OBJECT DETECTION USING YOLOv8 ALGORITHM

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ABSTRACT - In day to day life Object detection plays an important role in navigating the visually impaired. Such Object detection is a critical task in computer vision with applications ranging from surveillance to autonomous vehicles ,to maintain reduced risk in Hospitals,banks even in houses,monitoring crop health in agriculture .YOLO (You Only Look Once) is an Object detection algorithm used for image and video processing which have gained significant attention due to their real-time processing capabilities. Exploring the implementation and performance evaluation of the YOLOv8 algorithm for object detection.We then delve into the training process, dataset selection, and data augmentation techniques employed to enhance model generalization.In order to implement this YOLOv8 ,we used ROBOFLOW, a tool to create a dataset. We created an image dataset in roboflow,Splitted it into training and testing dataset . We explore practical applications of YOLOv8 in scenarios such as pedestrian detection, vehicle detection, and object tracking. We proposed potential solutions to improve the algorithm's robustness and adaptability.This paper provides insights into the YOLOv8 algorithm's capabilities, performance, and applications in object detection tasks. It serves as a valuable resource for researchers, engineers, and practitioners in the field of computer vision.

***KEYWORDS*-Ultralytics,YOLOv8,Object Detection,Roboflow,Machine Learning,Computer vision.**

I. INTRODUCTION

Object Detection is a technique used to detect objects in a given picture or visual media.It is a important methodology used in computer vision that analyzes the input and predicts the objects accurately.The purpose of object detection is that it only locates the objects in the predefined dataset and ignores the surroundings .It has real world applications that includes detecting tumors cells in health care , keeps track of crop health in agriculture, face detection for authorized entry in security cameras , helps to detect vehicle parked in no parking areas.

Jason Brownlee [1] on his research book called “Deep learning for computer vision”(Image classification, Object detection and Face recognition in Python) He started with the introduction to computer vision and evaluate CNN that include problems like Fashion-MNIST and CIFAR-10 , discovered models for object detection like R-CNN and YOLO and also on Face recognition that includes FaceNet and VGGFace for face identification and face verification.

Fei Li, Hongping Yan and Linsu Shi [2] on their article “Multi-scale coupled attention for visual object detection” proposed about the network structure called Multi-Scale coupled Attention (MSCA) module that consists of Multi- Scale Coupled Channel Attention (MSCCA) and Multi-Scale Coupled Spatial Attention (MSCSA) connected together in sequence for object detection and their proposed model is compared with R-CNN, Cascade R-CNN, RetinaNet, SSD, PP-YOLO, YOLO v3, YOLO v5, YOLO v7, YOLOX, DETR, conditional DETR, UP-DETR and FP-DETR and demonstrated the effectiveness of proposed model.

Frouke Hermens [3] on his article “ Automatic Object Detection For Behavioral research using YOLOv8” surveyed the conditions for accurate object detection with YOLOv8 (You Only Look Once) and showed almost faultless even when he trained the model with small dataset approximately about 100 to 350 images for a variety of background.

Yuegui Wang, Caiyun Yang, Qiuting Yang, Rong Zhong, Kangjian Wang, Haolin Shen [4] investigated ability of proposed model using YOLOv7 on classification of cervical lymphadenopathy images and correlated its performance with qualitative visual evaluation by experienced radiologists and the output turned out to be 0.962 for benign lymph nodes, 0.982 for lymphomas and 0.960 for metastatic lymph nodes.

Tian Luan , Shixiong Zhou, Guokang Zhang, Zechun Song, Jiahui Wu and Weijun Pan [5] demonstrated the detection of forest fires ,images captured by UAVs by using YOLOX by improving the algorithm’s efficiency for small - target fire areas and also integrated CBAM to reduce disturbance by background noise and the output of YOLO model achieved a maP of 96.3%

Xing Jiang, Xiting Zhuang, Jisheng Chen, Jian Zhang and Yiwen Zhang [6] on their research on underwater visual detection technology using YOLOv8 - MU and discuss the challenges of localization accuracy and boundary clarity in underwater organism detection and result of YOLO-v8 MU on maP@0.5 of 78.4% and results of the models used by them generalizes the capability of underwater datasets.

Xuewei Wang and Jun Liu [7] on their study on tomato disease , by acknowledging the challenges such as excessive interference, imprecise lesion localization for small targets and heightened false-positive and false-negative rates in cultivation by introducing model’s ability to capture details regarding small target disease by leaving an accuracy of maP of 92.3% and detection speed of 46.6 frames per second (FPS).

Eman Abdullah Aldakheel , Mohammed Zakariah, Amira H.Alabdalall [8] on their article “Detection and identification of plant leaf diseases using YOLOv4” looked into the use of YOLOv4 Algorithm for detecting and identifying plant leaf disease that include over 50,000 photos of healthy and diseased plant leaves from 14 different species to establish advanced disease prediction system in agriculture with remarkable accuracy of 99.99%

Yu- Wei Lin ,Chu-Fu Chiu, Li -Hsien Chen and Chao-Ching Ho [9] developed a rockfall detection and tracking system using deep learning and image processing technology by training with a self-collected dataset of 2490 high resolution RGB images and the performance was evaluated with 30 videos featuring various rockfall scenarios. This effectively identifies rockfalls and provides disaster management and prevention.

II MATERIALS AND METHODS

The Method used in this project You only Look Once ,YOLO algorithm divides the input image into a grid of cells, and for each cell, it predicts the probability of the presence of an object in the image and the bounding box coordinates of the object.In this way it is used to predict in real-time monitoring and also the version 8 of You Only Look Once is more accurate and precise.This methodology uses hardware materials like webcam and software like Roboflow to create , manage and maintain dataset and colab to implement the working of the project.

Hardware requirements of the project include

- Operating System (Windows/Linux)
- RAM (4 GB Minimum)
- Secondary Storage (256 GB Minimum)

Software requirements include

- Internet browser (Chrome/Edge/Mozilla Firefox)
- Roboflow
- Webcam
- Internet Connection
- Google Colab
- Ultralytics

III .EXISTING SYSTEM

The existing system of the You only Look Once algorithm provides speed and accuracy in training and testing only for the predefined datasets .It predicts on real time but not on the particular individual or object in the image and uses older versions of You only Look Once that may lack efficiency in continuously monitoring the vicinity.

3.1 LIMITATIONS IN DATASET

The dataset used in the existing dataset is used only to detect only common objects or individuals in the image.This may lead to lack in efficiency of the module in providing the well. The datasets lacks updating if needed after building the model or in the middle of using it after some time.

3.2 MODEL TRAINING

The model trained depends on the predetermined and not on the user defined datasets. This may lead to not being able to monitor based on the user's criteria to supervise the specific region they want to . It is trained in such a way that it detects only the specific ones and can’t predict the ones that are in real time and the dataset seems not to be updated with time.

IV .METHODOLOGY

You Only Look Once is a framework that can support previous versions of YOLO and can toggle between previous versions, so it is easy to it with compare the performance of previous versions.

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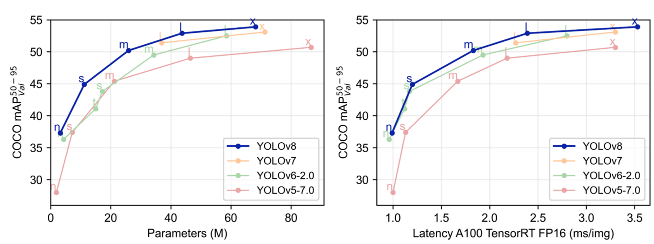
$$DFL(si,si+1)=-((yi+1-y)\log(si)+(y-yi)\log(si+1))$$

YOLOv8 is 1% more accurate than YOLOv5, making it the most accurate detector.

$$t=s\alpha\times u\beta$$

YOLOv8 provides a great benefit to researchers working on YOLO projects. Therefore, the version YOLOv8 was selected as the baseline.It uses CNN algorithm and multi layered architecture to train the dataset and fine tune to provide precise output.



V.APPROACH

5.1 Computer Vision-

Computer vision is a type of Artificial Intelligence that is trained to identify and classify the objects and living beings in the images and videos . It tries to perform and automate tasks as it replicates the human’s brain.It is used in main fields in modern days.Image classification,object detection, object tracking,count-based image retrievals, face recognition are some examples where the computer vision is used.

Computer vision basically needs more data,it analyzes the data over and over again to recognize the image or object accurately.To achieve this it uses two strong methodologies they are Deep learning and CNN.

5.2Ultralytics -

Ultralytics is a company that provides tools for computer vision. It basically provides developing art of the algorithms.One of its best model provided for computer vision is YOLO. Its primary works are object detection,the key features of the ultralytic algorithm are efficiency and speed, accuracy,ease to use in detecting objects in real time as well as in non real time environment . It plays a vital role in the field of computer vision in this Era.it creates and trains a machine learning model for the provided dataset .It provides several libraries and functionality to achieve accurate output.

5.3 YOLOv8:

YOLO is the most predominant model ultralytics computer vision algorithm .YOLO standards for You Only Look Once. YOLOv8 - YOLO version 8 , it as some advancement in the YOLO model.This improved version of the YOLO provides accuracy and speed of object detection is faster than other algorithms.It uses single Neural Network Algorithm.This model is basically used for detecting objects in real time environment like detecting objects or living being in CCTV footages.It divides the input(image) into grid cells to identify objects and empty space in the image then analyzes the identified objects features to know its classification (like cat,dog or person).It omits the empty spaces.

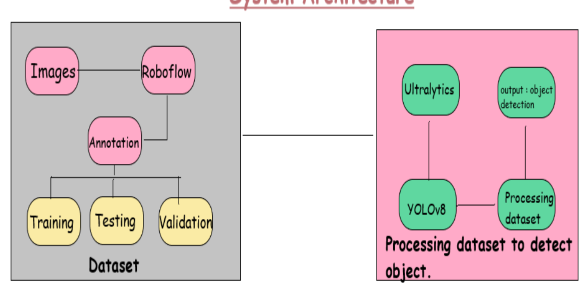
5.4RoboFlow -

Roboflow is a universal conversion tool for computer vision datasets. It provides data frame work for computer vision based problems. It is used to split the dataset into training ,testing and validation sets and provides code snippets for the corresponding dataset according to the model that is chosen. The code helps to load the dataset from the roboflow. It further provides preprocessing options .If needed we can apply the preprocessing also. The dataset is splitted into training ,testing and validation by annotating the images in the dataset. Annotation is the process of classifying the objects in the dataset as training , testing, validation . The train part should be 40% of the dataset , 30% percentage should be splitted for testing and 10% should be for the validation part.

VI.PROPOSED SYSTEM

The proposed work on "OBJECT DETECTION USING YOLOv8 ALGORITHM" aims to find the particular object and also determines the specific individual, group of person based on the preloaded dataset.The first step in the process is to collect the images for which the object within the image to be discerned.With the collected image the dataset is built with the help of Roboflow ,a tool to develop a raw dataset into annotated dataset.After uploading the raw dataset into the project folder each images in the folder is annotated to classify into particular individual or object or group of person . Following this process, the dataset is splitted into three main categories namely Training , testing and validation .The splitted dataset is exported so that unique access ID and code snippet are generated for that dataset, using the code snippet the dataset is accessible to the one who generated.Till this the dataset process is over. On the way forward, the processed dataset is imported,within the classified dataset the trained one is made to detect the objects in order to evaluate the performance. On summarizing the model's performance, the confusion matrix is generated between the background and class (predefined).

System Architecture



VII.SYSTEM FLOW

Object Detection using YOLOv8 algorithm project flows by keeping the YOLO (You Only Look Once) as the major part that plays a vital role in detecting objects by naming them in bounding boxes. The detected objects are outputted in the form of bounded boxes around by specifying the probability of the detection.This You Only Look Once Algorithm is part of Ultralytics, a company that provides tools for computer vision by basically providing art of algorithms. The dataset is collected and processed using RoboFlow, a tool to develop computer vision dataset from provided images . The processed dataset is divided into training, testing and validation datasets . 70% of the dataset is splitted into training , 20% for testing and 10% for validation . This splitted dataset is fed into the Ultralytic YOLO model and it trains the machine to detect the given class accurately. The output is provided in form of confusion matrix that summaries the performance of the model.

VIII.EXPERIMENTAL RESULT

Our model results in creating a clear ideology about how the machine splits between the object and background within the image. The result is produced in confusion matrix form that shows the performance of the model on how it differentiates and classifies the specific object in the image.

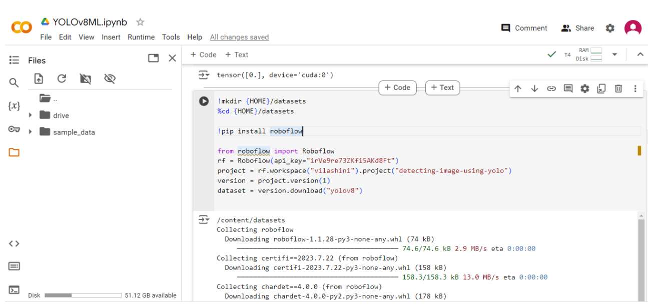


Figure 8.1 Code Snippet of the model

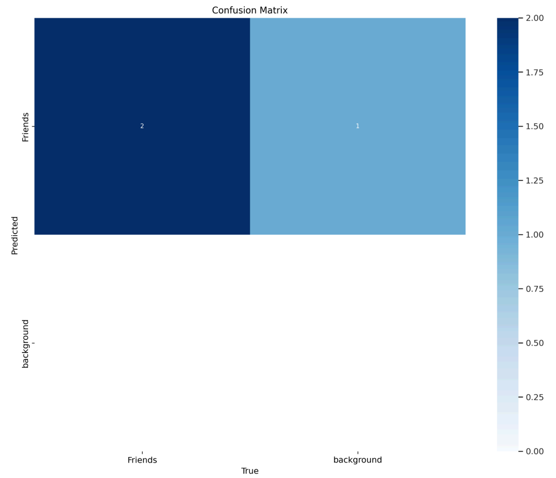


Figure 8.2 Confusion matrix

This shows the result of the model's prediction smoothness and accuracy.

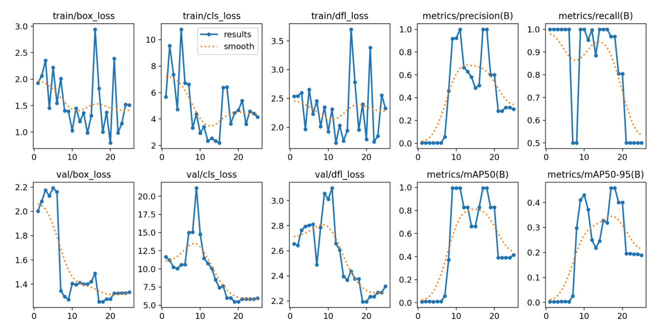


Figure 8.3 Graphical result of the model.

IX.OUTPUT

Our project is deployed in the form of a website that detects the particular objects in the image which is pre-trained . The website is able to detect images with the trained dataset and outputs with greater accuracy, quicker and yet stable response time. The user interface is generated with the trained model of dataset which is fed earlier.

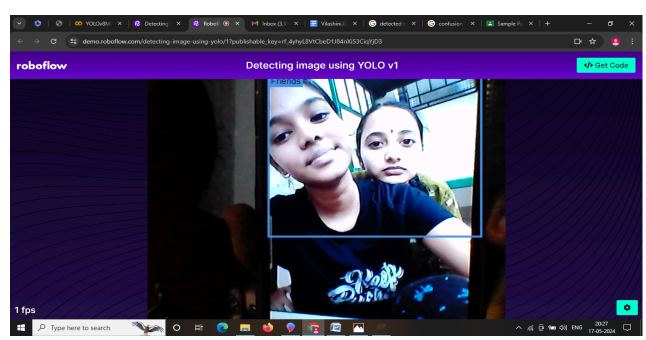


Figure 9.1 detecting object using webcam

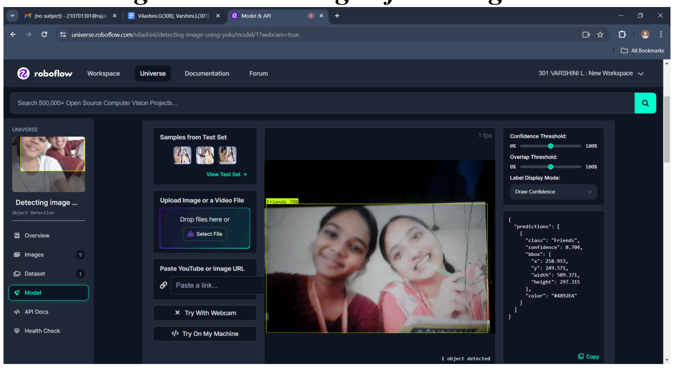


Figure 9.2 Detecting object using Drag and Drop

X. CONCLUSION AND FUTURE ENHANCEMENT

10.1 Conclusion-

In conclusion, our model ascertains the particular objects in the given input(image) with the reference of fed data.our model used YOLOv8 and roboflow tools to detect the object and ascertained the details of the particular object with maximum accuracy.Ultralytics library supported the computer vision related libraries and functionalities to train and test the model . Roboflow tool is used to create a well defined dataset from the uploaded raw dataset and to deploy the trained model as a website that is easily accessible using mobile devices and PC. To access this website a QR code is provided ,by scanning it we can navigate to the website where we can capture the image and the model will analyze and classify the objects in the image and also provide the accuracy rate. To access this model with PC we have two options.Either we can drag and drop the image from the files in the device or else we can also on the webcam and take the picture and submit it.The object detection model will provide the object's class and its prediction accuracy.

10.2 Future Enhancement-

- Our model can be further developed to detect multiple specific objects, that is the model will be trained with more than one class.
- The accuracy and performance of the predicting model can be improved.
- Enhanced features of the YOLO algorithm can be used to compare the output between this model and the enhanced model.
- The dataset can be maximized in order to maximize the accuracy , performance and prediction clarity.

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