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CRIME PREDICTION AND PREVENTION USING DEEP LEARNING AND COMPUTER VISION

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Abstract

Without human assistance, crime scene prediction can have a significant impact on computer vision. The usage of CNN (Convolutional Neural Network) to detect knife, blood, and gun from an image is presented in this research. Detecting these threatening objects in an image can help us determine whether or not a crime has occurred, as well as where the image was captured. We focused on detecting accuracy so that we don't get false alerts and can make the most of the system. To arrive at a detection result, this model employs the Convolutional Layer, Fully Connected Layer, and CNN Dropout Function. To obtain our desired results, we develop CNN using Tensorflow, an open source platform. For the dataset that was examined, the proposed model had 90.2 percent accuracy.
Keywords: Crime Prediction, CNN, Tensorflow, Deep Learning, Keras, Surveillance Systems.

1. INTRODUCTION

Preventing crime is an essential duty since it is a major issue facing our society. Criminals commit an enormous number of offences each day. daily. As a result, crime has a negative impact on people's well-being and the economy. According to the nature of civilization and community, criminal activity fluctuates. Predicting the location of a crime scene may now aid law enforcement agencies in their efforts to save time spent searching for evidence. Many CCTV cameras have been set up to monitor a specific location, as can be seen above. Because we have to manually keep track of so many more CCTV cameras, the proliferation of these devices is a problem. Artificial Intelligence (AI) in the security business is becoming more significant, and computers might predict crime situations by analysing CCTV camera data. This would make life simpler. When it comes to crime scene detection, feature extraction techniques like HOG [8], SIFT [7], and others have previously been used. Classification of the data was accomplished using a multiscale convolutional network [4] Deep Neural Networks (DNNs) are capable of delivering outstanding performance in image classification, hence the authors of [6] focused on the issues of object localisation in the picture. Ten employs a neural network for weapon detection. Automatic feature representation beats manual feature representation, and unsupervised techniques may provide results that are relatively comparable to supervised ones [5]. Images may be used to identify firearms and knives using the OpenCV method outlined in [11,14]. A single lost opportunity to detect a handgun or knife in a real-world circumstance might result in the death of several people.. A Convolutional Neural Network-based approach to the detection of potentially hazardous objects is thus presented in this research study (CNN).

Knife, gun (short, revolver, and machine gun) and blood are the datasets we utilise to test our model. Sample data is shown inFig. 1 according to the categories.

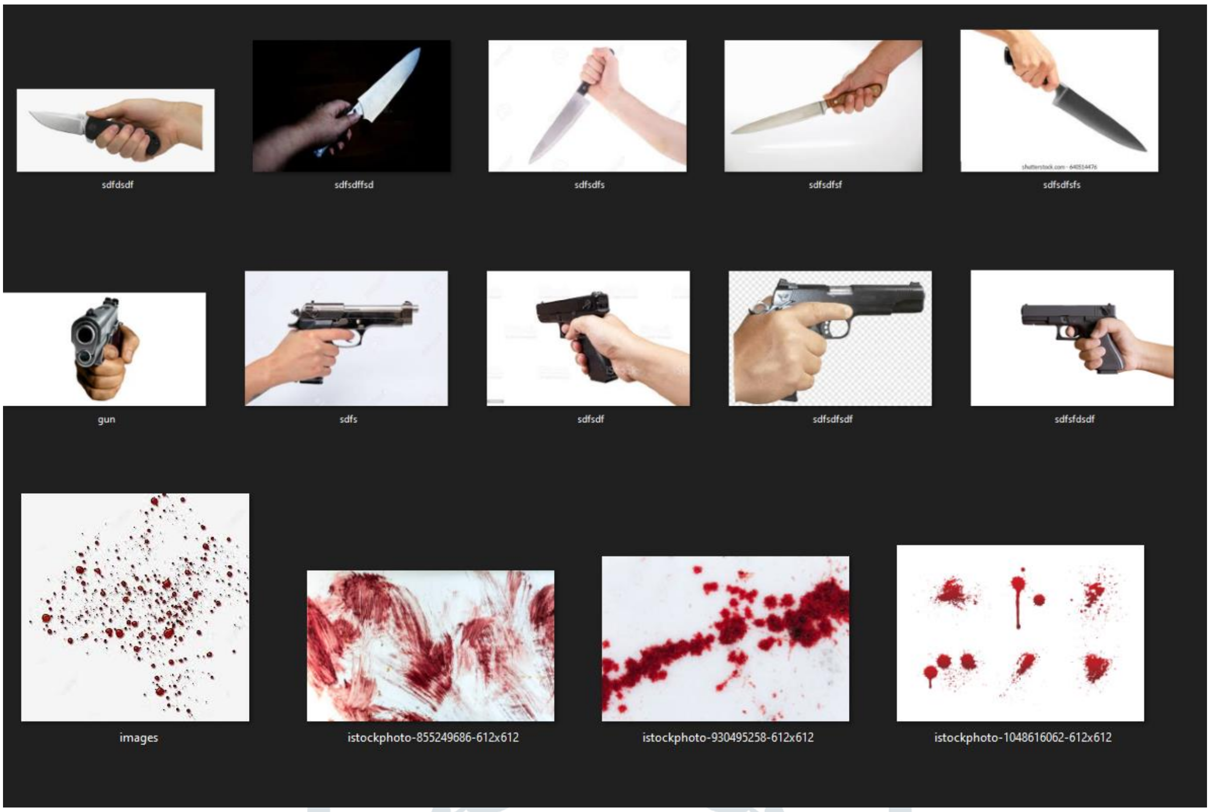

Fig1: Examples of data are provided in accordance with the classification schemes.

2. Literature Review:

They claim that artificial intelligence (AI) has the potential to be used in a wide range of illness categories including genetic and physiologic disorders as well as malignancies. Artificial intelligence (AI) algorithms have been studied, and the findings of such analyses have been applied to the disorders listed above. Also included in this research is a survey of pertinent clinical applications of several artificial intelligence techniques. To precisely estimate the future oil and gas markets in the future, big data is currently being utilised in the storage and transportation of oil and gas, as well as in the upstream sector for health and safety. Using big data in the petroleum downstream business presents a number of obstacles, but there are a number of areas where it may be used effectively. According to Szeliski R, the practical significance of the work is the construction of classification models in the modified data space, confirmation of the efficiency of the proposed modifications of data analysis on examples of images, and development of software models for implementation of the proposed classification methods in computer vision systems. The goal of Vedaldi A, Fulkerson B is to make it easier for computer vision researchers and students to rapidly prototype and conduct repeatable research. Feature detection, feature extraction, hierarchical k-means clustering, randomised kd-tree matching, and super-pixelization are all included in this method's rigorous implementation. Code and interfaces are properly documented. As a prominent programming language for computer vision, MATLAB is a natural fit for the library. "Human posture identification" is both an interesting and demanding problem for computer vision researchers, according to a recent study by Le TL, Nguyen MQ, and TTM. Some problematic issues experienced while dealing with traditional cameras may now be easily resolved thanks to the low-cost Kinect and its SDK. In the context of a health monitoring system, they investigate the capability of employing Kinect skeletal information for human posture identification in this research. In all, they perform seven studies using four kinds of skeletal characteristics taken from the human skeleton. That is, the findings reveal that this gadget is quite accurate at detecting four specific body positions (lying, sitting, standing, bending).

3. PROPOSED SYSTEM

To acquire the required outcomes from the model, we suggest a CNN model that may be trained on our data. In this case, we begin by extracting characteristics from the photos and then determining their classification.

Feature Extraction:

Photos are generalised and transformed into a certain pattern in order to extract characteristics from them via a series of steps. It's crucial to build a softmax regression models and train the model for feature extraction. These two stages have a number of sub-steps.

Create a Softmax Regression Model:

For the softmax regression model, we begin by building a single linear layer. The number of photographs in a batch increases by 50 photos throughout the training process. We need to figure out what our weights W and biases b are. Our input has a weights matrix of 15006, a dimension of 150100 pixels, and a total of six classes. To make matters more complicated, our input bias matrix b has a dimension of 16 bytes since it only includes biases for six classes. The regression model may now be performed with placeholders and variables in place. Input pictures X are vectorized and weighted, and the bias b is added to the multiplication matrix before being multiplied with the weights W.Batches of input photographs are represented by Y.It's possible to create a loss function, which measures how well the model predicts batches. Maintaining detection efficiency requires that we minimise the loss function of our system.The loss function in this research is the cross-entropy of the target and softmax activation functions used to forecast a batch of photographs. Probability inaccuracies in our lessons are identified by this. In the case of revolvers, machine guns, as well as shotguns, our detecting system needs improvement. There are various traits that may readily be linked to other classes when separating revolvers, machine guns, and shotguns. Typical elements of every gun include things like a trigger and barrel.

Training Model:

In With the tools we developed, we outline the stages required in training the system. In order to improve our error function, we apply a gradient optimizer before executing the training phases. If you're looking for an easy way to lower the error function, the gradient descent optimizer is a great option.The gradient descent technique is used by the model's optimizer, which uses gradient descent to improve performance. As a general rule, slowing down the learning rate of models is a good idea when feeding them data. We used a learning rate of 0.003 in Gradient Descent Optimizer. Partially derive the error function from all weights and biases, then sum them all together to get the partial derivative. In order to reduce cross-entropy from subsequent training photographs, we will repeat this procedure. Upon the return of the gradient descent optimizer function, the training parameter is changed. During the training, each batch must be 50 images greater than the previous one. Numbers 50 to 450 were assigned to the various collections of photos. The software regression model's placeholders are replaced by this data during training. Finally, we assessed the model's efficiency and uncovered its flaws in detail.

Build Multilayer Convolutional Model:

We Weight initialization, convolution and pooling, the first convolutional layer, the second convolutional layer, the densely connected layer, dropout, readout, train, and evaluate are some of the procedures we need to follow in order to build a multilayer convolutional network from the model we have so far.

Weight initialization is critical since our models include a large number of weights and biases that need to be set up. To prevent 0 gradients and violate symmetry, we add some noise to the weights when they are first created. We use a weighting factor of 0.1 for weights with a low degree of noise. Furthermore, we employ ReLu in our model. To prevent "dead neurons," we utilise a somewhat positive bias in the beginning. By default, the bias is set to levels that are somewhat in our favour from the outset.

The convolution and pooling process is used to perform border management duties.

Because the output is as near to the input as feasible, we utilise convolutions with a stride of one and no padding. We apply pooling to a 22-block region in our input photographs. The collection contains images with a resolution of 150100 pixels. For each picture, a stride of one divides the image into 22 blocks of the same colour. Because we use max pooling, we keep the largest value of the block in the matrix. Using this method, we can calculate the most weighted value so that we can more precisely anticipate the form.

4. ALGORITHM

Convolutional Neural Networks

An algorithm known as a Convolutional Neural Network (ConvNet/CNN) is a Deep Learning system that can take in an image, give significance (learnable weights and biases) to various aspects/objects in the picture, and be able to discern one from the other. The amount of pre-processing needed in a ConvNet is much less than in other classification techniques. Rather of relying on hand-engineered filters, ConvNets may be trained to learn these filters/characteristics over time.

When designing a ConvNet, we took inspiration from how neurons are connected in the human brain's visual cortex to create its architecture. An area of the visual field known as the Receptive Field is where individual neurons react to visual input. All of the visual space is filled by overlapping fields of this kind.

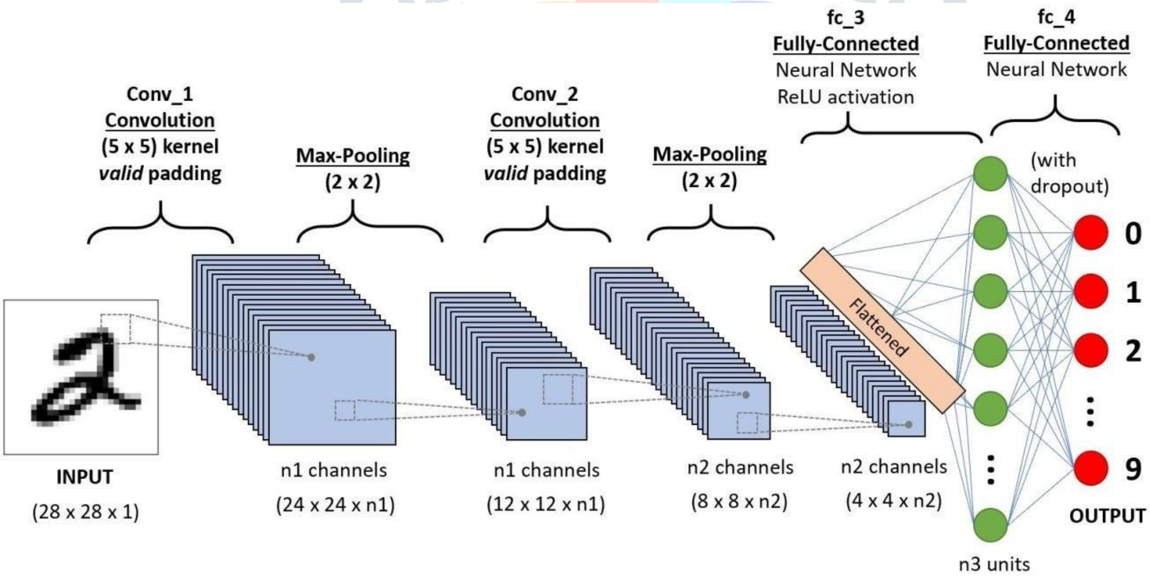

Fig2. Convolutional Neural Networks Architecture

Convolution Layer

Features are extracted from an input picture using convolution. Using tiny input data squares, convolution learns visual attributes while preserving the connection among pixels. An image matrix and a filter or kernel is used in this mathematical procedure.

5. PROPOSED SYSTEM ARCHITECTURE

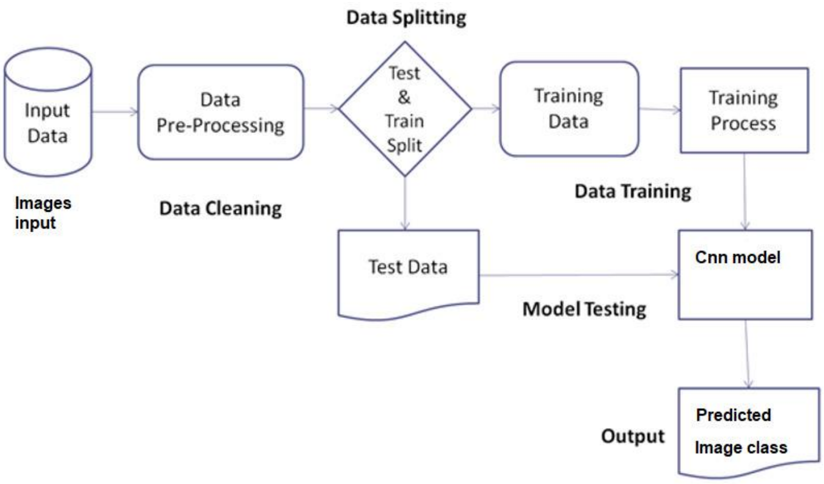

Fig3: Proposed Architecture

6. EXPERIMENTAL RESULTS

Our pictures are 92% accurate after 30 epochs when we use a multi-layer convolutional neural network (CNN). And we can see that after the first five epochs, our model has gone from a high error rate to a low error rate.

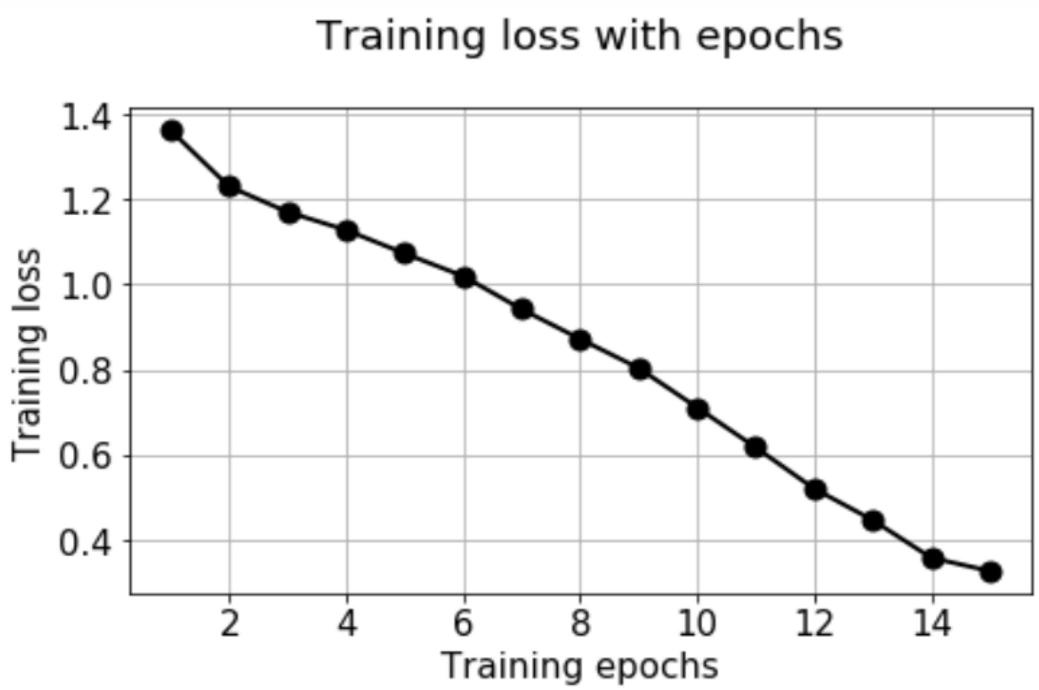

Fig4: Training Loss with epochs

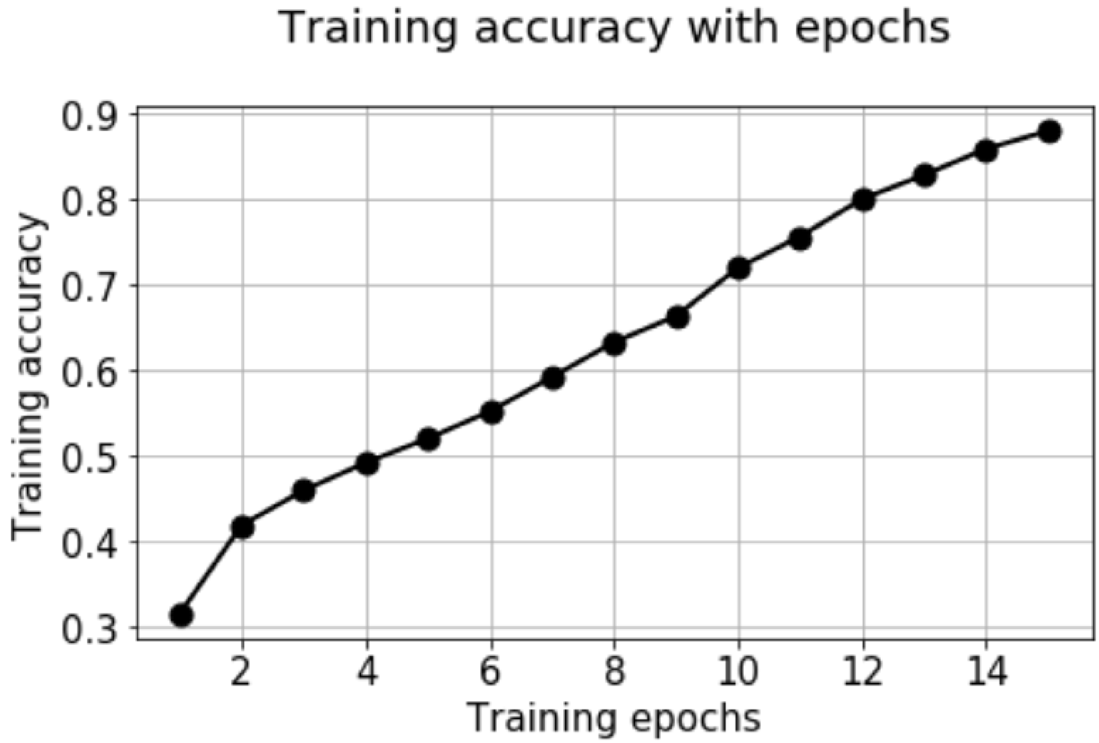

Fig5: Training Accuracy with epochs

7. CONCLUSION

A novel approach for determining whether or not a crime scene has occurred has been discovered through this study. Our methodology is especially helpful in this regard since it minimises the amount of false alarms. TensorFlow has shown to be the most effective tool for our task.. The suggested CNN model has a 90.2 percent accuracy rate when evaluated on the dataset in question.

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