As per UGC guidelines an electronic bar code is provided to seure your paper

International Journal for Modern Trends in Science and Technology, 8(02): 01-05, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0802001
Available online at: http://www.ijmtst.com/vol8issue02.html

Check for updates

Classification of Crime Scene Images using the Computer Vision and Deep Learning Techniques

Jyotsna Bhargavi Karri

Department of CSE, University College of Engineering Kakinada JNTUK, AP, India.
Corresponding Author Mail Id: karrijyotsnabhargavi@gmail.com

To Cite this Article
Jyotsna Bhargavi Karri . Classification of Crime Scene Images using the Computer Vision and Deep Learning Techniques. *International Journal for Modern Trends in Science and Technology* 2022, *8* pp. 01-05. https://doi.org/10.46501/IJMTST0802001

Article Info
Received: 29 December 2021; Accepted: 25 January 2022; Published: 28 January 2022.

ABSTRACT

Crime is a major issue in our society, and preventing it is a vital duty. Criminals commit thousands of crimes each day. Criminality is a social and economic issue that has a negative impact on people's lives and the economy. According to the sort of civilization and community, the methods used to commit crime vary. A number of previously conducted studies in the field of crime prediction have indicated that variables including socioeconomic status, education, poverty, and the state of the local economy all have an influence on how violent crime occurs. Maintaining a database of all crimes committed will be necessary for future reference. At the moment, one of the most difficult challenges is collecting and evaluating an adequate dataset of criminal activity in order to make predictions about future crimes and solve them. The goal of this study is to examine a large dataset of crimes and make predictions about the kind of crimes that could occur in the future under different circumstances. For the purpose of crime prediction utilising an India crime data collection, we will use machine learning and data science techniques. Crime statistics were obtained from the Indian police's official website. It includes information such as the location of the crime, the kind of crime, the date and time, and the latitude and longitude of the crime site. For maximum accuracy, feature selection and scaling will be performed on the preprocessed data prior to the training of the model. There will be a variety of algorithms examined for crime prediction, with the most accurate one being used to train the others. We'll use graphs to show when and where crimes are most common, for example. Machine learning may be used by law enforcement agencies to detect, forecast, and solve crimes more quickly, which in turn reduces crime, the purpose of this study. Depending on the availability of the datasets, it may be used in different states and countries.

Keywords - *Crime, Deep learning, Computer vision, Crime prediction, forensics.*

1.INTRODUCTION

This new technology makes it possible for law enforcement agencies to work more efficiently. Many CCTV cameras have been set up to monitor a specific location, as can be seen above. The increasing number of CCTV cameras, on the other hand, creates a challenge since they all need to be manually monitored. By analysing CCTV camera data and using artificial intelligence (AI) in the security industry, computers might predict criminal scenarios. When it comes to crime scene detection, feature extraction techniques like HOG [8], SIFT [7], and others have previously been used. Using a multi-scale convolutional network, the data was classified in [4]. Deep Neural Network (DNN) may give amazing performance on picture categorization, which drew the attention of the authors of [6]. When it comes to detecting firearms, [10]'s developers use a neural network. Automated feature representation beats manual feature representation, and unsupervised techniques may provide results that are almost identical to supervised ones [5]. In [11,14], OpenCV is used to identify a firearm and a knife in a picture. Many people's lives might be lost if we fail to recognise a gun or knife in a real-world scenario even one time. This research proposes a Convolutional Neural Network-based method for the detection of potentially hazardous objects (CNN).

Feature extraction:

We use a variety of techniques to generalise the photographs and change them into a certain pattern so that we can extract information from them. Building a softmax regression model and training the model are the two most crucial steps in feature extraction. Steps one and two each include a few sub-steps. Softmax regression models with one linear layer are first constructed. The number of photographs in a batch increases by 50 images throughout the training process.. Our weights W and biases b need to be established. At 150X100 pixels, the dimensions of our input picture are 150X150 pixels, and we have 6 classes in our weight matrix. There are also just six biases in our input, hence the bias matrix b is 16 bytes in size. After creating variables and placeholders, we're ready to run the regression model and see how it performs.

Build Multilayer Convolutional Model

Convolution and pooling of weights; convolution and pooling of matrices; first convolutional layer; densely connected layer; dropout; readout ; train; and evaluate are some of processes we need to take before we build a multilayer network based on the model we've previously constructed. Our model will be trained and evaluated using a variety of convolutional networks. According to the findings of this study, our system's training dataset has almost the same amount of each of the classes.

2. LITERATURE REVIEW

Crime rate patterns from the Communities and Crime Unnormalized Dataset were compared to actual crime statistics using data mining software Waikato Environment for Knowledge Analysis. (WEKA). This restricted collection of characteristics from actual crime datasets as well as subjective reports of crime from community people was used to develop linear regression and additive regression, as well as decision stump. The test subjects were chosen at random. Linear regression was the most successful strategy since it was able to handle some unpredictability in the test data. As a result of the programme, machine learning algorithms may be used to identify crime hotspots, create criminal profiles, and gain knowledge about crime trends. When WEKA [13] is used, a new graphical user interface that can replace Internet Explorer is possible. Java beans are used to represent specific learning components in data mining, whereas IT gives a more focused perspective of data mining in conjunction with the process orientation. " There are many different learning algorithms and datasets that may be tested using the experimenter, which is simply named "experimenter." The use of a predictive strategy to urban crime may be more successful in forecasting it, according to [8,]. Residential break-ins, robberies on the street, and battery were all divided down into 200-by-two-meter grids and probed backwards. Logistic regression and neural network algorithms were used to forecast crime rates for 2014 in an ensemble model. The accuracy, direct hit rate, and prediction index of each forecast were all considered. Predictive analytic techniques were used to analyse the data and provide accurate projections, as shown by these forecasts. Machine learning was applied to attempt to predict crime, according to ref. [10]. We looked into Vancouver, Canada's crime statistics over the previous 15 years to see if we could predict the city's criminal activity trends in the future. This machine learning-based examination of criminal activities includes data gathering, data categorization, pattern identification, prediction, and visualisation. To dig deeper into the crime data, we turned to technologies like KNN and enhanced decision trees. For the years 2003 to 2018, researchers examined 560,000 police data and discovered that machine learning algorithms could properly forecast crime by 39–44 percent each year. Machine learning may be used to predict crime rates in Philadelphia, Pennsylvania, the United States. As a direct result of the difficulty, there was a crime that might have been done but wasn't. Algorithms like KNN, ordinal regression and tree methods were used to train the datasets and offer more accurate quantitative crime projections. An additional visual aid was supplied that depicted during a particular time period the number of crimes committed in various parts of Philadelphia, with different colours indicating the kind of crime committed. Playing as Philadelphia's general crime rate, several offences, including assault and computer fraud were introduced to the game.

3. WORKING METHOD

Convolutional Neural Networks

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm that can take in an image, give significance (learnable weights and biases) to various aspects/objects in the picture, and be able to distinguish one from the other. There is far less pre-processing necessary when using a ConvNet than with other classifiers. While in basic approaches filters are hand-engineered, ConvNets have the potential to learn these filters/characteristics with sufficient training.

Architecture of ConvNet is similar to that of human brain connection patterns and was based on visual cortex arrangement. The Receptive Field is a small portion of the visual field in which individual neurons are responsive to stimuli solely in this area. To encompass the whole field of vision, these fields merge together.

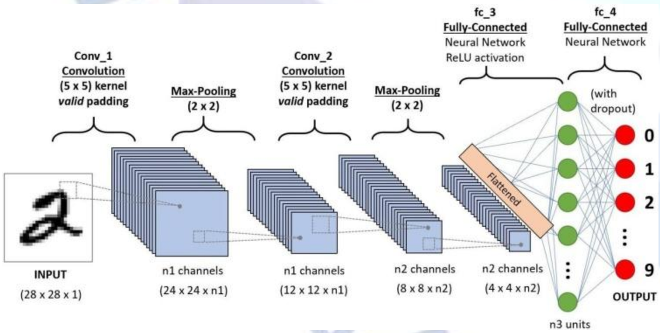

Fig1: Convolutional Neural Networks Architecture

Convolution Layer

In order to extract features from a picture, convolution is the first layer to do so. Convolution retains the link between pixels by learning visual attributes from tiny squares of input data. Two different inputs, such as an image matrix and a filter or kernel, are combined mathematically to produce the final product.

- An image matrix (volume) of dimension (h x w x d)
- A filter (f_h x f_w x d)
- Outputs a volume dimension (h - f_h + 1) x (w – f_w + 1) x 1

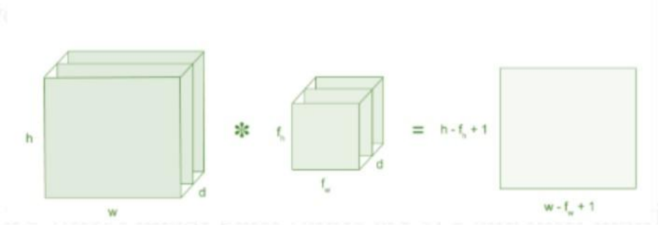

Fig2: Image matrix multiplies kernel or filter matrix

Consider a 5 x 5 whose image pixel values are 0, 1 and filter matrix 3 x 3 as shown in below

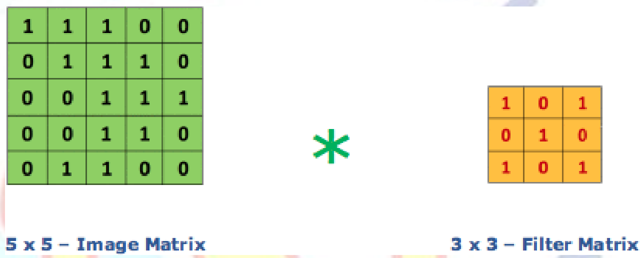

Fig3: Image matrix multiplies kernel

The resulting "Feature Map" is a convolution of a 5 x 5 image matrix with a 3 x 3 filter matrix. It is represented as an output in the figure below. By adding filters to a convolution of an image, you may do operations like edge detection, blurring, and sharpening.

Strides:

Pixel shifts are counted as strides. We shift the filters one pixel at a time when the stride is one. We shift the filters to 2 pixels at a time when the stride is 2 and so on. A stride of two, as seen in the graph below, would allow convolution to operate.

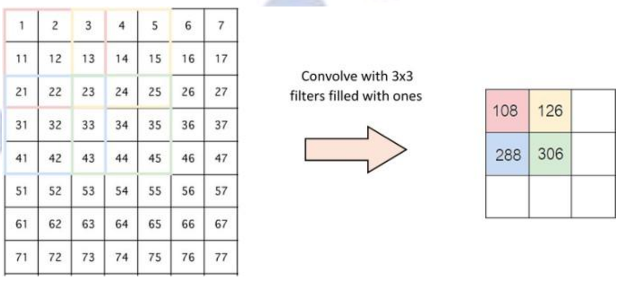

Fig4: Stride of 2 Pixels

Padding

The supplied picture may not match completely with the filter. Alternatively, we can: Pad the image with zeros (zero-padding) so that it fits

Non Linearity (ReLU)

For a non-linear operation, ReLU stands for the Rectified Linear Unit. The result is given $f(x) = max(0,x)$. Because ReLU is so important: ReLU is designed to bring non-linearity into our ConvNet. Non-negative linear numbers are what our ConvNet should be trained on in the actual world.

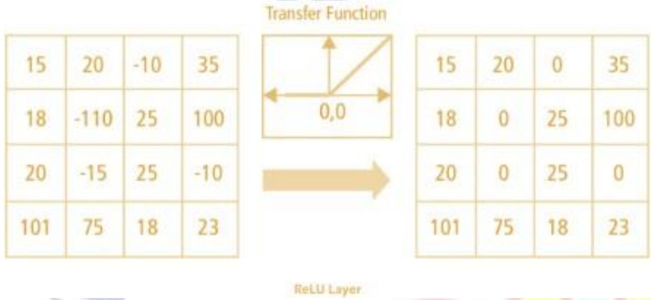

Fig5: ReLU Operation

Non-linear functions like tanh and sigmoid may be used in place of ReLU. Because ReLU performs better than the other two, most data scientists choose to utilise it over the other two.

Fully Connected Layer

We created an artificial neural network out of our matrix by flattening it into a vector and feeding it into the FC layer we've named for it.

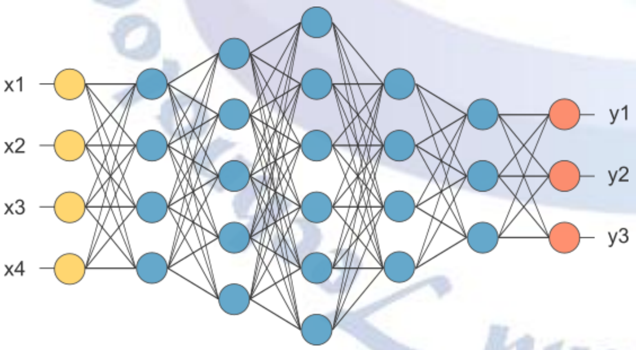

Fig6: After pooling layer, flattened as FC layer

Here, the feature map matrix will be transformed into the vectors (x1–x3, etc.) seen in the picture above. We were able to incorporate these characteristics into a model using the fully connected layers. Finally, an activation function like softmax or sigmoid may be used to sort the outputs into categories like "cat," "dog," "car," and "truck."

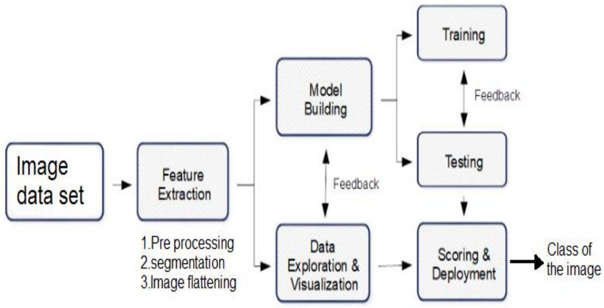

Fig7: System Architecture

4. CONCLUSION:

An innovative new approach for identifying blood, knives, and firearms at a crime scene was presented in this study. There were a lot of photographs in the dataset that we found on the internet. In order to get the dataset's characteristics, we must first preprocess those photographs. Classification and picture segmentation were made easier thanks to the cnn model we built. Our model has a low rate of false alarms, making it ideal for this purpose. For this subject, TensorFlow is the ideal platform to use. An estimated 92.2 percent of the time, the suggested CNN model performs well on the tested dataset.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Abadi, Martín, "Tensor Flow: A system for large-scale machine learning," 12th USENIX Symposium on Operating Systems Design and Implementation (OSDI), Savannah, Georgia, USA. 2016.

[2] "An Intuitive Explanation Of Convolutional Neural Networks," The data science blog, 2017. [online]. https://ujjwalkarn.me/2016/08/11/intuitive-explanation-convnets

[3] "An open-source software library for Machine Intelligence," Web. 25 Dec. 2016. [online]. https://www.tensorflow.org/

[4] P. Sermanet and Y. Lecun, "Traffic sign recognition with multi-scale Convolutional Networks," International Joint Conference on Neural Networks, 2011.

[5] K. He, X. Zhang, S. Ren, and J. Sun, "Deep Residual Learning for Image Recognition," 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016.

[6] Erhan, Dumitru, Christian Szegedy, Alexander Toshev, and Dragomir Anguelov, "Scalable Object Detection Using Deep Neural Networks," 2014 IEEE Conference on Computer Vision and Pattern Recognition (2014).

[7] D. Lowe, "Object recognition from local scale-invariant features," In ICCV, 1999.

[8] N. Dalal and B. Triggs, “Histograms of oriented gradients for human detection,” In CVPR, 2005.
[9] Ali, Khawlah Hussein, and Tianjiang Wang, “Learning Features for Action Recognition and Identity with Deep Belief Networks,” 2014 International Conference on Audio, Language and Image Processing (2014).
[10] O'reilly, Dean, Nicholas Bowring, and Stuart Harmer, “Signal Processing Techniques for Concealed Weapon Detection by Use of Neural Networks,” 2012 IEEE 27th Convention of Electrical and Electronics Engineers in Israel (2012).
[11] Grega, Michael, Andrzej Matiolanski, Piotr Guzik, and Mikolaj Leszczuk, “Automated Detection of Firearms and Knives in a CCTV Image,” Sensors vol.16, issue 1, 2016.
[12] Nitish Srivastava, Geoffrey Hinton, Alex Krizhevsky, Ilya Sutskever, and Ruslan Salakhutdinov, “Dropout: a simple way to prevent neural networks from overfitting,” J. Mach. Learn. Res. Vol. 15, issue 1 pp.1929-1958, January 2014.
[13] Kingma, Diederik P., and Jimmy Ba., “Adam: A Method For Stochastic Optimization,” 3rd International Conference for Learning Representations, San Diego, 2015 v1 (2014).
[14] S. Brahmbhatt, “Introduction to Computer Vision and OpenCV,” Practical OpenCV, pp. 3-5, 2013