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Real Time Object Detection And Recognition In Machine Learning Using Jetson Nano

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Abstract: Object detection is the technique of determining the presence of an object and estimating its location in the image canvas. Object recognition classifies the detected object from the list of previously seen(trained on) objects. In an image with multiple objects, it is a challenging task to determine the location of all the individual objects (detection) and then recognize them, due to several reasons: 1) There can be a possible overlap between multiple objects causing collusions for one or all. 2)Objects in the image can have varying orientations. 3)The objects could only be partially present in the image. 4)Images from low fps video stream can be blurry and distort the features of the object. Jetson Nano is a GPU-enabled edge computing platform for Machine Learning and deep learning applications. The GPU-powered platform is capable of training models and deploying online learning models but is most suited for deploying pre-trained AI models for real-time high-performance inference. In this research paper we provide a mechanism to create real-time multiple object detection and recognition application using python on the Jetson Nano developer kit using the camera and deep learning models and libraries. We are able to detect various objects using proposed mechanism in the research lab and storing the data of the object to be utilized for various application for attendance and surveillance.

Keywords: Jetson Nano, Object Detection, Classification, Recognition

I INTRODUCTION

Object detection is technologically challenging and practically useful problems in the field of computer vision. [1] object detection is a way of finding the object in a given image or in a video clip correctly and identifying whether the object belongs to the appropriate category or not when objects are placed in arbitrary poses in cluttered and occluded environment. As an example, it might be easy to train a domestic help robot to recognize the presence of coffee machine with nothing else in the image. On the other hand, imagine the difficulty of such robot in detecting the machine on kitchen slab that is cluttered by other utensils, gadgets, tools, etc. The searching or recognition process in such scenario is very difficult. So far, no effective solution has been found for this problem. [2] A lot of research is being done in the area of object recognition and detection during the last two decades. The research on object detection is multi-disciplinary and often involves the fields of image processing, machine learning, linear algebra, topology, statistics/probability, optimization, etc. As different objects

may appear in any positions of the image and have different aspect ratios or sizes, it is a natural choice to scan the whole image with a multi-scale sliding window. Although this exhaustive strategy can find out all possible positions of the objects, its shortcomings are also obvious. Due to a large number of candidate windows, it is computationally expensive and produces too many redundant windows. However, if only a fixed number of sliding window templates are applied, unsatisfactory regions may be produced.

II. Related Work

Enhanced object detection: Object detection is a popular research over the past few decades. Classic object detectors use hand-crafted features, such as histogram of oriented gradients (HOG) [3], integral channel features (ICF) and aggregated channel features (ACF). From the aspect of feature enhancement, Feature Extraction is one of the most popular research areas in the field of image analysis as it is a prime requirement in order to represent an object. Feature extraction is a process of dimensionality reduction by which an initial set of raw data is reduced to more manageable groups for processing. A characteristic of these large data sets is a largenumber of variables that require a lot of computing resources to process. This feature vector is used to recognize objects and classify them. Feature detection is a low-level image processing operation. A graph-based algorithm in generates proposals of vehicles with better quality than other traditional region proposal approaches DPM is the latest successful classic object detector with significantly improved detection accuracy. However the computation complexity of DPM is still very high and its detection accuracy is low for driving object detection. While classic object detection gets stuck in a bottleneck, there is a large break through on visual object detection with deep learning models, especially CNN models. Powered by GPUcomputers and huge object detection samples, CNN models can automatically learn complex and efficient features from sample images.

Object Detection API Provided by Tenser Flow: The Tensor Flow Object Detection API Single-Shot Detector models converted to Tensor Flow Lite that describes the signature of it any object detection technique is firstly trained in order to detect the boundaries of an object that belonging to multiple classes. For example, if a model is trained with some pictures that contain many other pictures but all of them are related, also provides the label that specifies which specifies the

class of an object (e.g. an book, a car, or a pole), and data specifying where each object appears in the image. When an image or live video is continuously recording in a specified model, it will recognize the objects and provides a list of images related to it while detecting, the location of a bounding box that contains each object, and a accuracy of an detected object is given in terms of confidence.

Deep Convolutional Neural Network: In deep learning theory, CNN is one of the most important model because there are many applications that uses CNN model for image recognition and classification purpose [7]. It is introduced from artificial neural networks. CNN uses the back-propagation algorithm to update the different parameters. In CNN model previously used layer or an output layer is used as the input layer for coming next layers. The CNN algorithm contains many network layers, that takes colored image as the input, and that colored image is converted into grey color because the average value of each pixel is contributed to convert into grey color. Grey color intensifies the image for pre-processing image. CNN model performs many strategies some of them are pooling, convolution, dropout and convolution all these are used to improve the fault tolerance. A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, and details which are important are shared to various objects in the picture and they can categories the different objects. The pre- processing required in a CNN is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, CNN have the ability to learn these filters/characteristics. The sensor of agriculture field deployed in [4] is used for detection of pesticides. we can obtain the data for detecting the object from the sensor which has been deployed by using [5]. [6] cross layer mechanism can be utilized to reduce the computational power and complexity of the complex data sets.

III. Proposed Work

In these research we have used an edge device for measurement of real-time performance of object detection for that we have selected the NVIDIA's JETSON NANO. [8] In NVIDIA Jetson Nano is the smallest offering for specialized SOCs for AI applications, it offers a CPU and GPU integrated into the SOC and has acomputational power of 472 FLOPs, at a power draw of 5 Watts. These specifications fall within what one might reasonably consider for a mass-available edge device. In These era there is a rapidly increasing demand for fast and

accurate object detection algorithm that can run on edge devices in real-time. To solve these problem, we have tuning deep learning architectures to obtain an optimal balance between performance and accuracy where it is a most popular research field over the past few years. So we tried to solve this issue by deploying object detection models onto an edge device like jet son Nano for measurement of real-time object recognition performance. We selected NVIDIA's Jetson Nano to be clear, the problem that object detection intended to solve it involves identifying location the object is, and what actually the object is. However,solving this issue is not so easy [9]. where a computer vision processes images in multiple dimensions. Furthermore, the size of the object, its orientation in the space, its attitude, and its location in the image can all vary greatly.

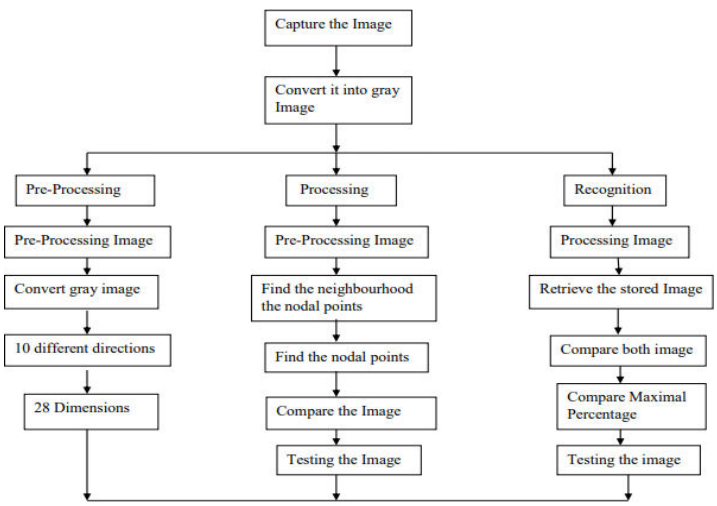

Figure 1: Object Detection steps

- Capturing the image from pictures and also from a live video stream and converting those pictures into grey image is very important because it is an intuitive way to convert a color image 3D array to a grayscale 2D array is, it takes the average of red, blue, green pixel values to get a grayscale. [10] Each pixel implies the intensity details of the light
- Pre-processing: It is used to improve the quality of the image so that we can analyses it in a better way.
- Processing are the steps taken to format images before theyare used by model training and inference.

Data Flow Diagram**:** The basic steps that are performed in First Data flow diagrams is to capture an input image and the performing some kind of algorithms or different models such as in these paper we have used the Jetson Nano and after

then recognition of that particular object

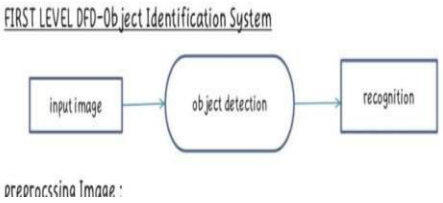

Figure 2: Data flow diagram

Preprocessing: Here captured image is passes through the preprocessing stage so that the image turns into grey color and the internal grids/pixels divides and search into multiple different directions in different dimensions.

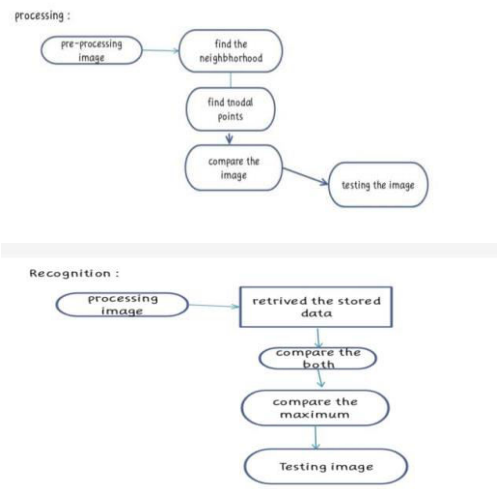

Figure 3: preprocessing

Processing: As stated above these object using the back propagation method so for the output of previous stage is used as in input an another stage. The previous preprocessing details are taken input for these stage and some algorithms are performed here e.g. R- KNN It checks the distance between different objects in a single image and then comparing it with the database that we havecollected.

Recognition: The processed image is retrieved from the stored data I.e. from database and then both the images are compared If both the image comparison rate is maximum then it passes it into nextstage I.e. testing.

Figure 4: Detecting the object

As shown above in figure 4 detecting of the object such as fruits and remote by using Jetson Nano in the research lab**.**

Testing: The final process it tests the compared image if that image is found then it gives it as a Matched along with these it also givesthe accuracy rate of that particular objects. If in case the tested image is not found in database, then it gives as Not Matched. It identifies the remote and a person from a live video stream. Not only a single image is detected here we have made these project such that multiple objects can be identified/Detected at once only I.e. Sequence of Images are recognized.

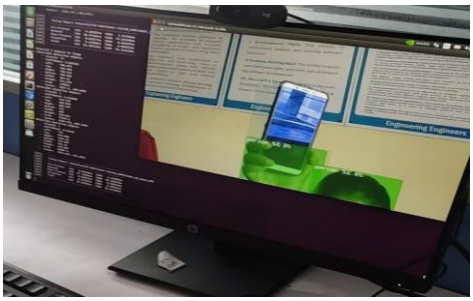

Figure 5: Detecting the object from live streaming

As shown above in figure 5 It detects the mobiles and a person in the image. Therefore, the proposed algorithm work successfully in detecting and recognizing the object from live video streaming. we can also consider taking live streaming video from various form of mobility sensors as mentioned in this research article [11].

V. CONCLUSION

Object detection and recognition are one of the most important contents of AI techniques where it has several applications in automated electric cars because the camera sensor has the recognize the object and it as to pass the whole details that are captured to the cloud and from the commands have to be passed then only electric cars will be safer without keeping in dangerous situation as accidents. It is one of the basic application where object detection is used. It can be also used in traffic systems, hospitals and in robotics. This technique is mainly used in real-world because a lot projects are depending on object detection for higher resolution purpose in their detections. The ImageNet and the Detection Net techniques that we have used in our project it plays a major role of having image database where are these image data is used to compare an object final stages of process. All the requirements are achieved for detection such as pixel-level detection and for the process. The Jetson Nano developer kit is a small accelerated kit platform it optimizes the problem and to avoid the computational overload Jetson Nano uses a low FTS of 10 and it can use for detecting the object from images and live streaming using the proposed mechanism.

VI. FUTURE WORK

To use the data provided by this project to be utilized for the surveillance and attendance of student and faculty instead of taking it manually. It can also be used for detecting the number of resources in a particular location.

REFERENCE

[1] zhong-qiu zhao, member, ieee, peng zheng, shou-tao xu, and xindong wu, fellow object detection with deep learning: a review, ieee ieee transactions on neural networks and learning systems 2019

[2] jun deng1,a, xiaojing xuan2,b, weifeng wang3 , zhao li4 , hanwen yao5 , zhiqiang wang6 a review of research on object detection based on deep learning journal of physics: doi:10.1088/1742-6596/1684/1/012028

[3] ajeet ram pathak, manjusha pandey,

siddharth rautaray, application of deep learning for object detection, procedia computer science,volume 132, 2018,pages 1706-1717,

[4] Mohammed nazeer 1*, garimella rama murthy 2, aishwarya jain3 "energy efficient clustering in wsn using weighted centriod)" international conference on soft computing and signal processing aug:21-22 springer, goggle scholar, scopus.

[5] Garimella rama murthy 1 mohammed nazeer 2, padmalaya nayak 3, "energy efficient design of mobile wireless sensor networks: constrained clustering". international journal of innovative technology and exploring engineering (ijitee), scopus, may2019.

[6] Mohammed nazeer, garimella rama murthy cognitive cross-layer, energy efficient mac protocol in mobile wireless sensor networks international journal of engineering and advanced technology (ijeat) issn: 2249 – 8958, volume-8 issue-2, december

[7] https://towardsdatascience.com/yolov5-object-detection-on-nvidia-jetson-nano-148cfa21a024

[8] https://github.com/dusty-nv/jetson-inference

[9] https://digitalenvironment.org/jetson-nano-object-detection-and-image-classification/

[10]https://www.forecr.io/blogs/ai-algorithms/how-to-run-nvidia%c2%ae-jetson%e2%84%a2-inference-example-on-forecr-products-installation-detectnet

[11] Mohammed Nazeer, G Rama murthy," Protocols in mobile cognitive sensor networks" International Journal of Applied Engineering Research ISSN 0973-4562 Vol. 13, Number 12, pp: 10268-10275, 2018.