IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 9, May 2023

Crime Prediction using Machine Learning

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Abstract: *Use of robots has become exceptionally famous yet its fullest potential must be acknowledged when teamed up with other modified sensors, subsystem carrying out functionalities like picture handling, route control, automated activation. Nowadays crime security is one of the major concerns to be tended in our country. At the point when a lady needs critical assistance at the hour of provocation or attack, legitimate reachability is absent for them. It is a system which will take input pictures and it will foresee the potential outcomes of crime unsafety and its stages utilizing profound learning. This venture assists in using rambling innovation as a viable method for tackling various issues of society by proposing a CNN based picture handling model. The paper talks about the prerequisite for utilizing such quicker, less complex, and powerful working techniques in protection of peoples by smoothing out and improving their activities by conquering the different difficulties of preparing to arrange and recognize weapons and shoot mishaps. In this paper we are going to discuss deep learning architecture such as Convolutional neural network for detection and classification of objects, K-Nearest Neighbor for generating alert and sending location to the nearby emergency units.*

Keywords: Convolutional Neural Network, K- Nearest Neighbors, Deep Learning, Image Processing, Object Classification, Crime Safety Prediction

I. INTRODUCTION

Machine Learning is method of understanding and building models that learn. A subfield of artificial intelligence (AI) and computer science called machine learning focuses on using data and algorithms to simulate how people learn, progressively increasing the accuracy of the system. By utilizing the web, each machine can be constrained by anybody with the right access anyplace from the world. ML is used in wide variety of applications and constantly advancing to be adaptable to work with it. It can likewise be utilized in any significant circumstance gave that there exists a solid web association. Considering that, this papercenters around giving security to individuals confronting actual behavior. In many creating nations, the security of its peoples has forever been a question mark in India. We see that nowadays the number of working peoples has been rapidly increasing and their security has been major concern to us. Few crime work in night shift and they travel alone during those times, few travels through cabs or their own personal transport, we get to see from past few experiences that how peoples are been harassed, molested and killed for various reasons. Peoples panic when an assailant is trying to harm them and they are unable to call for help at that moment. With this in mind, we are developing a system that will use phases of deep learning to ensure the protection and security of peoples while also offering rapid assistance. Lack of knowledge, indignation, perversion, power, predominance, and other factors are major justifications for sexual cruelty. There is obviously a need for a system that can save the victim immediately during the time of ferocity in order to protect people from this. Sadly, most of the approaches which have been offered to solve this issue rely on human intervention to get started. A framework totally depending on the mediation of any sort from the casualty isn't proficient in light of the fact that few out of every odd time the casualty cannot connect with the trigger and as a matter of fact, generally speaking, the casualties are deadened. A few frameworks exist which are not totally reliant on an activity to set off it, however the exactness of those frameworks is extremely low. With low exactness, those frameworks can never be utilized in urgent circumstances like this. So, there is a need for a framework that shouldn't be entirely dependent on an action to start it, and it also needs to be very productive, precise, and simple to use.

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1.1 Problem Definition

Now a day's peoples security is one of the main issues to be tended to in our country. At the point when a lady needs earnest assistance at the hour of provocation or attack, legitimate reachability is absent for them. Aside from staying alert about the meaning of peoples' security, it is fundamental that they are given insurance during those vital times.

II. LITERATURE SURVEY

Aadesh Guru Bhakt Dandamudi et al. [1] expressed that involving a CNN based image processing model with multiple intelligent autonomous modes that is efficient for aerial surveillance. The study also coversthe need for using such quicker, easier, and more efficient working techniques in aerial surveillance by streamlining and boosting its operations by utilizing pose estimation to overcome the numerous difficulties in aerial photography.

So, by inspiration of above paper we have use CNN based image processing technology for recognition of weapons. The above paper uses drones for capturing image which we will replace with web camera.

Rajesh Nasare et al. [2] expressed that it will pre- illuminate the client about the full alert areas where she will go. Our system will finish GPS which will sort out their continuous region and enlighten them about the spot being frail. This paper presents a versatile application called SWMS (SafetyApp for Peoples: a non-Liberal Protect) that give an essential component to put an emergency help.

In our system, we have incorporated GPS technology by referring to the aforementioned research.

Rishika K. et al [3] expressed that savvy security device to help peoples with being safeguarded during times of most outrageous gamble. The device includes an Arduino Super board, various sensors to screen the body limit assortments, GPS and GSM modules.

By referring above paper, we are using GSM for contacting the nearest police stations.

S Pradeep, Kanikannan et al. [4] stated that the different security measures accessible for peoples and this assignment goes under the piece of sharp security. New point of view of peoples' security alert structure with Arduino is proposed which has the limit of sending SMS alarm to the family members of the casualty so peoples can go out and get things done without delay.

For deploying the sensor alarm, we are going to refer the above paper.

We found that most of the papers are Arduino based or android based which will detect the peoples in panic situation, simply she will press the button or if her heartbeat is high the system will access the location of that particular user and takes the necessityaction. So, in our proposed method we will also detect the peoples who is in unsafe zone using convolutional neural network for classification. Because the CNN has specialty to extract the features automatically from images where it impacts on the accuracy of model. At the same time when we compare this model to RNN or LSTM these two algorithms work on sequence of data also it will take large time for training. So, we have taken the CNN algorithm for our project for classification. Also, we are sending alert to the nearest police station if the peoples are in unsafe zone by using KNN algorithm.

When evaluating visual, sparse, or inconsistently spaced data, CNNs are favored. Recurrent neural networks, however, are made to identify sequential or temporal data. Areas where CNNs are particularly helpful include face detection, medical analysis, medication development, and picture analysis. They make superior predictions when considering the order or sequence of the data as they relate to previous or next data nodes. RNNs are helpful for speech analysis, entity extraction, conversational intelligence, and language translation.

RNN's benefits

- Inputs of any length can be processed by RNN.
- Any time series predictor can benefit greatly from an RNN model because it is designed to remember every piece of data throughout time.
- The model still works even with bigger input sizes. Size doesn't become bigger.
- Each time step can use a different set of weights.
- In contrast to feedforward neural networks, RNNs are able to handle any set of inputs using their internal memory.

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RNN Drawbacks:

- The computation is slow because it is recurring.
- RNN model training can be challenging.
- Processing very long sequences becomes very challenging if we use relu or tanh as activation functions.
- vulnerable to issues like explosions and gradient fading.

CNN benefits:

- CNN's primary benefit is its ability to identify significant features without human intervention.
- CNN would be the perfect solution to issues with computer vision and picture classification because of this.

CNN drawback:

- CNNs have a number of drawbacks, including the requirement for a large amount of training data and the inability to encode the location and orientation of objects. The position and orientation of objects are not encoded. They struggle to categories photos with various positions.

III. PROPOSED ARCHITECTURE

3.1 Proposed System

In a proposed system, we are proposing an experiment on detection of peoples in safe or unsafe zone based on some attributes such as weapon, gun, knife or fire in an image. Also, we are going to send the alert to the nearest police station if the peoples is found in the danger zone. At the initial stage the user will start the webcam and provide the image to system. The system will classify the image into safe or unsafe zone based on the attributes such as gun, weapon and knife [1]. If she is in danger zone immediately the system will trigger the cameras location to the nearest police station [7].

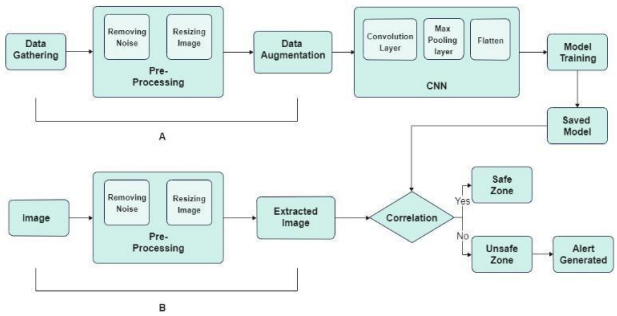

Fig.1. Proposed System Architecture

Proposed System consist of three important modules:

- Weapon Detection
- Alarm Generation

Under the admin module gathering of the data, pre-processing, data augmentation and model training is done. In the user module the user will simply provide the image to the system and her location based on these two inputs the system will identify the peoples in safe zone or not. Below are the steps of our proposed project:

In the above Proposed System Architecture, A part consists of: -

- Data Processing
- Dataset Gathering
- Data Preprocessing
- Data Augmentation

Dataset Gathering

For our project we have gathered two datasets one is of weapons (gun, knife) and other is fire

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data from Kaggle platform. After gathering of data, we have split the data into two parts training and testing. The training part contains 600 images and testing part we reserve the 60 images.

Dataset Pre-processing

After gathering of data, we resize the image into standard size such as 224*224.Sometimes the data we analyze is not properly screened and so it can give us wrong outputs, to remove all the redundancy, noise and re-size the image so proper training on the dataset can be performed.

Data Augmentation

The data augmentation reduces the overfitting. It means that it will give the high accuracy for training as well as testing. It will increase the size of training dataset with 4 times such as rotating, zooming, shearing of the image and changing its brightness.

CNN (Convolutional Neural Network)

- Convolutional Layer
- Max-pooling Layer
- Flattening

Convolutional Layer**:** In a convolutional layer we extract different features such as Edges, Texture, Shape of images consisting of weapons like gun, knife and fire.

Pooling Layer: The pooling layer is used to reduce the dimensionality of the feature map. There will be multiple activation & pooling layers inside the hidden layer of the CNN.

Flatten: Flattening is converting the data into a 1-dimensional array for inputting it to the next layer. We flatten the output of the convolutional layers to create a single long feature vector.

After complete training on 100 epochs we saved the model. In model creation we built the CNN model again it is having four stages convolutional layer, max pooling layer, flatten and dense layer. We are trained the model on 100 epochs we get the 89.65% accuracy.

We have taken one more dataset of location co-ordinates if the peoples found is in unsafe zone it will trigger an alert to the nearest police station by using KNN algorithm.

In the above Proposed System Architecture B part consists of: -

1. User

The user will start the webcam and provide the image to the model. The approach will be same as we did for training. The image gets pre-processed into 224*224 size and it goes to CNN block. The features will be extracted and finally by calculating the probability we get to know how much of these features are correlated to specific category. If the predicted class belongs to safe zone then no alert will be generated. If predicted class is in unsafe zone then an alert will be generated to the nearest police station by KNN classifier. For that we will take the location of user at the time of giving the image to the system.

2. Weapon Detection

All types of crimes, odd behavior, anomalous events, the presence of weapons(gun, knife),the situation's mood, crimes based on gender and gender classification, emergencies like sudden falls and fires, sparks in electrical wires and transformers, and vehicle accidents can all be detected by the classifiers used in the model. Figs.5 displays a small number of the findings. In the event, such situation's are detected, it notifies the control centre or base station. In an emergency, the system will sent an alert to the police or other emergency agencies and give them the relevant information. When the monitoring system is notified by autonomous detection of the events without a call from the victim, it is considered as a dangerous activity.

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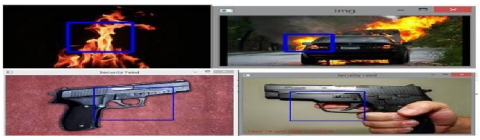

Fig 2. Results of few classifiers

Convolutional Neural Network

In general, the CNN model is used for promoting pictures shows in the beneath outline with four blocks (input, catching, order, yield). In this image we have a huge number, with three fundamental handling parts: setups and in state, CNN Learning and Representation and get Test. Arrangements and Instate part has two sources of info: occasion and setups. Right off the bat, the case portrays the quantity of layers, names of layers, the quantity of channels on each conv layer, the characterization strategy, size of information pictures and the piece of convolution layers. In conclusion, the design portrays a few boundaries for the model, for example, learning-rate, smaller than normal group, weight rot, energy. CNN Learning and Representation part of nLmF-CNN portrays highlights of pictures in many layers like information, conv, relu, pool, fc, and softmax layers. It envisions the ongoing aftereffect of learning status.

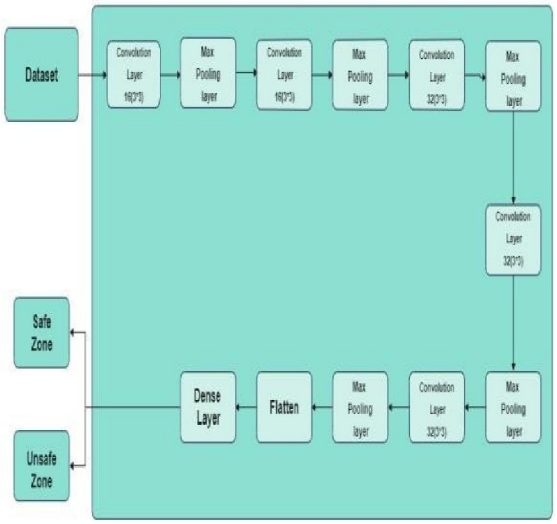

Fig.3. CNN Architecture

A convolution extricates tiles of the info highlight guide, and applies channels to them to process new elements, delivering a result include map, or convolved highlight (which might have an alternate size and profundity than the info includes map). Convolutions are characterized by two boundaries: Size of the tiles that are removed (regularly 3x3 or 5x5 pixels). The profundity of the result highlight map, which relates to the quantity of channels that are applied During a convolution, the channels (frameworks a similar size as the tile size) really slide over the info include guide's lattice on a level plane and in an upward direction, each pixel in turn, removing each comparing tile.

Following every convolution activity, the CNN applies a Redressed Direct Unit (ReLU) change to the convolved highlight, to bring nonlinearity into the model. The ReLU capability, $F(x)=\max(0,x)$, returns x for all upsides of $x > 0$, and returns 0 for all upsides of $x \leq 0$.

ReLU is utilized as an enactment capability in different brain organizations;

After ReLU comes a pooling step, in which the CNN down examples the convolved highlight (to save money on handling time), decreasing the quantity of components of the element map, while as yet safeguarding the most basic component data. A typical calculation utilized for this interaction is called max pooling.

Max pooling works likewise to convolution. We slide over the element guide and concentrate tiles of a predetermined size. For each tile, the greatest worth is result to another element guide, and any remaining qualities are disposed of. Max pooling activities take two boundaries. Size of the maximum pooling channel (normally 2x2 pixels)

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Toward the finish of a convolutional brain network are at least one completely associated layers (when two layers are "completely associated," each hub in the principal layer is associated with each hub in the subsequent layer). Their responsibility is to perform characterization in light of the elements removed by the convolutions. Ordinarily, the last completely associated layer contains a softmax enactment capability, which yields a likelihood esteem from 0 to 1 for every one of the grouping marks the model is attempting to anticipate.

Creating Alert by using K-Nearest Neighbor

A refinement of the k-NN portrayal estimation is to measure the responsibility of all of the k neighbors as demonstrated by their distance to the request point, giving more unmistakable burden to closer neighbors. The KNN classifier trigger the police headquarters in the event that peoples in peril zone. In below diagram we are trained 5 police station (A, B, C, D, E) data points(co-ordinates) and for new location the KNN model will find the nearest police station and then trigger to it as shown in figure3.

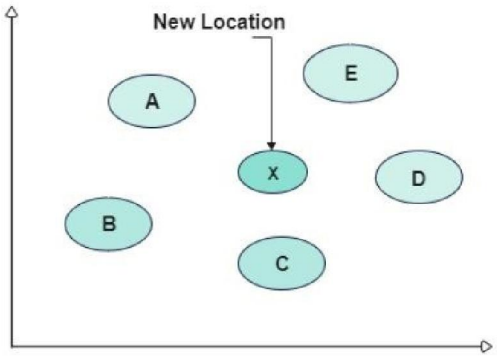

Fig.6. KNN Feature Space

IV. RESULTS AND DISCUSSION

The model is executed utilizing Raspberry Pi, Arduino associated with PI-camera, GPS Neo 6m, HC-SR04 ultrasonic sensor and the model purposes the Tensor stream and OpenCV. what's more, they get 68.14% exactness [1]. This model uses the force of IoT with a gadget that can recognize actual attack on the client and they get 96% precision utilizing calculated relapse [2]. Our proposed method achieves the 89.65% accuracy for
100 epochs through a CNN algorithm. We have extracted the 128 features from image using CNN algorithm. After detection we are also trigger to nearest police station by KNN algorithm.

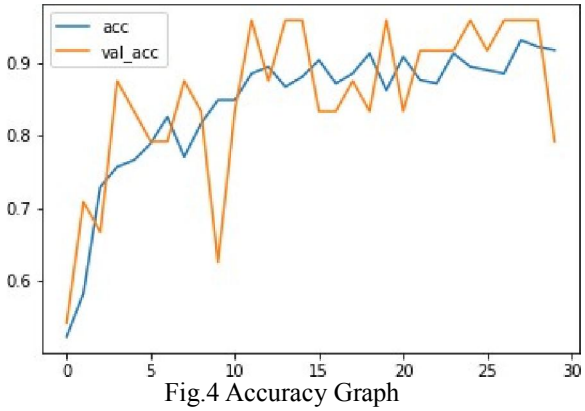

Fig.4 Accuracy Graph

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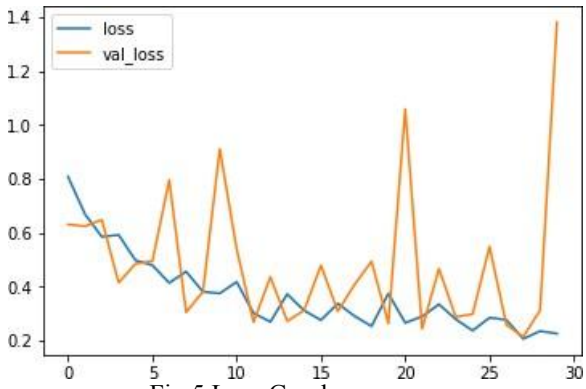

Fig.5 Loss Graph

V. CONCLUSION

AI-based frameworks can be used to understand unsafe situations more effectively than any currently available technology. With the implementation and exploitation of this technology, it will be possible to provide peoples with the level of opportunity, care, and assistance they deserve, enabling them to function as men's equals and take advantage of the opportunities they were meant to have from the beginning. Not only will this help those who already have the technology, but it will also help with information gathering from customers, grouping risksat various locations, identifying the danger districts from the data base, and hopefully reducing the number of crimes against peoples unquestionably. This foundation will allow for the continuation of a peaceful life.

VI. FUTURE SCOPE

There's a ton of potential outcomes and mixes that can be applied to this model so it can turn out to be more effective in space and time. With some more work, it might really anticipate the specific situation of the circumstance by simply investigating the sound and prepared marks. It has huge chance particularly with the utilization of the recurrent neural networks where it continues to get wise and savvy what's more, fires getting the best hyperparameters it necessities to distinguish a scene. If there're any future security issues, they'll be settled with the utilization of advances developing from here on out. Moreover, as the innovation propels, the ongoing applications can likewise adjust to the progressions to the ideal climate for client's better insight and model's exhibition. We can also keep a particular sign which peoples can show to the camera when she feels she is in danger, so that our system can detect it faster and alert can be generated. And we can spread this particular sign by various modes like news, advertisement etc.

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