel framework is developed for automatic behaviour profiling and online anomaly sampling/detection without any manual labelling of the training data set. The framework consist various key components: A compact and effective behaviour representation method is developed based on discrete-scene event detection. The similarity between behaviour patterns are measured based on modelling each pattern using a Dynamic Bayesian Network (DBN). The natural grouping of behaviour patterns is discovered through a novel spectral clustering algorithm with unsupervised model selection and feature selection on the eigenvectors of a normalized affinity matrix.

• [Ali S.F] has given a complete framework and approach for making the system of Automatic Target Recognition System we suggest the name of IVATRs (Intelligent Video Automatic Target Recognition System). This framework will be helpful for making a bridge between the theoretical models of AI techniques and their implementations with hardware.

• [Mann et al.] analyze video content by physically modeling the interaction of objects in video. However this requires the complete specification of the geometry of each object in the video, and is limited to very simple interactions such as picking up a can of soft drink or tipping one box against another.

VI. METHODOLOGIES

There are several approaches for recognizing and understanding activities and behaviors of the individuals in place.

- A surveillance system having at least one primary video camera for translating real images of a Zone into electronic video signals at a first level
- It is beneficial for the input camera to view the area under surveillance from a point located directly above, e.g., With the input camera mounted high on a Wall, a utility tower, or a traffic light support tower.
- It will gather experts in human factors, signal processing, computer vision, and surveillance technology. In a first stage, focus will be on human factors in order to define and model behaviors. Then, the focus will be shifted towards automatic analysis of surveillance data (video and audio).
- It will create models of behavior that can be used to describe behaviors to be detected and how they can be observed. Such models will enable the prediction of the evolution of behavior; so that potentially threatening behavior can be detected as it unfolds, thus enabling pro-active surveillance. In order to detect behavior defined by these models, advanced methods for sensor data analysis are needed. These methods should extract sensor data features that can be coupled to the defined behavior primitives, and thus detect the presence of the (potentially) threatening behavior and to detect behavior that is not considered normal.
- Once the objects within each sampled video frame are segmented (i.e., detected and isolated), an analysis is made of their relative movements with respect to the other objects.
- For example, subsequent differencing signals may reveal that an individual's arm is moving to a high position, such as the upper limit of that arm's motion, i.e., above his head) at a fast speed. This particular movement could be perceived, as described below, as a hostile movement with a possible criminal intent requiring the expert analysis of security personnel.

Sample behaviors are given here

a. Trouble happens when groups of lads stop
b. A pattern of approach, retreat, strike—for example, with theft, the perpetrator will often go up and circle the object, then retreat before making a move.
c. Loitering in certain areas is seen as worthy of surveillance.
d. Waiting on a place whilst several customers and people pass through without buying any object.

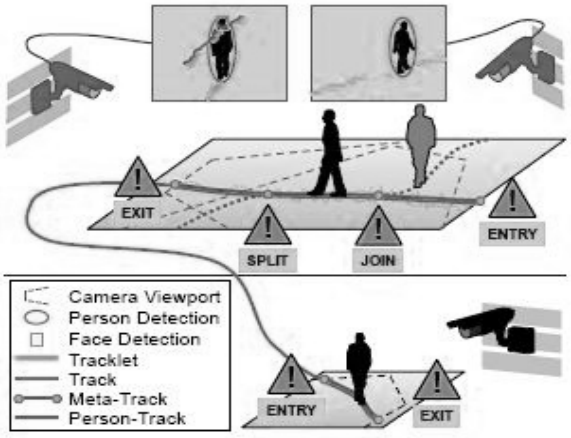

Fig 2.Steps in detecting persons

- The generation of an alarm, light and sound devices located, for example, on a monitor will turn a guard's attention only to that monitor, hence the labor savings.
- If a comparison is made positive with one or more of the signature video signals, an output "alert" signal is sent through Wi-Fi from the comparison to a human
- Summon a supervisor to immediately view the pertinent video images showing the apparent crime in progress and access its accuracy.
- Retinal scanners and face detection play a vital role in identifying potential suspects and improving the analysis in theft detection.

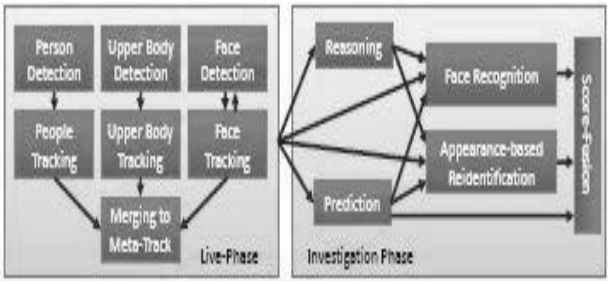

Fig.3. Techniques used cumulatively in behavior detection

VII. FINDINGS

The recent interest in surveillance in public, military and commercial scenarios is increasing the need to create and deploy intelligent or automated visual surveillance systems. The increasing demand for security by society leads to a growing need for surveillance activities in many environments. Lately, the demand for remote monitoring for safety and security purposes has received particular attention, especially in the following areas. Transport applications such as airports, maritime environments, railways, underground and motorways to survey traffic. Public places such as banks, supermarkets, homes, department stores and parking lots.

Surveillance systems created for commercial purposes differ from surveillance systems created in the academic world. Research in academia tends to improve image processing tasks by generating more accurate and robust algorithms in object detection and recognition, tracking, human activity recognition, database and tracking performance evaluation tools. Existing behavior analysis systems focus on the predefined behaviors. Advanced behavior analysis systems have begun to exploit the capability to automatically capture and learn new behaviors by pattern matching, and further present the behavior to the specialists for confirmation.

VIII. SUGGESTIONS

- Techniques are required to deliver affectability to poor determination, casing rate, intense enlightenment changes, among other basic issues predominant in observation frameworks.
- Consequently, enhanced center innovation calculations are required to expand the dependability of human conduct distinguishment.
- Sensors, for example, sound, movement, multi ghastly (warm and infrared) Polaroid's could build trust in the results and include an alternate point of view the occasions happening in the scene.
- Creating standard assessment apparatuses incorporates characterizing a typical set of wording and producing operationally comparable information sets. Case in point, a transport and a metro can both be "packed." However, operationally, the "swarms" in both circumstances are altogether different. Hence, without a standard exact meaning of "swarm," formal examinations turn into an exceptionally troublesome undertaking.
- The ID of gathering practices, in light of consolidations of practices from one or more sensors in a nature.
- Improving face following by utilizing retinal scanners and utilizing their complex indicators to sense danger. Individuals sensed as potential risk may be put away in database and might be recognized next time with retinal examining and f

IX. FURTHER RESEARCH

This level of interpretation was the goal of our research effort that can deal with the theft detection in shopping malls using human behavior analysis. Current system limitations include the inability to detect camouflaged objects, handling large crowds. Our plan is to test the system with a wide variety of users, test the system using a large number of behaviors in our lexicon. In conjunction with other gesture projects, using data from video surveillance cameras.

X. CONCLUSION

The developing interest for wellbeing and security has prompted more research in building more productive and shrewd mechanized reconnaissance frameworks. Subsequently, future difficulties to create a wide-region appropriated multi-sensor reconnaissance framework which has hearty, continuous machine calculations equipped to perform with negligible manual reconfiguration on variable applications. The profits of taking preventive measures against retail burglary need to be stressed by introducing mechanized visual observation frameworks which utilizes human conduct dissection.

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