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Crime Activity Detection Using Machine Learning

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***Abstract:** This study focuses mostly on criminal activity identification. To solve this issue, we employ the machine learning methodology. A criminal offense is characterized as an act or omission that violates the law and is penalized. Crimes seldom involve a particular place because they can occur anywhere, from small towns to major cities. Using an automated video surveillance system rather than human operators is one strategy to combat this issue. A system like this allows for simultaneous monitoring of numerous screens without sacrificing focus. Intelligent video surveillance is only one of the many fields where understanding human behavior in the actual world has applications.*

I. INTRODUCTION

Crime poses a serious threat to humanity. An action or omission that constitutes an infraction and is sanctioned by the law is referred to as a crime. While some crimes cause the least damage, some might result in a fatality.

Crimes don't have a particular place of concern because they can occur anywhere, from small towns to major metropolia. It is crucial to find a speedier solution to this issue in order to protect our society from all threats. To identify suspicious conduct and safeguard the defenseless, the police force must constantly observe people's actions and behavior.

Government and numerous private sectors employ surveillance for crime prevention, protection of a process, person, or group, as well as for crime investigation. There are many surveillance techniques, including the use of CCTV cameras or the interception of electronically transmitted data.

CCTV cameras are the method that is most frequently employed. CCTV cameras can be used in a variety of ways, including recording solely, recording with sound effects, and hiding the cameras. Many businesses and individuals utilize closed-circuit television (CCTV) cameras as part of their video surveillance systems at their locations for increased security.

Using automated video surveillance systems instead of human operators is one way to solve this issue. With such a technology, numerous screens can be watched concurrently without sacrificing focus. A notification is made to the relevant department as soon as the crime is discovered.

II. LITERATURE REVIEW

Proposed a method to deal with the issue of recognising anomalous occurrences in video surveillance in their research paper. A photo descriptor and an internet nonlinear classification approach make up the algorithm. As a descriptor encoding movement information, we offer the covariance matrix of the optical flow and picture intensity. To create a basic reference model, the nonlinear online support vector machine (SVM) initially learns a small number of training frames. It then updates the reference model and looks for anomalous occurrences in the current frame. Lastly, they use the strategy to find anomalous occurrences on a benchmark video surveillance dataset to show the usefulness of the suggested technique.[1]

In a research paper, an algorithm was proposed that would be ready to notify the human operator in the event of the following: the presence of a dangerous act; the establishment of zones of interest and danger zones within those zones of interest; and the detection of danger when an object trespasses the zone. This algorithm may help to lower the number of accidents in factories and suicides in particular locations. Someone's unusual activity, such as holding weapons or engaging in abuse or molestation, gets noticed and may pose a threat. The initial step is to capture the videos. Video is only captured when it is necessary, that is, when the individual is not alone and when there are abrupt movements or actions, in order to increase efficiency.[2]

In their study report, they suggested a successful method for identifying irregularities in videos. In order to do so, a one-class SVM classification algorithm is employed in conjunction with log-Euclidean covariance matrices. Using clues from appearance and motion, covariance matrices are constructed. Gradient-based characteristics are chosen for visual cues. Optical flow-based characteristics are employed for motion cues. Using data gleaned from regular occurrences and one-class SVM, the model-building process—which is the first step in the detection of abnormal situations—is carried out. Dissimilar events, or those that don't match the model, are flagged as abnormal during the detection process. They provide details on the aberrant crowd behaviour dataset from UMN as well as evaluation measures in this section. Results are then presented, both qualitative and quantitative.[3]

Proposed the main goal of automatic facial recognition is to take those important elements from an image, represent them in a

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useful way, and classify them. The most instinctive method for human face identification relies on the geometric aspects of a face. identification. There are three main steps that make up the entire procedure.

1) Finding a good database of faces with several photos for each person is the first stage.
2) The following stage is to find faces in the database images so that you can train the face recognizer with them.
3) Testing the face recognizer's ability to identify the faces it was trained to recognise. [4]

A limitless data and ML technique for behaviour analysis and criminal prediction is described in references. This study examines the tracking of knowledge using big data, alternative data collection ways, and also the last phase of crime prediction utilising ML techniques backed data collection and analysis. Processing past crime patterns enabled ML utilising RapidMiner to perform a prediction study. Data gathering, data analysis, and data visualisation made up the major four parts of the research. Big data was proven to be a viable framework for analysing crime data due to its ability to analyse extremely large datasets, provide throughput and fault tolerance, and produce reliable results, as opposed to the ML-based naive Bayes algorithm, which is prepared to make better predictions using available datasets.[5]

Proposed that the rate is significantly rising day by day. Since crime is neither systematic nor random, it cannot be predicted. Additionally, modern technologies and high-tech procedures aid criminals in committing their crimes. Crimes like burglary and arson are declining, according to the Crime Records Bureau, while crimes like murder, sex abuse, gang rap, and other serious offences are rising. Although we are unable to foresee who might also become the victims of crime, we can forecast the location where it is most likely to happen. The results demonstrate that our programme helps in reducing the rate to a certain level by offering security crimesensitive timings, albeit the results cannot be guaranteed to be 100% accurate.[6]

III. METHODOLOGY

Machine Learning is an ongoing trend in information technology. It's a practical application of artificial intelligence (AI) that gives systems the adaptability to autonomously learn from experience and get better without explicit programming. A Neural Network which can be a component of Machine Learning is employed for various security reasons like face recognition, object detection, activity recognition, etc.

The approach for classification of videos into crime or safe is as follows:

1) Extracting 15 frames from the input video.
2) Resizing the frames to size 200X200.
3) Eliminating the Background of frames and converting to grayscale.
4) Obtaining transfer value from each frame employing a pre-defines model named Inception v3.
5) Feeding the transfer values as input to the LSTM model for the aim of prediction.
6) LSTM is used in applications like predicting the subsequent word out of the given sequence.
7) The feature LSTM is an improved solution in classifying videos as we'll work on a sequence of actions

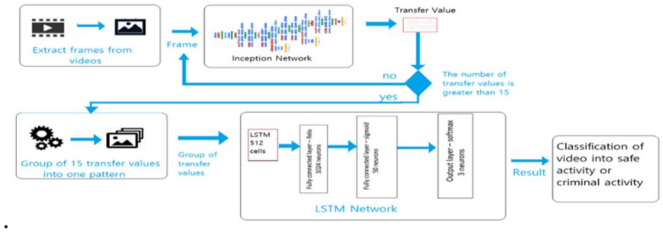
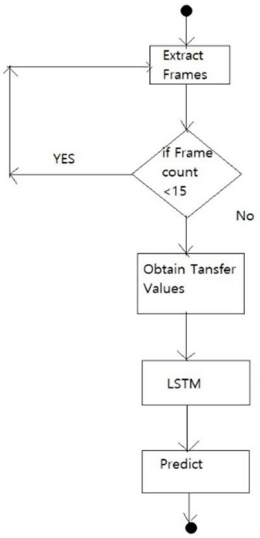


Figure: System Architecture

represents the high-level architecture of the project. Extraction of the video's frames is the initial stage. Every five seconds, a frame is extracted and used. Utilizing the inception model, we generate a forecast. We won't extract the final classification of the last pooling layer, which is a vector of 2048 values, because we are utilising the transfer learning technique. We formerly had a single frame feature map, however, we do not use single frames to determine our final prediction. In order to categorise a section of the movie rather than a single frame, we take a group of frames. Making an accurate prediction of the activity that is occurring right now just requires the analysis of three seconds of footage at a time.

Activity Diagram: In a manner similar to a flowchart or a data flow diagram, it graphically displays a sequence of events or the flow of control within a system. A common tool in business process modelling is the activity diagram. Additionally, they can outline

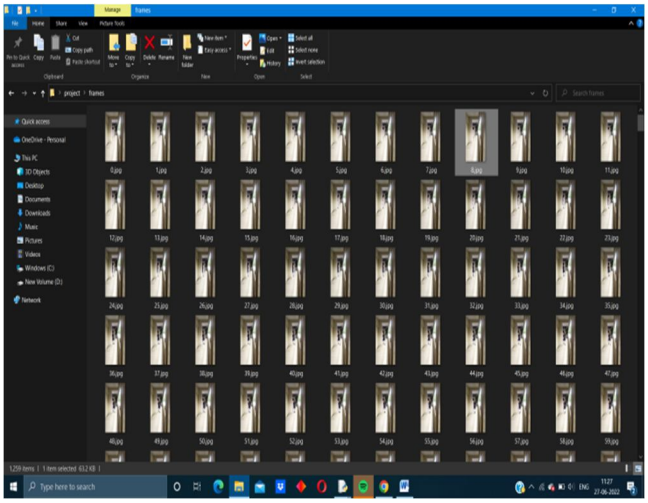
the procedures in a use case diagram. Activities can be sequential or concurrent when being modelled. An activity diagram will always have a start (also known as an initial state) and an end (a final state).



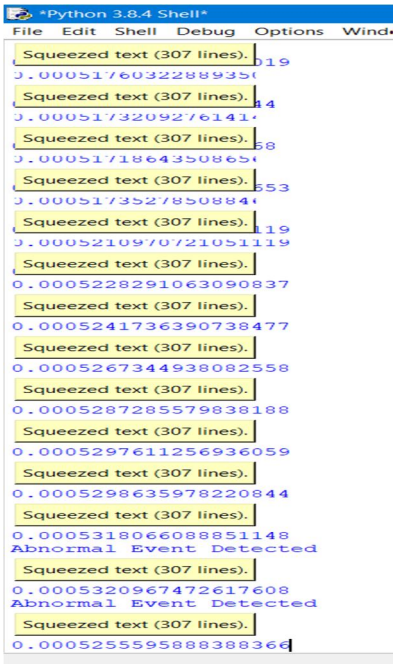
IV. EXPERIMENT AND RESULTS

The proposed system makes use of the concept of Transfer learning and LSTM(long short-term memory).VG background elimination is done on each extracted frame.

The frames are fed into the Inception v3 model in order to obtain the transfer values. The LSTM model is then fed these transfer values as input, and a classification is done..The system is trained with an dataset of 16 videos and the frames are obtained.The accuracy of the training is around 0.7.



Epoch	Accuracy rate
Value=5	0.55090
Value=10	0.60690
Value=20	0.78909
Value=25	0.83454
Value=30	0.85989



A. *Module 1*

Transfer learning is a machine learning method where a model developed for a task is reused because the start line for a model on a second task. it's a well-liked approach in deep learning where pre-trained models are used because the place to begin on computer vision and linguistic communication processing tasks given the vast compute and time resources required to develop neural network models on these problems and from huge jumps in the skill that they supply on related problems.

Transfer learning is an optimization that enables rapid progress or improved performance when modeling the second task. it's common to perform transfer learning with predictive modeling problems that use image data as input. For these varieties of problems, it's common to use a deep learning model pre-trained for an oversized and challenging image classification task like the ImageNet 1000-class photograph classification competition. The research organizations that develop models for this competition and act often release their final model under a permissive license for reuse.

These models can take days or weeks to coach on modern hardware. These models are downloaded and incorporated directly into new models that expect image data as input.

Examples of such models are the :

1) Oxford VGG Model and the Google Inception Model.

2) Model for Microsoft ResNet.

Our model assumes pre-trained model is the Inception v3 model.

We trained using data from our own dataset.

B. *Module 2*

where the user doesn't have to worry about the bill going over the user's budget as they can view the bill at any time and decide what to purchase as well as An artificial recurrent neural network (RNN) architecture called long short-term memory (LSTM) is used in the deep learning field. unlike conventional feed-forward neural networks. Because of its feedback links, LSTM is a "general-purpose computer" (that is, it can compute anything that an information processing system can). It can handle complete knowledge sequences in addition to just single data points (like photos) (such as speech or video). For example, LSTM can be used for applications like speech recognition or connected unsegmented handwriting recognition. A cell, an input gate, an output gate, and a forget gate make up an ordinary LSTM unit. It makes intuitive sense that the cell is responsible for tracking the dependencies between the weather within the input sequence. The input gate regulates how much new value enters the cell, and the forget gate regulates how much of the data in the cell is used to calculate the output activation of the LSTM unit. The logistic function is frequently the activation function of the LSTM gates.

The three gates control the flow of data into and out of the cell since the cell remembers values across arbitrary time intervals. Given

that there would be lags between significant occurrences in an extremely statistic, it is well suited to categorising, processing, and generating predictions backed statistic data. In order to address the exploding and vanishing gradient issues that may arise during the training of conventional RNNs, LSTMs were created.the time taken to stand in a line for billing as well as helps the user see the details of each scanned item. It evenlets the user have a shopping experience what they do not need and can delete unwanted items from the list saving them time. The existing smart shopping systems are expensive to implement andcostly to maintain. Using this system will drastically reduce the implementation as well as maintenance cost.

V. FUTURE WORK

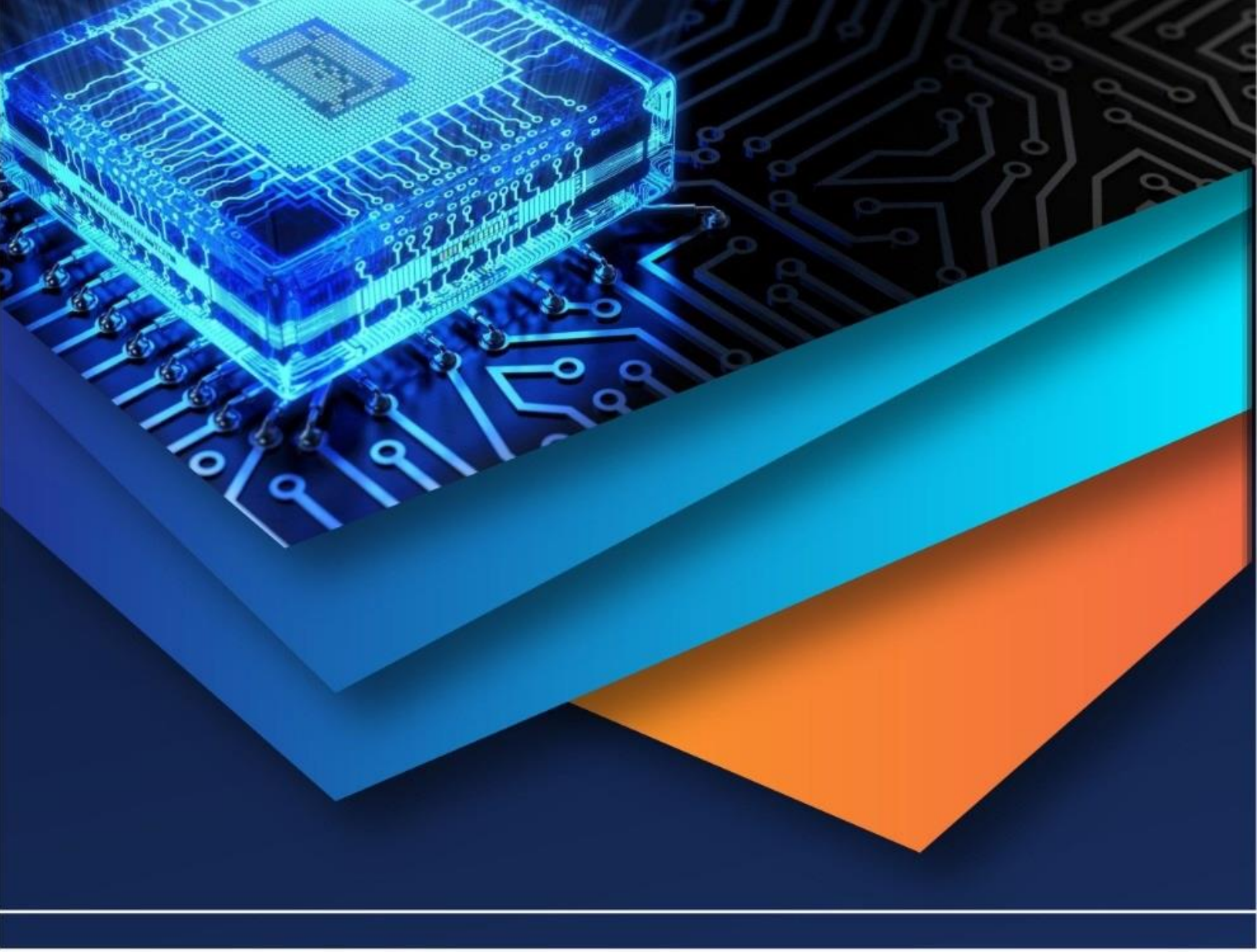
The future scope of this study can be done by connecting various automated CCTV cameras so that the path of the criminal can be easily traced, making it very efficient to catch the thief. Face recognition can also be implemented. When a criminal is found in the video, his face can be compared with the old criminal records. If match is found, arresting him becomes an easier task.

VI. CONCLUSION

This study is of great practical importance in the modern world where crime rates are increased, and the pressure on the concerned department has also increased. In such cases, this study stands out to be of major help to the since it automatically detects crimes. The crime rate can be decreased to some extent with the help of this.Initially, detection was done using a single image as input,But the output obtained was not satisfactory because of some test cases. This led to in considering the sequence of image to video dataset and since LSTM works best with sequences, use of LSTM was done. This study faces predicting the action in the previous set of frames.

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