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IMPROVING SURVEILLANCE EFFICIENCY WITH MACHINE LEARNING FOR SUSPICIOUS BEHAVIOR IDENTIFICATION

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ABSTRACT

The enhancement in the quality of cameras and the development in the computer vision have magnified surveillance camera by applying machine learning algorithms to monitor and analyze actions on the run. This innovative system recognizes different kinds of abnormal activities: Unlawful parking, abandoning items, beating, and punching crimes have been done away with through Kaggle and UCF101 datasets. An invention intended for sending alerts to the security guards, it could prevent crime incidences and enhance response time in places such as railway stations, airports and shopping malls among others. An overview of these systems' approach, issues, and potential is provided in this paper

Keywords: Suspicious Detection; Abandoned Object, Accidents, Violence.

I. INTRODUCTION

Cameras in today's world are widely selected to solve various issues related to security in commercial and non-commercial buildings. In these places, occurrence of activities can be monitored by having surveillance cameras to avoid the vice. Abnormal activities are such as hitting, fighting, snatching, punching, fire, attacks etc, while normal activities are such as jogging, running, walking, handshaking that can be made by human beings in places such as public places. Compared with automatic surveillance systems, there is always a need for a human being to intervene and control the video on going continually in the semi automatic surveillance systems. As for a guard, waiting is not possible, and therefore, it's very complex to stand and watch videos when waiting. Therefore, the user himself must have a smart and intelligent system that can investigate the matter and take note on it and most importantly should possess the capacity to differentiate between normal and suspicious activities. Such smart systems or fully automatic systems can also alert the security agencies in case one or some of these activities falls under the abnormal activities. Regarding risks such as bombs in densely populated areas or leaving trolleys behind, rational systems can enhance safety requirements in large areas such as terminals. Hence, it becomes imperative to move from semi-automated systems to fully automated systems so as to maintain high level of security and to guarantee that every possibly hazardous objects and activities are detected and identified without needed to be spotted by a human eye.

II. LITERATURE REVIEW

"Fire detection inthe buildings using image processing", [1] Seebamrungsat et al. (2014) specifically focused on processing images methodology, with the objective of recognize fire in buildings. This includes the identification of features such as color, shape, and motion in frames of the video that bear relations to fire. that deals with enhancing construction safety and security measure in identifying fires, efficiently and effectively.

"Real-time abandoned and stolen object detection based on spatio-temporal features in crowded scenes", [2] Nam (2016) also presented an effective strategy for instantaneous using foreground segmentation and background subtraction for purposes of security and giving a timely alert. It utilizes characteristics of space and time in the finding of lost and stolen items in areas that are densely populated.

"Motion influence map forsunusual human activity detection and localization in crowded scenes", [3] D. G. Lee et al. (2015) developed a concept called Motion Influence Map that allowed for the identificationn of the potential of a pedestrian engaged in the area's crowd. This technology constructs Anomaly maps upon further processing of motion data from the videos and defining an event such as fight or abrupt movement. One of such techniques is useful in The recognition of dubious patterns that are beneficial in increasing the surveillance effectiveness and enabling remedial action to be taken when necessary.

"Crime Scene Prediction by Detecting Threatening Objects Using convolutional neural Network", [4] Mohammad Nakib at al. (2018) apply a technique of Convolutional neural Networks (CNN) for analyzing crime scenes for possible dangerous items and predicting it. in the same note, their method categorizes and

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recognizes objects or people and objects of disparate nature and use—weapons or items that could potentially pose a danger to the general public or warrant closer preventive monitoring, for instance—to aid safety.

"Unsupervised Universal Attribute Modeling for Action Recognition", [5] Debaditya Roy et al. (2018) have created an unsupervised approach for universal attribute modelling in action identification, which aimed to identify and extract the common resemblances among several activity types without the use of labelled data. It enhances the action recognition models independently of the dataset and scenarios and enables the transfer of knowledge from one model to another.

III. METHODOLOGY

1. Data Collection

One of the steps in acquiring information in the intelligent surveillance system is to gather various datasets relevant to some specific doubtful actions. A number of battle scenes are presented through the films within the collection to demonstrate how sometimes, people run, fall, or chase each other to express aggression. The real-world action sequences are provided by well-known datasets such as UCF101 and Kaggle, which obtains its content from sites such as YouTube. The input data concerning traffic monitoring derives from the MIT traffic dataset, which contains sequences of the movements and flow of vehicles. Inventory of the offense involves the use of I-LIDS parking dataset which comprises videos of prohibited parking. Theft detection rely on the Bank Dataset, which provide history of robberies and suspicious activity in banking environments. This data in regard to fire detection has been provided from FireSense dataset which is contains movies of fires. The final CAVIAR video is Fall detection which uses a database of many instances where individuals become off balance and fall. This ambit of data gathering encompasses a broad spectrum of behaviors and can help the intelligent surveillance system identify transgressions concerning the subject's conduct.

2. Data Pre-processing

The significance of data preparation in augmenting the effectiveness of intelligent surveillance systems has been emphasized by several studies. Starting with background subtraction, moving objects (foreground) are distinguished from static objects (background) by employing single Gaussian, Gaussian mixtures, and frame differencing algorithms. Next, utilizing techniques like color normalization, Phong Shading, Radial Reach Filter, Gaussian smoothing, and fuzzy histogram color, one must control light and noise to avoid classification mistakes. The next step is object recognition, which makes use of change detection and backdrop modeling to recognize and examine actions such as fights, falls, and robbery. After that, dual background modeling is used to find stationary things in the foreground, such misplaced objects. Together, these preprocessing procedures enhance the system's capacity to identify and report questionable activity.

3. Model Training and Tuning

Looking at the method of constructing the predictive models using a training dataset, model training entails choosing the best algorithm, which could be SVM, k-NN or NN type and among others. Data pre-processing is the initial process that needs to be performed and feature extraction that entails identifying features from the collected data is one of them. Following feature extraction, the training process entails the use of training data where the goal here is to reduce error and increase the model's accuracy formed by manipulating the parameters that define the model. Several approaches are used in benchmarking the model including the cross validation technique to ascertain the efficiency of the model in management of new knowledge. Gaussian Mixture Models (GMM) will be of help especially in the probability estimation of density function. The supports of these functions enables the creation of action recognition models as the Universal Attributes Model (UAM).

3.1 Gaussian mixture model

All the neighborhood points are simultaneously estimated with none of them assigned to the given particular Gaussian with specified specification much the same as with the (GMM) technique. In regard to the model was developed for the purpose of the study, There is a weight put on each Gaussian in order to represent sigularity that the tested data1 98 point belongs to the specific component of not. Each of the different Gaussian components of the model has a different covariance matrix and vector of means. The parameters of the GMM are normally estimated using the Expectation-Maximization (EM) approach, where parameter estimates are iterated with the view of raising proximal probabilities of the observable data. Because of this feature, GMMs

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may be used in many learning tasks, such as clustering, anomaly detection, and density estimation if the data set analyzed contains multiple hidden processes. because of how NMIMs correspond to situations in which the data for modeling entails substantial base rate processes inherently. Sub pop is highly useful when the data especially targets those sub-populations because the data targets those sub-populations.

3.2 Support vector machine

Among all the algorithms in supervised learning for regression and classification, Support vector machines (SVM) is considerably valuable in high dimensional space. The best or most favorable hyperplane in SVM works in a way that it try to separate the given data in the best way possible. Here, The distance from the dividing hyperplane to the closest points—known as the support vectors—belonging to both classes forms the distance between the two classes with the largest margins. SVM possesses the capacity to do non-linear classification using techniques that include the kernel tricks for instance the Radial basis function (RBF), it transforms characteristics of input into higher dimensions to achieve linear discernment. SVM in surveillance systems classify the different activities, which are frequently legitimate or suspicious, by training on a labeled database and then enables one to look at the extraction of feature vectors from video clips and distinguish small differences in those vectors.

4. Model Evaluation and Comparison

That is why it is necessary to evaluate the intelligent video monitoring systems for various uses: theft, violent actions, parking violations, accidents, falls, and fires. The following quantitative measurements of accuracy that is often used includes recall, precision, and recognition accuracy. Recognition accuracy is the extent to which activities are identified. It is calculated as the overall quantity of instances made half by the sum of the true positive cases, that is where the program suspected correctly and the true negative, where the program did not suspect correctly. Recall measures the ability of the model to detect the actual number of events by judging the proportion of total events that the model identified as valuable and Precision evaluates the ratio of actual alerts from the total alarms showing relevance. In these systems, GMM, that is the Gaussian Mixture Model and SVM, which is the Support Vector Machine is employed in the classification process. The probability distribution of F_i is catered for by GMMs. While, the correct accuracy of SVMs is disordered due to their strong decision boundaries especially in high-dimensional spaces, the probabilistic model of GMMs control the probability distribution of parameters in movies while keeping into consideration, intra-action variations.

IV. SYSTEM DESIGN

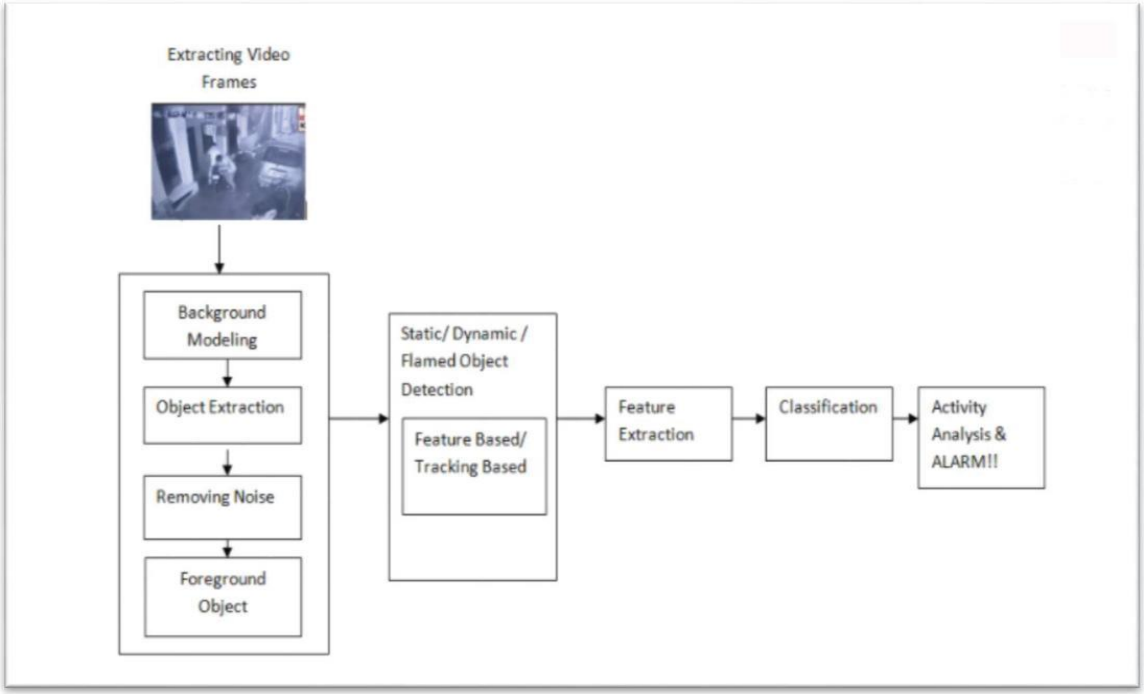

Figure 1: System Architecture

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The above-diagram explains working of Intelligent camera system which is particularly designed for the identification of 'SUSPICIOUS ACTION Only'. Starting with the Extraction of footage Frames from the security cameras for recording the environment in the real-time. The obtained After then, video frames are exposed to Background Modeling that separates the constantly changing background from the moving items. Next, the Object Extraction phase distinguishes between probable objects of interest and background After attaining Foreground Objects, under observation the filtering is used to make the effectiveness of the retrieved objects stronger.

Next, Foreground objects are decided and then, depend on the nature of such objects, Static/Dynamic/Flamed Object Detection is carried out for deciding the types of these objects. Then comes Feature Extraction, in which the features or attributes of the recognized objects that used in classifications are ascertained. The Classification step can then uses these features to label the detected actions or objects as defined classes, normal, or suspicious for instance. The Lastly, but not least of them is Activity Analysis carried out by the system and if the system finds out that any of the activity is ill and questionable then an Alarm is generated to the Higher Officials.

V. RESULTS AND DISCUSSION

It was revealed for instance, that there shifts in the performances of different classifiers in the violent category in the evaluation. SVM offered a superior performance When it comes to higher accuracy rates with various levels of the Universal Attribute Model (UAM) by applying features such as Histograms of OF (HOF) & MBH. As much as the accuracy rates were noted to have improved; they were up to 99 percent. 8% for specific setups. However, before this, when they attempted to enhance the performance even further, it was found that original K-Nearest Neighbors (KNN) was somewhat greater than that of SVM. Thus, from the results one can identify how effectively SVM can involve action acknowledgment in the surveillance videos and how it can assure detection of the necessary actions. Because of these all, It is advised that The real-time surveillance system apply the SVM because of the fact that the performance and the robustness of the SVM is significantly superior Artificial neural network.

Figure 2: Violence Detection.

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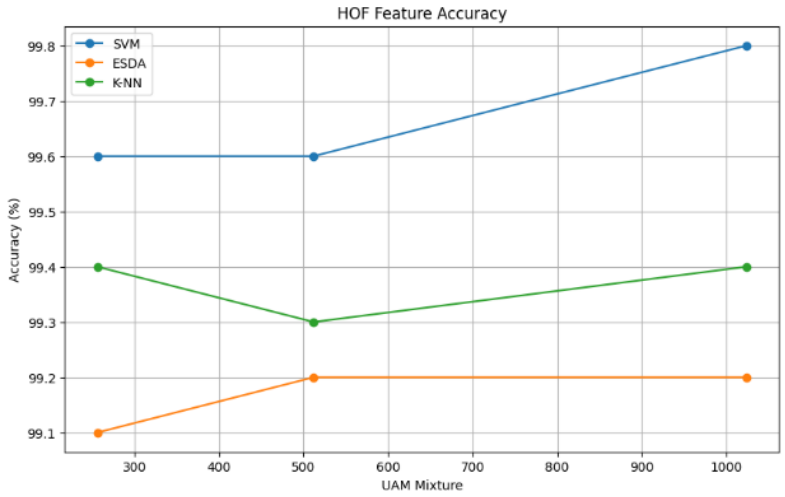

Figure 3: Mean Absolute Percent Error

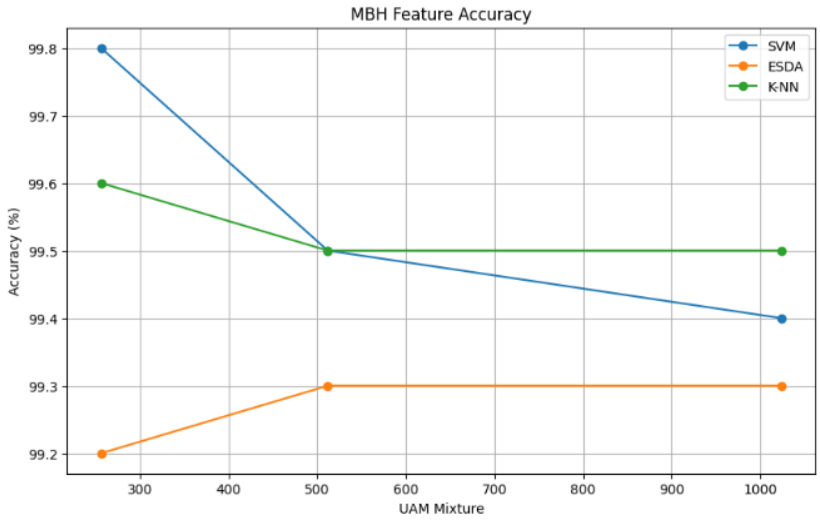

Figure 4: Final Energy Forecasting

VI. CONCLUSION

The investigation showed that different violence detection classifiers performed differently, with Decision Bound SVM employing HOF and MBH features obtaining the highest accuracy of 99.8% in specific UAM setups. Because SVM can recognize actions in surveillance footage better than K-Nearest Neighbors (KNN), It was capable of recognizing suspicious behaviors more accurately. For real-time surveillance systems, SVM comes highly recommended because to its stability and dependability. In conclusion, The efficiency of surveillance systems in identifying suspicious activity is greatly increased by the use of ML techniques, especially SVM. When employing characteristics such as HOF and MBH, Compared to other classifiers, SVM performs better, improving security, reaction times, and optimizing surveillance protocols to guarantee optimal safety in regions under observation. This method helps with proactive threat management in addition to increasing The accurate clarity of monitoring.

VII. REFERENCE

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