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Object Detecting Artificial Intelligence (ODAI)

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ABSTRACT: The artificial intelligence and the machine learning are one of the hot topics right now in all around the world in the Technology. When we saw movies or cartoons like Iron man and Batman and their awesome technology, we got amazed by this all and in Iron man, he has his own personal Artificial Intelligence which is Jarvis and we got so much fascinated by it and want to know, how actually can machine learn or understand to see or read like a human and also understand it. So, our project is based on the same thing but in this project, we select only one part to work with which is Object Detection. In this project we are trying to creating one small system which can identify and classify the objects in the real world and not only that it can also do that identification process with the real time footage. Also, we are trying to fit all Objecting Detecting System in the mobile application so, we can use our smartphone to detect the object in the real time. We are mainly focusing on the android based application because of the users' number. So, this is basic outline of the Object Detecting Artificial Intelligence (ODAI).

KEYWORDS: Object Detection, Real-Time Object Detection, Object Detecting A.I., Neural Network, CNN

I. INTRODUCTION

There are lot innovative inventions developed in last few decades and still new and new technology is coming and changing our lives and making our work easy compared to the past. The most fascinating technology which comes to this world is the machine which can do calculations different processes and other many things digitally and that machine is computer. Then after invention of the computer the growth in researching the new innovation just sky-rocket and many new gadgets come to life like, camera, cell phones and other cool stuff which makes our work very easy. They just change the way of doing day-to-day daily work and also saves our so much time. With help of computers the research in the A.I. field get more attention and more and more people getting interest in this new and fascinating technology field. Then many researchers and people make their own versions of the artificial intelligent machine which is can perform different types of processes respectively. Then with help of cameras and cell phone the research in the machine learning area gets the boost and people are doing very awesome job and creating more and more cool stuff. Now, there are lots of methods created by the researchers all around the world.

The Object Detection is just one part or one area in the machine learning field and artificial intelligence. The object detection is very important and also basic step to teach machine how to see and detect things. There are so many and different types of object detection models like YOLO (You Look Only Once) [1], SSD (Single Shot Detector) [2], etc. The above models use the deep learning network method which is also called as or also known as Convolutional Neural Network (CNN) [3]. In this method, the image or footage is given to the network and from that input the features or main highlighted things get extracted and with the help of the those extracted features the training is given to the system and then the model gets created. The CNN is very powerful method to create the any object detection model. This method is now mainly used in most of the new machine learning models because of its flexible functioning. The model in this project is mainly focused on the real-time footage and because of that the objects or the things in the real-time footage is moving and we need to identify those moving objects perfectly and correctly and for that reason the Convolutional Neural Network is used in this project. The CNN can identify those objects correctly and can extract the necessary features which are required for the training the model.

II. RELATED WORK

In order to detect the object from the input which is the image or video or any real-time footage first, we need to remove the unnecessary noise means the unwanted information which is not related to the data that we wanted for the training purpose. The same process is needed for the video footage like the image. We have to avoid

unnecessary information from the video but this time it's little bit complicated than the image input. In video input, we don't that much control on the data compared to the image data. In image we can get lots of images of the data on which we want to do the training but in video there is lot unnecessary information like background or the things which are not included in our training goals. The real-time footage input is most complicated but at the same time same as the video input. The difference between the real-time footage input and video input is that, in real-time input we have to perform the all detection processes in the real-time means now, and in video input the footage is pre-recorded. Following is the basic structure of the detection and tracking system which is used mostly.

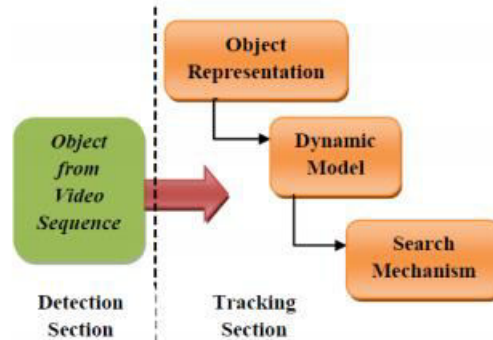


Figure 2.1 : Object Detection and Tracking model.

1) Video Target Tracking Project: In this video target tracking project, they created very decent type of model which can track the desired subject/ object in the video as mentioned in target goals. The functioning of this project looks simple but it's very challenging and comparatively tough. In this project they first get the video input from their data storage then that video input is then passed to important function which is the target identification then it extracts the features from that video which related to the desired target or the set goal. After all that main thing happened which is, the training of the model, the training is done with the help of the features extracted from the video and then with help of training dataset training is done. Then model can classify the desired target from the video and it can track that target throughout the video which is given to that model. This video target tracking project is mainly divided into few steps which are important to track the target in the video are as follows which is shown in Fig.2.2

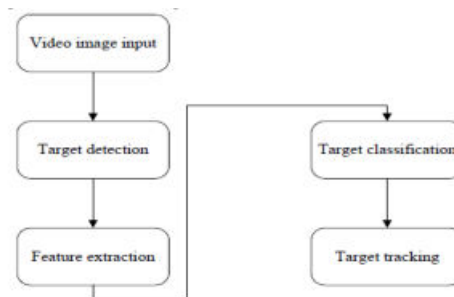


Figure 2.2: The process of video target tracking.

2) Moving object detection Using CNN Project: This moving object detection using CNN project is just similar as that of the previous project but in this project, they used the CNN technique to for detection and tracking functions. This project is more accurate than that of the first project which is mentioned above. The CNN is very useful for the feature extraction, with help of the CNN we can more accurately target the feature and filters to identify the desired object in the video. In CNN we can modify the algorithm based on our desired output then it will extract that exact features from the given data. The footage has the 2- dimensions so the it's much more easy compare to the 3-dimensional footage. This project uses the more advance technique to identify and detect the object in the video footage.

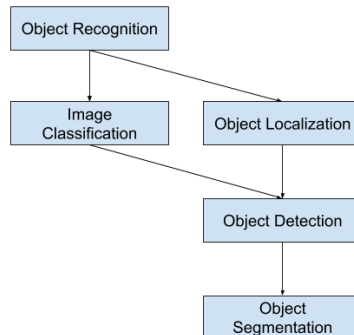


Figure 2.3: Types of CNN used for object detection model

3) Real Time Object Identification Using Neural Network with Caffe Model Project: In this real time object identification project [4], they perfectly demonstrated the very accurate implementation of the object detection system. This real time object detection technique is very accurate and more powerful than the previous two object detection models. This project also uses the CNN for the identification and tracking processes. But this project is very useful also it's much-much more valuable because this project has covered the very major problem or issue which many object detecting systems facing and that issue is solve by this project and that point is the "Real Time" object detection which is very difficult to do and very complicated to process. This project perfectly solves and demonstrated solution for that problem, they used the SSD (Single Shot Detector) which helps them in making in this model also this technique improves the accuracy of the model effectively. To use SSD in project effectively, they needed to learn the VGG16 model which contains the basic structure of a series of layers. That basic structure of series of layers of VGG16 is as follows in Figure 2.4.

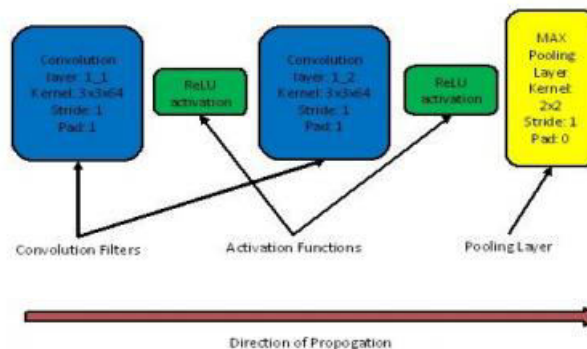


Figure 2.4: Basic structure of series of layers of VGG16

With that base VGG16 the complete functioning of the network and the needed additional feature layers are get established, that complete model of the SSD is introduce by the Liu et al [3], which is represented in the following Figure 2.5.

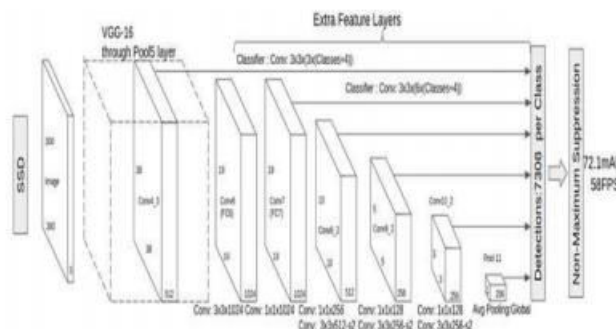


Figure 1.2: SSD300 model with breakdown of layers.



III. METHODOLOGY

There are lots of complications in the object detection field and to solve to issues it’s so complicated journey and after so many years of research we are now here, where we can detect the object in the real-time footage also, with the very high accuracy. The accuracy of the detection models before few years was very terrible compared to now and they were so poorly optimized and they can only detect object form still footage which is image. But nowadays object detection models can detect the objects in the real-time footage which is directly live footage which is captured by the various devices. As you can see in the below image, how nowadays object detecting model work. In the below example the model can detect the cat very easily and precisely also it gets further training and now it can identify the dog, cat and duck from the mix image of animals. This is the power of the object detection technology. The following image displays the full implementation of object detection in Figure. 3.1

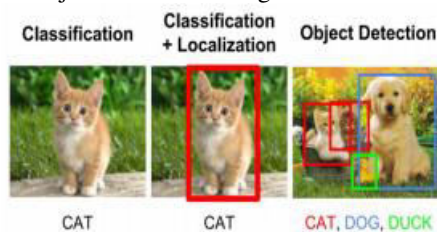


Figure 3.1: Object Detection.

The all the basic structure of this object detecting model is made up of the Convolutional Neural Network which is commonly known as the CNN. All the important stuff in this model is done by the CNN and may sound easy but it’s very big and complicated. The process sound simple which is first take input and extract the footage and then train the model with the help of that data to identify the things then optimize that model for more accurate predictions and then use this model for predictions or object detection in the real world. The CNN is the one of the best techniques which is used in the machine learning which gives researchers more flexibility in their work and gives more ease of work.

3.1 Object Detecting A.I Model Details

Our proposed system usage CNN (Convolution Neural Network) framework for object detection.

Convolution: It sends the image or the footage to the certain sets of the convolutional filters which then will extract the features from the given data which is image or any footage.

ReLU (Rectified Linear Unit): The ReLU is very important part in the object detection model training, this ReLU helps the model in training to do it more effectively and faster. This is also referred activation.

Pooling: The pooling is also one of the parts the object detection technique. The pooling makes the sampling process very simple and reduce the number of parameters which model needs to learn. This whole process consists of ten or hundred operations which are repeated and each layer is learning new feature. This model basically consists of two main parts within itself and the name of those parts are Object detection and Tracking respectively. The complete view of the CNN is represented in the following Figure 3.2.

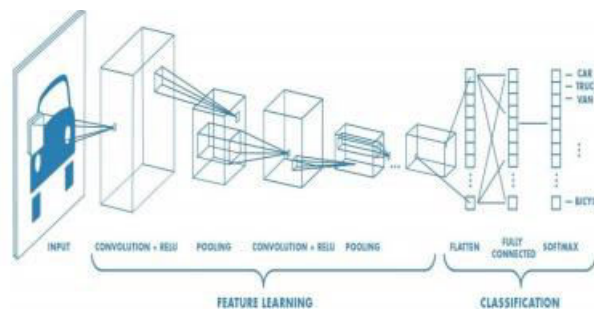


Figure 3.2: Complete view with CNN Layers

Our proposed system is as follows, in this project, we first take the input which is the footage which can be any format like image, video or real-time footage. Then this input which is the footage is send for the processing and then In this system, the video is feed to the system as an input. Frames are extracted for further processing. Then with the help of



detection and tracking algorithms which are the two main things needed for this project, this footage is processed and in that process the features which are required to get the desired object tracking and detection. Those object detection steps are explained in detailed below. This object detection is also depending on so many factors and it's very important but very complicated part in this all process.

In this project, we used the TensorFlow lite because we are aiming to do all those object detection processes, which is our Object Detecting Artificial Intelligence (ODAI) model on the on small devices like smartphones. This is the only hardware where all the above related work lacks in that section and our model solve this problem. With the help of TensorFlow lite we can do all that heavy processing and put that all detection in the compact file and can easily run on phone.

3.2 Object Detecting A.I. Processing Steps

These are the steps which are essential to create this Object Detecting Artificial Intelligence (ODAI):

S-1: First, we load the necessary packages.

S-2: Next we construct the necessary basic structure.

S-3: Then we create the data with correct labels for the training purpose and then we create boxes for those each classes.

S-4: Next, we load that trained object detection model and test it with testing data. Get the predictions and if any error, then improve the accuracy. Then after all this process we will get the final object detecting model.

S-5: Then, we create the application for the smartphone with the help of android studio and TensorFlow lite and with the trained model.

S-6: install that application on the smartphone (For this project we create the app for android system only). Then the app is ready to start and run hence, whenever the camera of smartphone is facing any object or thing which is present at front of it, the app will detect that object in the real time and then will start processing with help of the trained model data in it. Object Detection Artificial Intelligence (ODAI) processing steps workflow is represented with the help of the following Figure 3.3

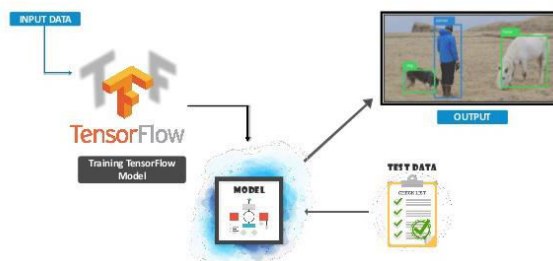


Figure 3.3: Processing Steps For ODAI.

IV. EXPERIMENTAL RESULTS

The object detection is very new and vast technology which is in the top of the trend in the machine learning and artificial intelligence technology field. Hence, we decided to enter and explore this field and also like to contribute some valuable and helpful information for that reason we create this mobile application specially for android base users so they will get know the basic working and functionality of the object detection system and they will get familiar with it. The following picture (a) showcase our app icon, which is the ODAI: Object Detecting Artificial Intelligence.

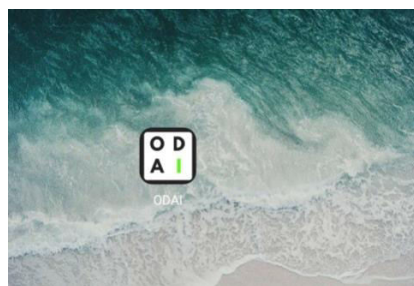


Figure (a): ODAI Application.



This is the GUI (Graphical User Interface) of the ODAI: Object Detecting Artificial Intelligence app. In figure (b) you can see the basic structure of the app layout. On the top-left corner there is the logo of the app and whole screen is the live camera-feed which is right now you can see in the below figure.

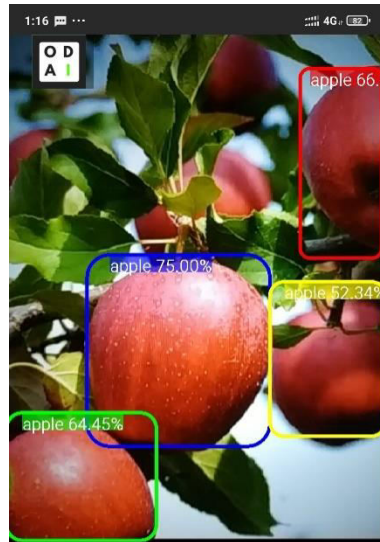


Figure (b): ODAI Application GUI

Object Detecting A.I. Application Results:

1. People Detection: In the following figures we can see the people detection system which is one of the major part the ODAI application. In figure (c), there are lots of people and our app still able to detect lots of people with small block and there is one red block which able to detect group of people. Fig. (d), there is a couple and our app can easily identify the people by drawing two different blocks. In fig.(e), our app easily identifies the news anchor and television and perfectly draws the box around them.

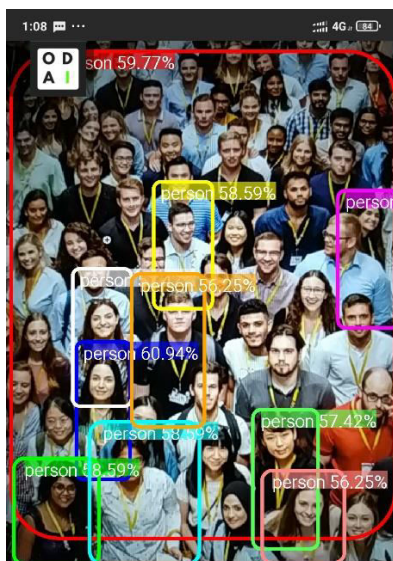


Figure (c)

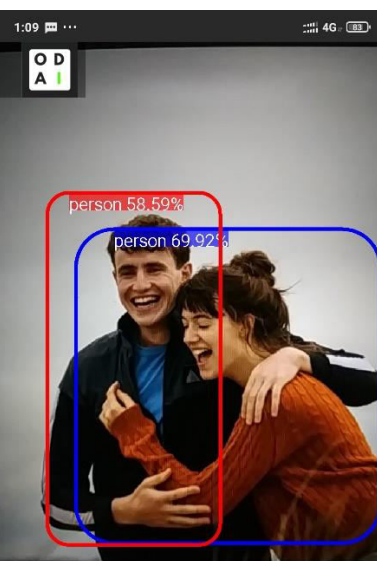


Figure (d)



Figure (e)

2. Cars and Traffic Light Detection: In fig.(f) and (g), we can see the ODAI app can very accurately differentiating between cars and traffic lights easily and identifying things on the screen. As you can see in the below figures, app is drawing boxes around cars and traffic lights perfectly and also showing the perfect labels as per the object.



Figure (f)

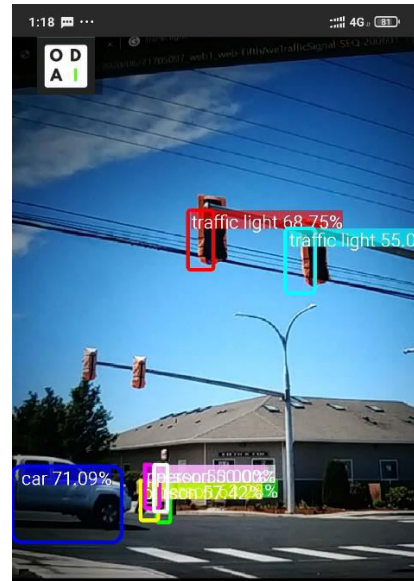


Figure (g)

2.Day-To-Day Life Object Detection: In fig.(h) app identifies the scissor and draw the box around it perfectly then next fig. (i), app also easily recognizes the clock and draw and labelled it perfectly. Also, we can see in the next figure which is fig.(j), it also identifies my gaming mouse and draws the box around it very accurately. In the last figure which is fig.(k), app even identifies the cell phone in the hand labelled it perfectly. Also, important point is that it identifies the human hand and also labelled as person and draws box around it in every following figures.



Figure (h)

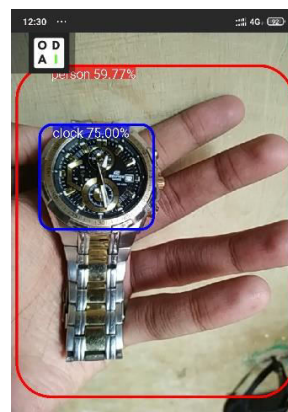


Figure (i)

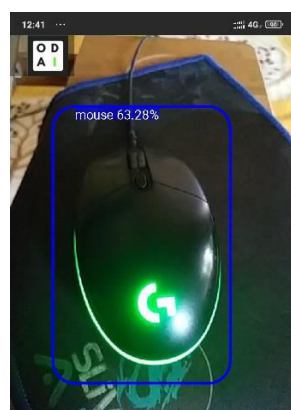


Figure (j)



Figure (k)



V. CONCLUSION

There are lots of many other objects detecting model are created throughout the world by my people but all models even new models are limited to big machines like computers and mac but with this project we solve that issue and we try to create the object detecting model which can also run on the small devices like the smartphone. We mainly focused on the android system because of the number of users. Hopefully this new Object Detecting Artificial Intelligence (ODAI) will also bring change in this field.

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