A Machine Learning based Embedded Criminal Face Identification System for Residential Doorstep Security

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Abstract-**With an extremely arousing and increasing number of criminal activities in and around our surroundings, it has become very difficult to protect ourselves and live in such an environment.This project model helps in evaluation of such entities in real time and provides us rapidly fast and accurate satisfactory conclusions in order to classify the entities (faces) based on the pre-trained dataset, with advancement in technology like Machine Learning, we are able to come up with designing and embedding this highly reliable real time image recognition model with already existing visual devices and also design a dedicated device for the same purpose. YOLO (You Only Look Once), real time Object Detection and Classification model is used for faster results which helps in detecting any face familiar with respect to the trained dataset with criminal record, which can be further reported to the responsible authorities.**

Keywords- **Machine Learning, YOLO, Python, Tensor flow, Keras, CUDA.**

I. INTRODUCTION

Crime detection is one of the highly useful applications in the fields of deep learning, as this helps in curbing the crime and increasing the safety of people. Developed an object detection model using YOLO Darknet to detect harmful and suspects that might be a threat to the society. This ensures prevention of false results with appreciable accuracy by using the dataset from registered organizations. With the integration of YOLO model in order to detect the object in real time, it provides more accurate results at a very short time.

II. BACKGROUND OF THE PROJECT

The idea of working on this concept came up when a lot of crimes could be only seen happening in the recorded CCTV cameras, but no action could be taken in that situation, with the capturing of the video from the visual devise, a better effort to get a positive move on the crime scene could be attempted.

III. LITERATURE SURVEY

In the early modern age, all the wealthy used to hire a security to keep their premises safe from any kind of intrusions, as time passed the human security guards were replaced with camera which indeed had a revolutionary impact on how the system of providing security evolved. In today's world, at with which the speed of technology is rapidly growing, this data that has to be processed by the older methods would take very long time.[3] With the introduction of the powerful technologies like Machine Learning, Deep Learning, Artificial Intelligence, Cloud Computing etc. the way data is processed has changed significantly and results are quite satisfactory.[3] Face detection to avoid any negative situations like robbery or any planned attacks can be done by embedding this feature in all technically advanced camera devices in places like bank, airports, prestigious events, general home security etc.[2] Redirecting to the design part of the project, we are using algorithms like YOLO(You-Only-Look-Once) for faster results since the algorithm is designed to not to search any interested regions of the image instead of that the image is split into cells of 19x19 grid where each cell is responsible for predicting 5 bounding boxes. There are a few implementations of the YOLO algorithm but with using the DARKNET open source neural network framework which makes use of CUDA technology enables parallel processing and carryout computations on GPU.

IV. MOTIVATION

Even today, it takes plenty of time to find and detect the right accused victim because of various challenges faced like no proper strategy, no proper availability of resources, our idea of proposal tries to reduce that barrier in order to bring advancement in this field by which a great impact can be made in the society.Idea of bringing in such advancement in this security field was very challenging and the results that it can provide in very less time is so accurate that it can be set as an asset of evidence for any purpose.The happenings in today's world like criminal offences like theft, robbery and murders etc., led us to make use of the resources available

and add an extra level of shielding to avoid such activities in real world situations.

V. OBJECTIVES OF THE PROJECT

The visionary aim of this project is to achieve the speed and accuracy with which the faulty persons are identified; this is achieved with the help of technology i.e. a Machine Learning model that provides the results of within fractions of time.

- It also serves as a legalized form of approach for several Investigation Departments in order to get speedy and appropriate results.
- It is capable of running on device with any scale of device with CPU assuming having minimum requirements.

VI. METHODOLOGY

A single neural network predicts bounding boxes and class probabilities directly from full images in one evaluation. Since the whole detection pipeline is a single network, it can be optimized end-to-end directly on detection performance. Our base YOLO model processes images in real-time at 45 frames per second.Fast YOLO, processes an astounding 155 frames per second while still achieving double the mAP of other real-time detectors. Compared to state-of-the-art detection systems, YOLO makes more localization errors but is less likely to predict false positives on background.
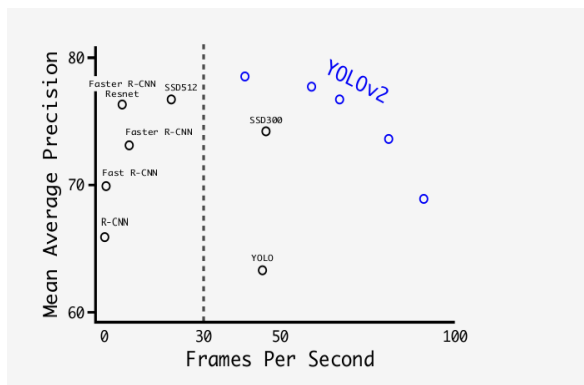

Fig. 1 Output computation rate of YOLO vs Other CNN

Finally, YOLO learns very general representations of objects. It outperforms other detection methods, including DPM and R-CNN, when generalizing from natural images to other domains like artwork.

VII.TOOLS AND TECHNOLOGY REQUIREMENT

For Collection of Data and annotation for reading, processing and getting the output of a video stream boundingboxes is used, for static images tools like.

1. Box-Label-Tool is used to label objects-
Creation of Annotation in Darknet Formatscripts/convert.py to convert the annotations. Python Libraries like: NumPy, OpenCV, dlib, imutils.CUDA/OpenCL and Darknet, enabled Linux or Windows Computing device for with a minimum of 8GB RAM, with a camera module to train the model and relevant dataset.

2. Hardware Requirements
- Minimum 8GB RAM.
- Intel i5 8th Gen.
- 100GB Memory.
- GeForce GTX 1050.

3. Software Requirements
- Darknet
- CUDA- Compute Unified Device Architecture.
- YOLO mark/enriqueav.
- Nccl 2.4 for CUDA 10.1
- CuDNN for CUDA 10.1

VIII. WORKING OF THE PROJECT

Fig. 2 Positive real time output in recognising the trained faces.

Final face recognition system is got which gives rapidly fast real-time results and identifies the criminal optimistically.
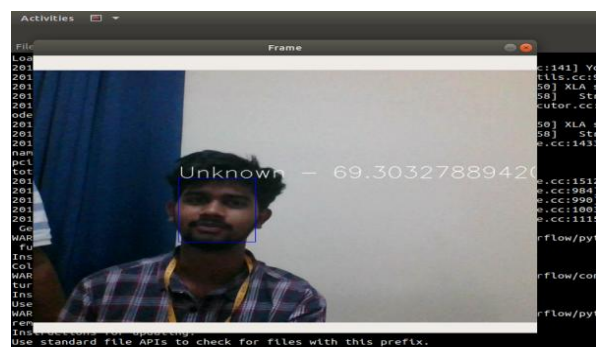

Fig. 3 Real Time classification of non-trained faces as 'Unknown'.

When non trained entities are found by the recognition model it identifies them as 'unknown',if wanted it can be added to the existing face database.

IX. APPLICATIONS

The developed model can be embedded in with a camera doorbell to identify a faulty person from a safe person in order to protect him in getting into harmful situations.It can be used by the Intelligence Bodies like CIA, FBI and others in order to identify the right person in case of any discrepancy or change in facial nodes of the accused.Serves as a connection device for the public in order to help the department by sending data of any doubtful person found nearby and report it to the authorities.

X. ADVANTAGES AND DISADVANTAGES

1. Advantages

- This proposed model built based on YOLO algorithm gives faster and accurate results.
- This model is easy to embed in existing vision capable devices.
- It does not take into consideration of any false inputs like photographs or captured images from other devices

2. Disadvantage

- This model is only built for facial recognition but not for specific recognition like Iris and other facial features.

XI. CONCLUSION

At the successful completion of this project, we will be able to able to identify a fraud/faulty/criminal and differentiate from a genuine person in case of any false accusations on that person, since this is completely dependent on the technology built on OpenCV and improved analysis of criminal detection will help to judge an accused individual prevent any future fraud based attacks.

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