

# An Efficient Object Detection System for the Blind People

<sup>1</sup>SRINATH JAMMULA, <sup>2</sup> SAI CHANDU.M, <sup>3</sup>C. HEMANATH HARISH, <sup>4</sup>Dr.S.GEETHA

<sup>1,2,3</sup> IV Year B. Tech CSE Students, Dept of Computer Science and Engineering, DR MGR EDUCATIONAL AND RESEARCH INSTITUTE, Maduravoyal, Chennai-95, Tamil Nadu, India

<sup>4</sup>Professor, Dept of Computer Science and Engineering, DR MGR EDUCATIONAL AND RESEARCH INSTITUTE, Maduravoyal, Chennai-95, Tamil Nadu, India

**Abstract:** As object recognition technology has developed recently, various technologies have been applied to autonomous vehicles, robots, and industrial facilities. However, the benefits of these technologies are not reaching the visually impaired, who need it the most. In this research, researchers proposed a deep learning based on object identification system for the visually impaired. Voice recognition technology is used to know what objects a blind person wants, and then to find the objects via object recognition. Furthermore, a voice guidance technique is used to inform sight impaired persons as to the location of objects. The object recognition deep learning model utilizes the single shot multi-box detector (SSD) neural network architecture, and voice recognition is designed through speech-to-text (STT) technology. In addition, a voice announcement is synthesized using text-to-speech (TTS) to make it easier for the blind to get information about objects. The system is built using python OpenCV tool. As a result, we implement an efficient object-detection system that helps the blind find objects in a specific space without help from others, and the system is analysed through experiments to verify performance.

**Keywords:** Object detection system, blind people, Open CV, Voice Recognition

## INTRODUCTION

Although YOLOv3, based on Darknet 53, was initially well-received for its ability to handle object detection changes, its accuracy has been criticized. While considered a classic, its detection of deformations and failures remains complex. A robust solution for handling missing components is also lacking. An optimized version of the same model then corrected this. After that, it is deployed far away and its overall performance is evaluated. In the first instance, improving analytics quality is a mistake. This is the best model. After the YOLOv4 article. To test, we can see that version three crashed even though there were additional functions for photo parsing, but they aren't the

main focus of the picture. Error experiences consistently been a difficulty concerning little depictions. Utilizing model 3 is somewhat vain for little photo examination Precision is round sixteen% (affirmed via our records). One more difficulty to word is convenience Darknet 53. CSPDarknet-53, which is superior to Darknet-fifty-three, was added in YOLOv4. Rendition three utilizes handiest sixty-six% of the wide assortment of boundaries utilized, yet gives higher impacts with that he sped up his speed and tirelessness. Precise recall curves generated using COCO API metrics allow us to make informed decisions about these three models' object detection capabilities. We tested on diverse shapes drawn in unfamiliar materials. The results show that the hidden orange area is accurately identified by the memory bend model with minimal errors. Purple concealed region recommends misdirected contraptions, blue concealed place proposes misdirected devices Limitation botches (Loc). At long last, we consider the white districts underneath the sharp bends. 0.75 shows an IOU charge more noteworthy than 0.75, and the concealed dim area demonstrates an IOU cost more than 0.75. From the contentions of the 3 models above 0. Five might be found area principally based finders F RNN and SSD have low exactness because of enormous red locales. Nevertheless, conclusion 1 states that F R-CN is more accurate than SSD, and SSD is more effective for real-time package processing and high MAP values. Just go for it could be plain to see Helpful for the sum, it has basically no seen purple regions.

## OBJECTIVE

The accuracy of voice output for blind people and the ability to identify objects in an image are the primary objectives of this project.

### LITERATURE SURVEY

#### ***1. Convincing Multi-Article Finishing Overall Thing Models and Object Impediment Learning***

***Year: 2016***

***Author: Joseph, Redmon, Santosh Divvala's, Ross Girshick, Ali Farhadi***

The trade-off between checking with accuracy and speed makes it difficult to perform the following of numerous contraptions using overall item designs. Rehearsing texture standards In-progress casing discoveries are linked to ongoing multi-object checking (Saying) techniques that make use of a single thing. Appearance and movement designs are used in these techniques. The method for greening multi-objective following is to diminish the computational complexity of coaching. Both are models. To this quit, this paper proposes overall models of beginning and improvement. Separate numerous items to investigate spatial article-specific models. Concrete specifically, it learns an overall appearance model the usage of move-objective overwhelming despite petitions, we consider the research standard relative advancement to go about as an outline of the usage of relative turn of events. This pamphlet emphasizes the importance of discipline in addition to dominating items and further developing following ability. In this assessment, the discriminant model is thought about. While there is a contention with the obstruction, it controls and inspects the two designs. Why objective-based thoroughly dominating is distinct from conventional online multi-objective thinking Method for improving the tracked down limits for each table. This integrates in general work Models and procedure for objects of rule inside the method of credit affiliations, and contrast our tracker and the contemporary procedure for public MOT Challenge datasets. As a result, we achieve 64. Five% MOTA (Different Thing Following Precision) and six. 54 Hz. To keep an eye on your speed, make use of the MOT16 check dataset. The overall outcomes show that our methodology are green Simultaneous noticing can help with additional creating precision and speed.

***Advantages:*** It has the assortment features in this endeavour.

***Downsides:*** It just perceives objects in recordings.

#### ***2. Object Recognizable proof and Following***

***Year: 2016***

***Author: Dhaval Deshpande, Nikhil Aat Kare, Prof. Reena Somani***

Various individuals visit corner stores, retail shops and stores to meander around Window purchasing to buy several things. Examining this kind of examination

Objective social thing area and following is one of the areas of pc vision. He grows incredibly fast. It gives you find and recognize things access an image or video. Thing discovery and checking can be used with this degree of prevalence and restriction. Remember the things for a given scene and pick and find the genuine district with an extra precise depiction. In this task we have involved two famous Python libraries for this method. Illustrations of discovery, OpenCV, and artificial intelligence. Today, every staple save has something like one video. Camera set up. Data is saved in a united storage facility with a period profile. Our end point become to get people to go into and leave the essential food thing shop or retail shop. Put them in front of the marks that say "Client" or "Non-Client." You have achieved your goal. We had the option to determine the creation cost.

***Advantages:*** It has the assortment features in this assignment

***Downsides:*** It can perceive the articles in accounts.

#### ***3. A learning calculation for finding objects utilizing models,***

***Year: 2019***

***Author: Tanya Ranjan***

Recognizing and distinguishing things in pictures is one of the greatest extreme obligations PC view scale, revolution, factor proportion, draw and history litter Normal inquiries Tone, profundity, inclination and force are generally utilized as references Object location and notoriety. Numerous things might be as it ought to be addressed by utilizing their figures. Shape is an exceptionally strong descriptor of noticeable recollect for high-energy identification techniques. Just recently, methods have appeared to be shaped like profiles. The majority of methods can be easily distinguished while getting close to the proposed factor. Comes nearer from bended boundaries [6] or in sync with the type of the spot. However, there may still be issues with object recognition and detection. Distinguishing devices in pic and recordings is a confounded and troublesome endeavour inside the discipline of PC creative and farsighted. Most identification calculations are delicate. Foundation litter and ileum, and its miles difficult to confine the verge of the article. The object's shape. This is regularly the most conspicuous side effect that individuals can relate to. Give this document the essential thing of the discovery technique is to utilize most straightforward the elements of the shape part. State of the thing the method is gained from a firm of tiny depictions. However, the model has meaning. A variety of approaches

are used to design the material in the strip shape. The impacts introduced in the article rivals different most recent item recognition strategies. House the commitment of this postulation is a model of figured out craftsmanship applied to reality Location in complex conditions and a shiny new two-stage thing discovery gadget.

**4. Title: Successful Multi-Item Following through Worldwide Article Models and Article Limitation Learning,  
Year: 2020**

**Authors: Yong-Sang Yoo, Seong-Ho Lee and Seung-Hwan Bae**

Following a few things is an inciting challenge as a result of the split the difference between following precision and Speed since late multi-thing following (Maxim) frameworks use the appearance and improvement of articles. Models for solidifying distinguishing pieces of proof among successive housings are crucial to green multi-objective the objective pursued is to decrease the computational multifaceted design of planning two models. As a result, the designs provided in this work's worldwide start and development provide methods for separating various substances for the purpose of local acquiring information on object-situated models. Particularly, it acquires a global animal species model employing threatening and dominating strategies.

**Advantages:** In this we can find the different thing fights at the same time

**Downsides:** The location of articles continuously won't be imaginable with this.

**5. Title: A Learning computation for model-based object acknowledgment,  
Year: 2017,**

**Year: 2017,**

**Authors: Chen Guodong, Zeyang Xia, Rongchuan Sun**

One of the most challenging tasks in computer vision is recognizing and identifying objects in images. Scaling, rotation, component modifications, blurring, and history muddle are all typical issues. Variety, power, inclination and force are normally utilized as information for thing discovery and notoriety. Numerous things might be accurately addressed through their figures. Shape is the best descriptor of clear item for high-consistency discovery. In current years, structure based absolutely and shape-based highlight based absolutely methods were proposed. Most methodologies might be comprehensively sorted as point-basically based procedures, limit bend based absolutely strategies [6] or region based thoroughly processes.

Nonetheless, there are a couple of issues with object recognition and notoriety. Object identification in photos and films is a difficult task for the circle of PC creative and perceptive. Most item discovery calculations are delicate to accurately endlessly clamour and can't track down devices. The type of count number is self-acknowledgment that is renowned with the guide of individuals in vogue. This report presents a thing orientated variant. A recognition method that utilizes just the capacities of a structure. A thing shape model is gained from a base arrangement of pictures. An item is a form of the state of the pieces. The subject is a different form. The impacts presented on this paper are serious with various state of the art objective systems. The main commitment of this paper is to apply the acquiring information on piece test as a model for thing recognition in complex conditions and another two-degree object discovery system.

#### EXISTING SYSTEM

People who're outwardly impeded or have low inventive and reasonable are as often as possible clueless about the dangers they face. Experience in everyday life. While finishing your everyday errands, you could run into a ton of issues. Movement inside the setting of a family bunch. In this work, something sagacious area gadget is proposed. It relies totally upon Convolutional Cerebrum Association (CNN) to give insightful and calm lifestyles obviously debilitated individuals. Execution become evaluated using recommend precision (Guide). In addition, when compared to Quick R-CNN, data per second and identified using a solitary shot multi-box (SSD) indicator reduce complexity at the expense of increased precision and speed.

#### Disadvantages of Existing System

- Location of object.
- Multidimensional and spatial proportions.
- Part modified
- Transformation
- Full information
- A noisy or rough historical past.

**PROPOSED SYSTEM**

The Python OpenCV system is utilized to find various contraptions. Progressively, with an ongoing literary substance peruser, the OpenCV library became utilized for picture handling. Handling since it offers help for genuine time programs. Python Programming The language is utilized to build a gadget acquiring information on model. The TensorFlow library offers developers tools to build machine learning models, including one for object detection. This technique enables devices to recognize objects accurately and efficiently without computationally intensive calculations. Its flexible architecture allows for training and deployment on various platforms. This capability empowers fast object detection in real-time.

**Advantages of Proposed System**

- It's faster speech recognition.
- It is fairly accurate object and precise location.

**SYSTEM ARCHITECTURE**

Object location is the second most material type of picture notoriety (after class). Also, find numerous things at rapid. Convolutional neural network architectures like Retina NET and YOLO are used for detection in deep learning based on object methods. Nearby offers, SSD, and Centernet.

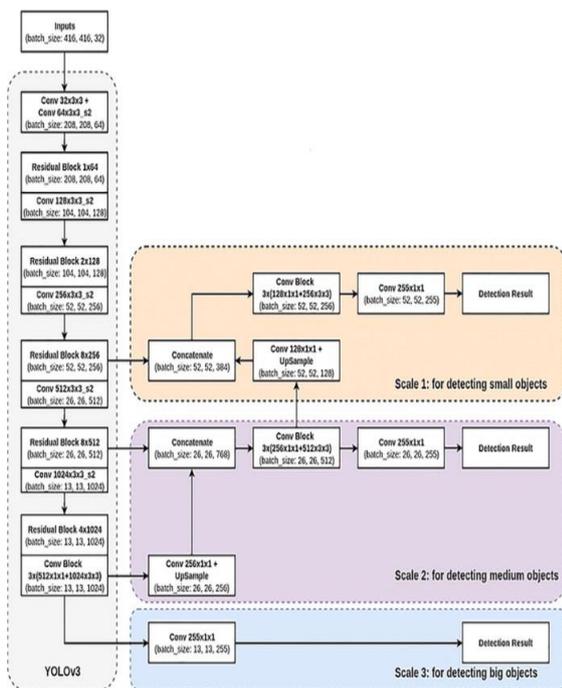


Fig:1.1 System Architecture for YOLO Algorithm

**FLOW DIAGRAM**

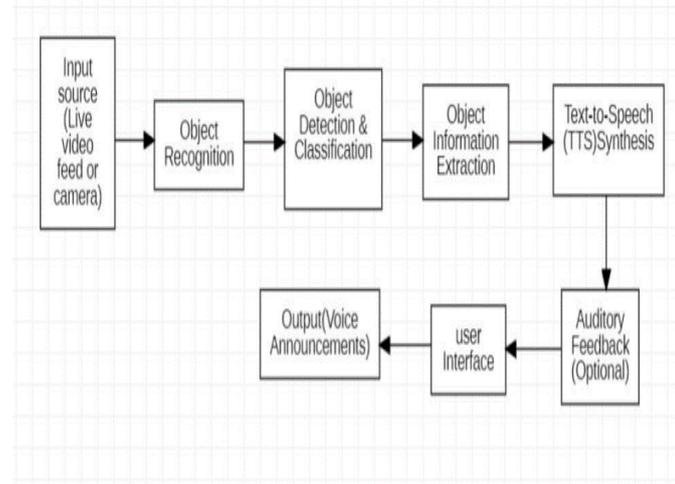


Fig:2 Flow Diagram for YOLO Algorithm

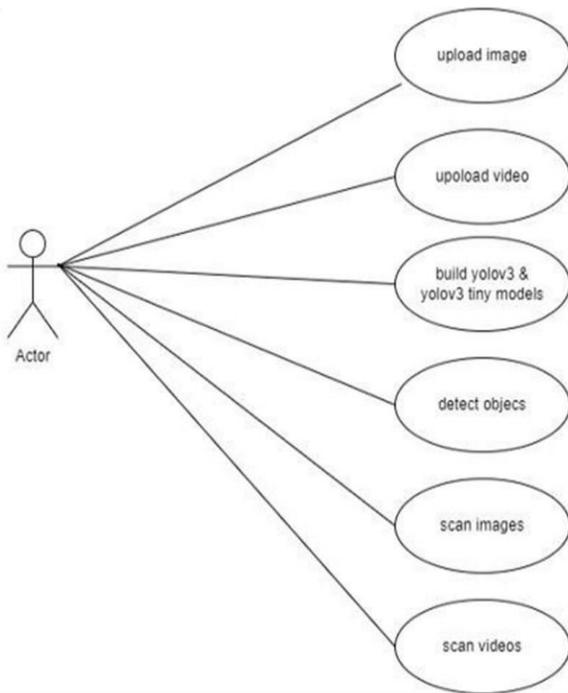
Fig 2: The system starts by taking input from a live video feed or camera source. The input frames undergo object recognition, which includes object detection and classification using the YOLO algorithm. The relevant information about the recognized objects is extracted. The extracted object information is passed to the TTS synthesis module, where it is converted into voice announcements. Optionally, auditory feedback may be provided during object detection or TTS processing. The system offers an accessible user interface for user interaction and requesting object information. The synthesized voice announcements containing object information are delivered as output to the user.

**DESIGN UML DIAGRAMS**

Design deals with the various UML [Unified Model language] diagrams for the implementation of project. Design is a meaningful engineering representation of a thing that is to be built. Software design is a process through which the requirements are translated into representation of the software. Design is the place where quality is rendered in software engineering. Design is the means to accurately translate customer requirements into finished product.

**USE CASE DIAGRAM**

The use case diagram is the main building block of object-oriented model. It is used both for general conceptual model of the systematic of the application, and for detailed model translating the models into programming code.

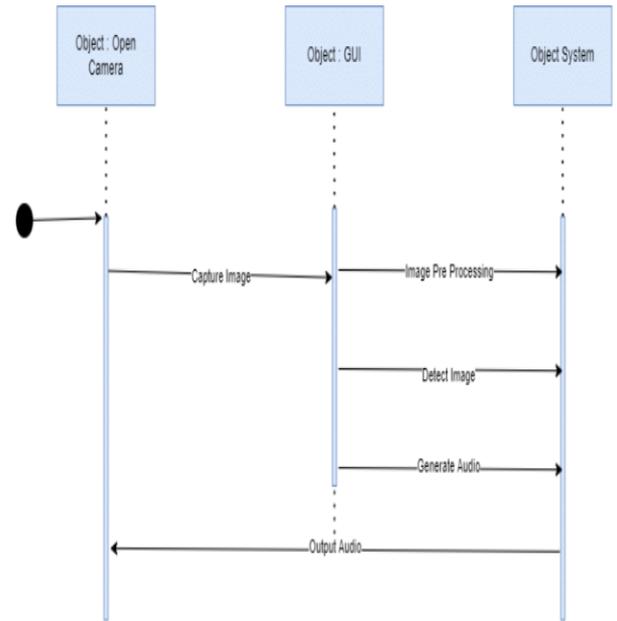


*Fig:3.1 USE CASE DIAGRAM FOR OBJECT MODELING*

*Fig: 3.1* In this use case diagram: The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted. In our use case diagram upload image or video, build yolov3, scan images and videos and detect objects.

**SEQUENCE DIAGRAM**

Sequence diagrams specifically focus on lifelines, or the processes and objects that live simultaneously, and the messages exchanged between them to perform a function before the lifeline ends.



*Fig:3.2 SEQUENCE DIAGRAM FOR OBJECT DETECTION*

*Fig: 3.2* In this sequence diagram. The object is captured live through mobile camera and this captured image gets passed through object GUI where image preprocessing process takes place, where object is detected and audio is generated for that particular detected object along with position of that detected object in object system and this generated audio is given as output to user.

**CLASS DIAGRAM**

The class diagram is the main building block of object-oriented model. It is used both for general conceptual model of the systematic of the application, and for detailed model translating the models into programming code. In class diagram took the text conversion stream-server, prepare stream, interfaces, and microphone.

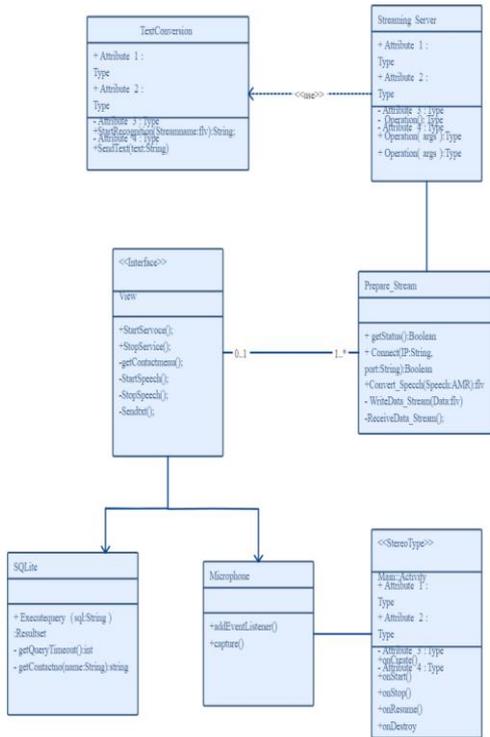


Fig: 3.3 CLASS DIAGRAM FOR OBJECT MODELING

E-R DIAGRAM

The workflow of activities and their modules are defined in ER diagram for the proposed system. That could be done through the visual representation for the proposed theme.

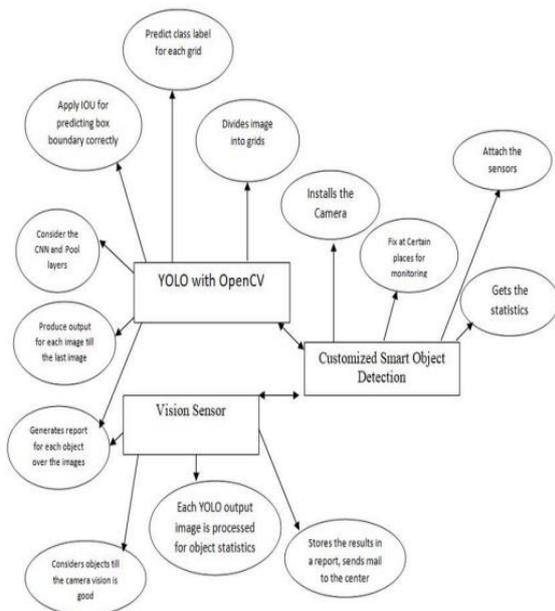


FIG:3.4 ER DIAGRAM FOR CUSTOMIZED SMART OBJECT DETECTION

MODULES

- 1.Open CV Module
- 2.Tensor Flow Module
- 3.PY Torch module

1.Open CV Module:

OpenCV is a Python library that allows in you to perform picture handling and PC creative and perceptive obligations. It offers a variety of capabilities, such as object detection, facial recognition, and more. In the OpenCV Python tutorial that follows, we can learn more about the library. OpenCV is a Python library that allows you to perform computer vision and image processing tasks. It offers different highlights including object discovery, facial standing and following. In this OpenCV Python instructional exercise, we will explore extra about the library.

CV is an acronym for computer vision in OpenCV. It is defined as a subject of study that enables computers to understand digital images and photos.

The thought process of pc innovative and insightful is to figure out the substance material of depictions. It takes an outline from pictures, which could be something like a 3-D model, a textual description, or even an item. For instance, vehicles might be prepared with PC vision which can comprehend different things around the street, including site guests lighting apparatuses, people on foot, street signs, and so on.

PC creative and judicious allows in PC frameworks to do the indistinguishable obligations as people with the equivalent capacities. There are two chief works which may be characterized under;

Request of elements. In category, we construct an item model using data from specific objects. The version divides new gadgets into subjects or categories.

Meaning indistinguishable o. With object notoriety, our rendition can secure a specific illustration of an item, as an example, through dividing two countenances in a photo and sorting out one as Virat Kohli and the option as Rohit Sharma.

Numbers indicate the depth of the image at a particular location. In the image over, the pixel values for a grayscale photograph contain just a single cost - the power of dark at that variable.

There are boundless ways of seeing pic:

### 1. Shades of Dim:

Grayscale photos are pic that contain handiest hues: highly contrasting. In any case, while he estimates explicit powers, dark is viewed as more fragile force, and white is viewed as better power. At the point when we utilize a grayscale photo, the PC doles out a worth to each pixel in light of its confirmation of haziness.

### 2. RGB

RGB is the total of red, un-practiced, and blue to make a pristine hue. The PC extricates this expense from each pixel and puts the ramifications for translation.

### 2. Tensor Flow Module

TensorFlow is an open inventory programming library. TensorFlow transformed into at first high level through specialists and designers running in the Google Cerebrum group on the Google Machine Knowledge Exploration Establishment to conduct device learning and profound brain local area studies, yet it's miles a well-known enough structure that might be utilized for parcels various bundles. Fields, as well! First we should attempt to grasp what the term TensorFlow way! TensorFlow is a software library that uses records float diagrams for numerical computation.

Where:

- Chart hubs address numerical activities.
- At the edges of the diagram, multi-faceted realities (called tensors) are given among them.

### 3. PY Torch:

PY-Torch is a profound getting to realize system fundamentally founded on the Python contraption acquiring information on the inclusive bundle.

I will do. This instructional is meant to make it easy to complete a challenging mastery task. PY-Torch is extremely proficient.

PY-Torch is a little PC programming based at the Face library. It is high Facebook's Learning Structure PY-Torch is framework getting to be aware. A library of the Python programming language utilized for bundles which incorporates Nature Language handling. Coming up next are the apex lines given through PY-Torch:

1. With the help of Designs Handling Unit (GPU), it gives tensor figuring serious areas of strength for with.
2. A profound brain network manages the cost of a huge evaluation of framework principally based structures.

PY-Torch is intended for more prominent adaptability and speed while forcing and developing profound acquiring information on brain organizations. You are aware that this is a system learning

library. Python is the programming language, so it is very simple to install, run, and comprehend. PY-Torch is totally Pythonic (involving a to be expected Python language for composing Java and C++ code), so you can fabricate a brain local area variant quick and accurately. What might be said about PY-Torch that forms a unique profound getting to know model? A dynamic library. PY-Torch A dynamic library is one that can be used in accordance with your preferences and modifications. It is currently frequently utilized by finishers of Kaggle contests.

## SYSTEM REQUIREMENTS

### Software Specifications

- OS: Windows 7, 8
- Module: OpenCV, Tenser-flow
- Language: python 2.7
- Software: PyCharm

### Hardware Specifications

- RAM: 8GB (min)
- Hard Disk: 2 GB
- Key Board: Standard Windows Keyboard
- Mouse: Two or Three Button Mouse

## RESULT AND DISCUSSION

YOLOv3 is the nice trade in item detection due to the fact that the appearance of Darknet fifty-three. The replace become well acquired by way of critics and different industry professionals. But he became wrong. Although YOLOv3 is still considered a veteran, the analysis confirmed a lack of complexity and no finest answers for lost capability. This changed into then adjusted to an optimum version and then used and tested to enhance performance.

The advanced version of this software is high-quality applicable for reading errors first. After reading the YOLOv4 article, we are able to see that model three crashes while you want to create numerous traces within the picture, however they may be now not the principle point of the image. Inaccuracy has continually been in trouble with regards to low-resolution pics. Version three used to investigate small pictures is nearly vain because the accuracy is ready sixteen% (confirmed through our information). Using Darknet 53 is any other issue to note. YOLOv4 achieves CSPDarknet-53, which is higher than Darknet fifty-three, which makes use of most effective 66%

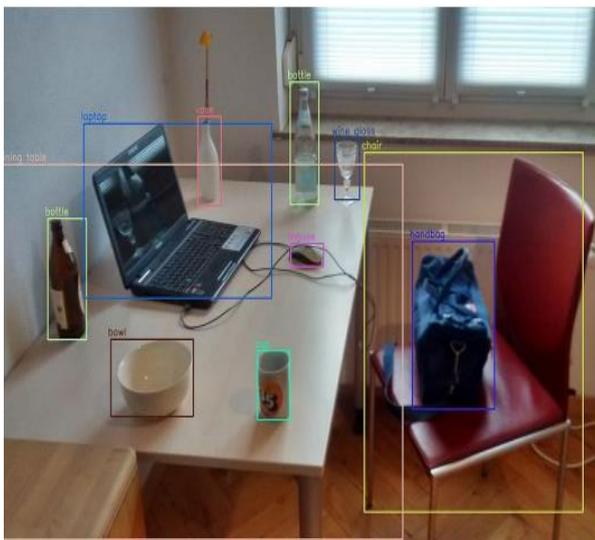
of the range of parameters utilized by version 3, however offers better outcomes. Increased velocity and accuracy.

Recall accuracy curves built using the COCO Metric, API allowed us to draw valid conclusions approximately the potential of these 3 models to provide object detection. For each model, graphs were made based on objects of various sizes.

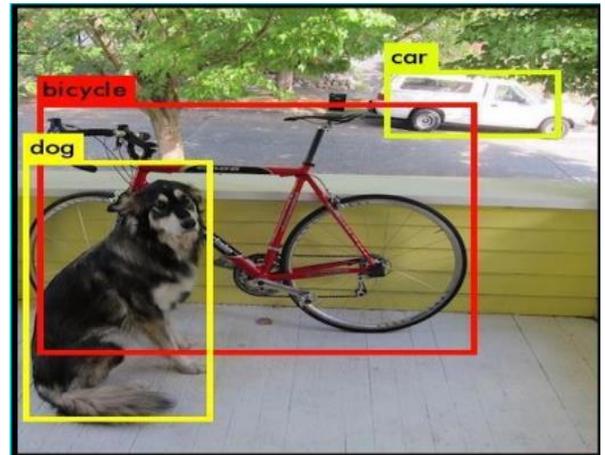
Shaded golden location shows correctly recalled curve with no mistakes, shaded purple place suggests undetected objects, and shaded blue region suggests localization errors (Loc.). Finally, the white areas underneath the most accurate do not forget curve imply an IOU value extra than 0. Seventy-five, and the shaded grey region shows an IOU fee greater than zero.75.

Than 0.5 From the arguments of the 3 examples, it can be visible that both place-based detectors which include F RCN and SSD have low accuracy because of big violet-scented regions. However, alternatively, F R-CN is extra accurate than SSD, whilst SSD is extra green for real-time processing applications with high map values. YOLO often is the most efficient bundle, as evidenced with the aid of the nearly non-existent purple areas.

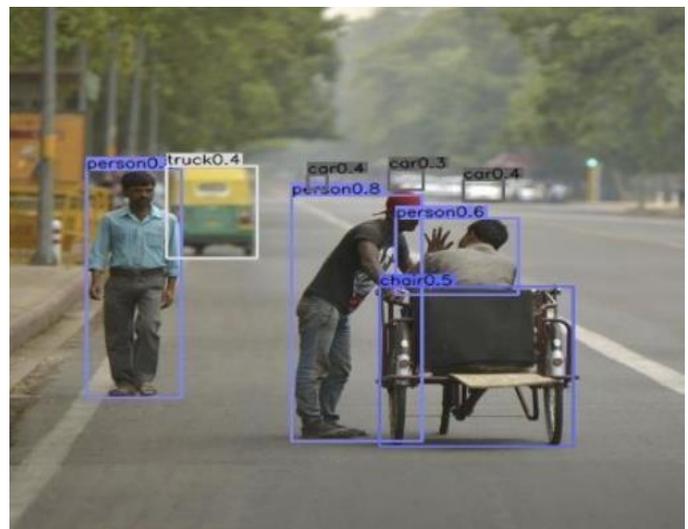
*Sample Output*



*Fig: 4.1 OUTPUT 1*



*Fig: 4.2 OUTPUT 2*



*Fig: 4.3 OUTPUT 3*

Assessment Scales

This stage examines the study attributes of thing discovery and crucial results revealing guidelines in convoluted conditions. Moreover, this part breaks down the adequacy of the systems referenced in Area 3 with quantitative and subjective causes. Finally, we present our experimental results for the three most typical dataset challenges.

Criteria for judgment It is absolutely necessary to standardize a method for evaluating the effectiveness of tactics on comparable statistics sets. Since thing identification in complex conditions is very much like conventional thing recognition, they utilize practically identical metric evaluation strategies.

Inconspicuously

The percent of the above region having a place with genuine land is precisely portrayed. Figure sixteen delineates the distinction among an accurately distinguished object and an erroneously recognized object.

In which TP addresses real up-sides and FP counterfeit up-sides.

Pull out

To gauge, its miles determined as a percent of the genuine spot that is in the expected spot.

By taking into account the concordant imply of precision, F-degree F measures are calculated.

Get stage through association

Convergence in addition to association (IOU) is one of the most basic assessment measurements naturally used to choose the presentation of thing recognition calculations. At the point when the actual land offers the truth it addresses the size of the previously mentioned U. S. A.

Normal Knowledge (AP)

Normal accuracy computes the typical accuracy for particular levels of remember. The higher the AP esteem, the higher the presentation as well as the other way around.

Mean Outright Mistake (MAE)

The propose outright bumbles measures the mean outright qualification on the pixel stage among the normal expense and the genuine worth.

Normal precision is 30"

Mean normal exactness (Guide) is another broadly utilized evaluation measure for object-exact class location. MAP is the typical utilizing force determined all through all examples.

Activity examination

Object identification in complex conditions is utilized to separate things from the legacy and change their hindrances. Rundown of appraisal of different generally speaking execution techniques. A particular evaluation metric is produced by various methods.

Consequently, we relegated "-" to peculiar size. Additionally, all methods utilized exceptional evaluation metrics and provided results for individual information units. Therefore, it is impossible to apply the findings presented in this table to every situation. Obviously every one the data utilized can be comparably exceptional.

For example, the mode inside the led area arrives at an AP of 0.490. Forty-nine at the SKU-110K dataset. Because of issues expressed inside the records, the mode may moreover find things toward the front of the digicam or embed numerous devices into a similar tastefulness. The strategy introduced in acquiring AP zero.340.34 on dataset Ex-Dark consolidates darkish indoor scenes, making thing identification more prominent testing. In a similar vein, the KAIST dataset's modes are 0.350.35 and 0.680.68 for the MAP relationships, which include pairs of thermal and RGB images. movies at night or when the weather is bad.

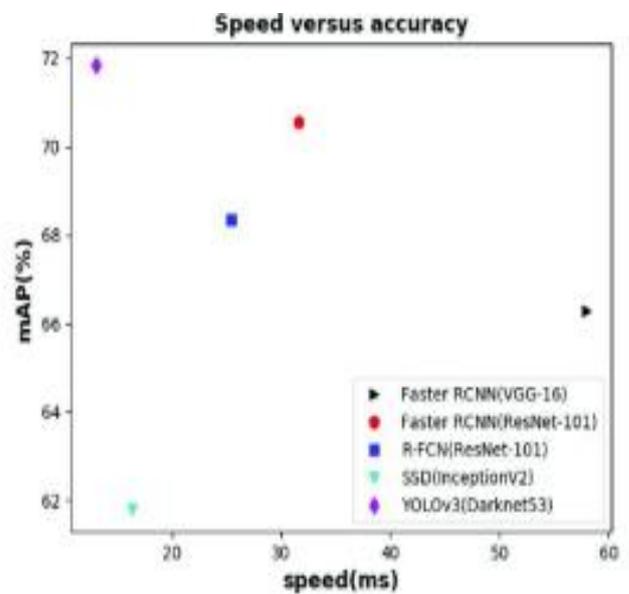


Fig:5 Speed & Accuracy

One more strategy for distinguishing road signs in evening pictures [62] accomplishes zero. 94 Guide at the DFG dataset, high level Sasakawa's strategy distinguishes objects with record 0.550.55 on the SID dataset, which consolidates low-gentle pictures. Additionally, Wang scored 0.900.90 at the VOT-2018 dataset. The methodology presented here changes over evening photos to day photographs sooner than object location, getting a guide cost of zero.820. Eighty-two, and

Kamal's strategy played out an AP of 0,940. Ninety-four at the CURA-TSD dataset, which is shown. For straightforward entry, we gift the impacts in a different work area as they expressed the results of oneself regulated quantitative assessment. Importantly, we emphasize that all methods, with the exception of five, do not control their computational homes.

In addition to the quantitative evaluation, we looked at a number of strategies, noticed their flaws, and saw from a

bird's eye perspective that the proposed strategy couldn't reach humans. In like manner, the works are mistaken for the lifeless human things inside the figures.

setbacks. Mobile phones can be without inconvenience conveyed and the mechanical assembly's camera can track down issues around it and result it with everything looking good. This is how we assist the obviously debilitated with "seeing their ears".

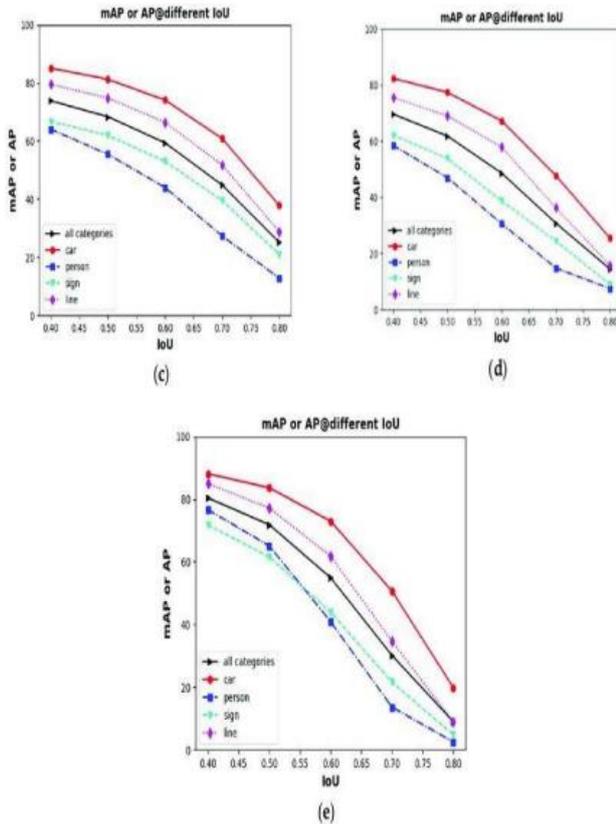


Fig: 6

CONCLUSION

This plan can be widely used to offer assurance and solace to surprise individuals in their reliably presence. Moreover, it is expected to be used in business locales where detectable quality is restricted, which consolidate coal mining tunnels and sea beds, with motivation to basically help gathering and business improvement. in terrible condition. The goal of the view is to assist people with evident ineptitudes live extra independently. Ostensibly debilitated individuals can defeat a portion of the perils they stumble over in standard ways of life through examining a book or strolling. Successful application use and the city's response to voice availability Therefore, this help hinders conceivable

REFERENCE

- [1] Global data on visual impairment, World-Health Organization.
- [2] Tom M. Mitchell "Machine Learning". McGraw Hill Education 2017. © 2021 IJRTI | Volume 6, Issue
- [3] ISSN: 2456-3315 IJRTI2103004 International Journal for Research Trends and Innovation (www.ijrti.org) 20 3. Rafael C. Gonzalez and Richard E. Woods "Digital Image Processing". Pearson 2018.
- [4] Aditya Raj, Manish Kannaujiya, Ajeet Bharti, Rahul Prasad, Namrata Singh, Ishan Bhardwaj "Model for Object Detection using Computer Vision and Machine Learning for Decision Making " International Journal of Computer Applications (0975 – 8887) Volume 181 – No. 43, March 2019.
- [5] Selman TOSUN, Enis KARAARSLAN "Real-Time Object Detection Application for Visually Impaired People: Third Eye". IEEE Conferences 2018.
- [6] "Jayshree R Pansare, Aditi Gaikwad, Vaishnavi Ankam, Priyanka Karne and Shikha Sharma
- [7] "Real - Time Text Reader" International Journal of Computer Applications 182(34):42- 45, December 2018.
- [8] OpenCV, <https://opencv.org/>.
- [9] Python programming language, <https://www.python.org/>.
- [10] Tensor-flow, <https://www.tensorflow.org/>
- [11] Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi "You Only Look Once: Unified, Real-Time Object Detection". Cornell University, Jun 2015 1
- [12] Google "Google Cloud Services", <https://cloud.google.com/>
- [13] Xinyu Zhou, Cong Yao, He Wen, Yuzhi Wang, Shuchang Zhou, Weiran He, Jiajun Liang "EAST: An Efficient and Accurate Scene Text Detector". Cornell University, Jul 2017.
- [14] Tesseract-Ocr. 58

- [15] Google Cloud Text-to-Speech,  
<https://cloud.google.com/text-to-speech>
- [16] Face Detection & Recognition from  
Images & Videos Based on CNN & Raspberry Pi  
M Zamir, N Ali, A Naseem,
- [17] A Ahmed Frasteen, B Zafar, M Assam,  
M Othman, EA Attia Computation, 2022.
- [18] A real-time framework for human face  
detection and recognition in cctv images R Ullah,  
H Hayat, AA Siddiqui, UA Siddiqui... -  
Mathematical ..., 2022
- [19] Design of object detection and  
recognition system to monitor students during  
online examinations using Machine Learning  
algorithms," M. Geetha, R. S. Latha, S. K. Nivetha,  
S. Hariprasath, S. Gowtham and C. S. Deepak,  
International Conference on Computer  
Communication and Informatics (ICCCI),2021,  
pp. 1-4, doi: 10.1109.