

Applications of Object Detection System

Abdul Vahab¹, Maruti S Naik², Prasanna G Raikar³, Prasad S R⁴

^{1,2,3}Anjuman Institute of Technology and Management, Bhatkal

⁴Professor of Computer Science and Engineering department AITM, Bhatkal)

Abstract - Object detection is a key ability required by most computer and robot vision systems. The latest research on this area has been making great progress in many directions. Object detection and tracking has a variety of uses, This paper presents the various applications of object detection system. In this we discuss current and future applications of object detection system in various fields

Key Words: Object Detection System, Object Extraction, Face Detection, Object Recognition, Object counting.

1. INTRODUCTION

Object detection using deep learning and computer vision to work with video streams and video files is provide features to identify the different kinds of objects. Object recognition is an important task in image processing and computer vision. It is concerned with determining the identity of an object being observed in an image. Humans can recognize any object in the real world easily without any efforts, on contrary machines by itself cannot recognize objects. Object Detection is a basic visual perception task and one of the key areas of applications of Computer Vision. It essentially deals with finding and locating specific objects within an image.

Object recognition is one of the fundamental tasks in computer vision. It is the process of finding or identifying instances of objects in digital images, stored videos and real time videos.

2. OBJECT DETECTION

Object detection is a computer technology related to computer vision and image processing that detects and defines objects such as persons, vehicles and animals from digital images and videos. This technology has the power to classify just one or several objects within a digital image or video at once. Object detection has been around for years, but is becoming more apparent across a range of industries now more than ever before. To build object detection system we have many methods but Object detection using deep learning technic (If we combine both the MobileNet architecture and the Single Shot Detector framework, we arrive at a fast, efficient deep learning-based method to object detection) gives more accuracy for variety of object classes.

Object tracking is the process of locating moving objects over time using the camera in video sequences. The objective of object tracking is to associate target objects in consecutive video frames. Object tracking requires location and shape or features of objects in the video frames. So, object detection and object classification is the preceding steps of object tracking in computer vision application. To detect or locate the moving object in frame, Object detection is first stage in tracking. After that, detected object can be classified as vehicles, human, birds and other moving objects. It is challenging or difficult task in the image processing to track the objects into consecutive frames. Various challenges can arise due to complex object motion, irregular shape of object, occlusion of object to object and object to scene and real time processing requirements.

Object recognition methods frequently use extracted features and learning algorithms to recognize instances of an object or images belonging to an object category. Object class recognition deals with classifying objects into a certain class or category whereas object detection aims at localizing a specific object of interest in digital images or videos. Every object or object class has its own particular features that characterize themselves and differentiate them from the rest, helping in the recognition of the same or similar objects in other images or videos.

Classification: Given an image patch, decide which of the multiple possible categories is present in that patch.

Localization and Detection: Given a complex image, decide if an specific object of interest is located somewhere in this image, and provide accurate location information on the object.

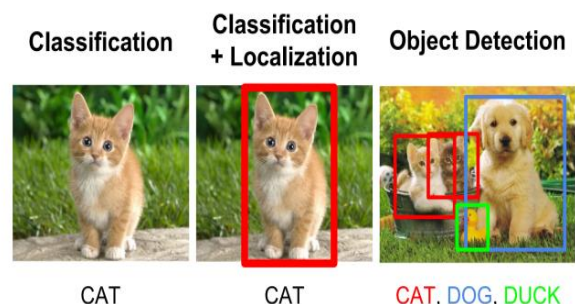


Fig 2.1 Object Detection Process

3. APPLICATIONS

Object detection is breaking into a wide range of industries, with use cases ranging from personal security to productivity in the workplace. Object detection and recognition is applied in many areas of computer vision, including image retrieval, security, surveillance, automated vehicle systems and machine inspection. Significant challenges stay on the field of object recognition. The possibilities are endless when it comes to future use cases for object detection. Here we can discuss some current and future applications in detail.

3.1 OPTICAL CHARACTER RECOGNITION

Optical character recognition or optical character reader, often abbreviated as OCR, is the mechanical or electronic conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo) or from subtitle text superimposed on an image, we are extracting characters from the image or video.



Fig 3.1 Optical Character Recognition

Widely used as a form of information entry from printed paper data records – whether passport documents, invoices, bank statements, computerized receipts, business cards, mail, printouts of static-data, or any suitable documentation it is a common method of digitizing printed texts so that they can be electronically edited, searched, stored more compactly, displayed on-line, and used in machine processes such as cognitive computing, machine translation, (extracted) text-to-speech.

3.2 SELF DRIVING CARS

One of the best examples of why you need object detection is In order for a car to decide what to do in next step whether accelerate, apply brakes or turn, it needs to know where all the objects are around the car and what those objects are That requires object detection and we would essentially train the car to detect known set of objects such as cars, pedestrians, traffic lights, road signs, bicycles, motorcycles, etc.

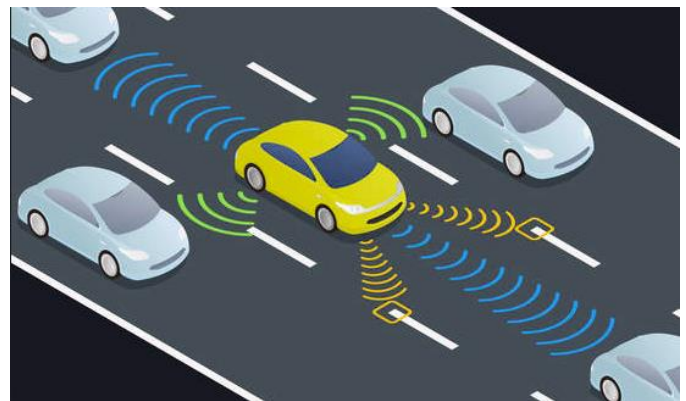


Fig 3.3.1 Tracking Vehicles

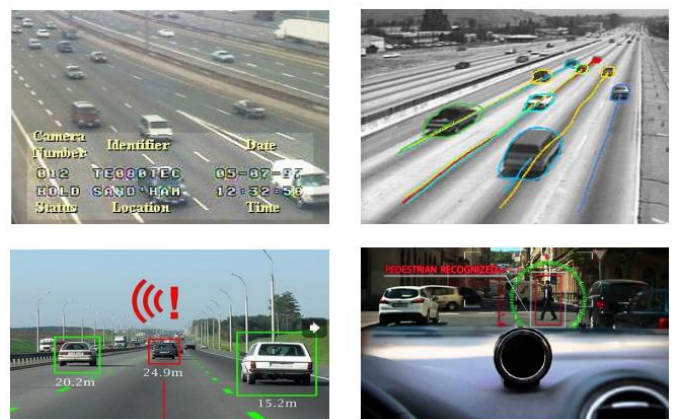


Fig 3.2 Self Driving Vehicles

3.3 TRACKING OBJECTS

Object detection system is also used in tracking the objects, for example tracking a ball during a football match, tracking movement of a cricket bat, tracking a person in a video. Object tracking has a variety of uses, some of which are surveillance and security, traffic monitoring, video communication, robot vision and animation.

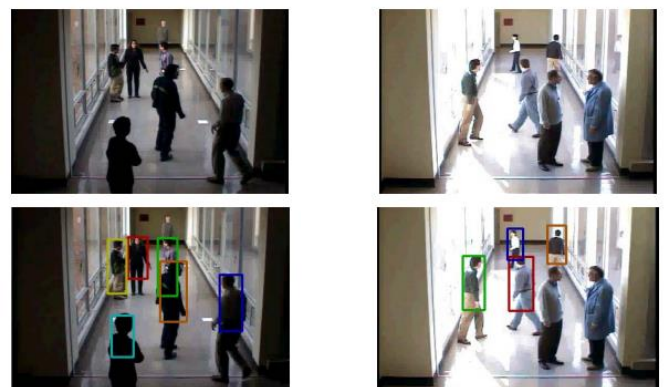


Fig 3.3.2 Tracking People

3.4 FACE DETECTION AND FACE RECOGNITION

Face detection and Face Recognition is widely used in computer vision task. We noticed how facebook detects our face when you upload a photo This is a simple application of object detection that we see in our daily life.Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Examples include upper torsos, pedestrians, and cars.

Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. Face recognition describes a biometric technology that goes way beyond recognizing when a human face is present. It actually attempts to establish whose face it is. Face-detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image stores in database. Any facial feature changes in the database will invalidate the matching process.

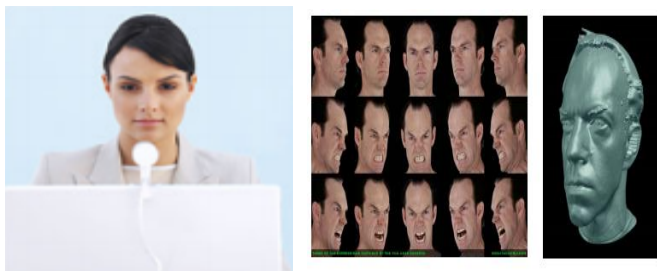


Fig 3.4 Face Recognition and Detection

There are lots of applications of face recognition. Face recognition is already being used to unlock phones and specific applications. Face recognition is also used for biometric surveillance, Banks, retail stores, stadiums, airports and other facilities use facial recognition to reduce crime and prevent violence.

3.5 IDENTITY VERIFICATION THROUGH IRIS CODE

Iris recognition is one of the most accurate identity verification systems. Identity verification and identification is becoming increasingly popular. However, advances in the field have expanded the options to include biometrics such as iris, retina and more. Among the large set of options it has been shown that the iris is the most accurate biometric. Hence we need object detection system in iris detection

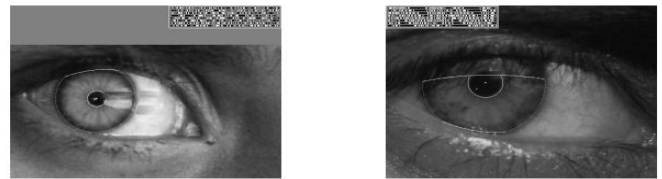


Fig 3.5 Identity Verification through Iris code

3.6 OBJECT EXTRACTION FROM AN IMAGE OR VIDEO

Object Extraction is a closely related issue with the segmentation process. Image Segmentation is a process of dividing an image into sub partition based on some characteristics like color, intensity etc. The main goal of object extraction is to change the representation of an image into something more meaningful. To extract an object from the image first we have to segment the entire image. User select the region as background and foreground by using the markers and then the algorithm will segment the image and the foreground region will be extracted from the image. In future we can also be able to extract the required object from video with further improvement of this technology.



Fig 3.6 Object Extraction from an Image

3.7 SMILE DETECTION

Facial expression analysis plays a key role in analyzing emotions and human behaviors. Smile detection is a special task in facial expression analysis with various potential applications such as photo selection, user experience analysis and patient monitoring.

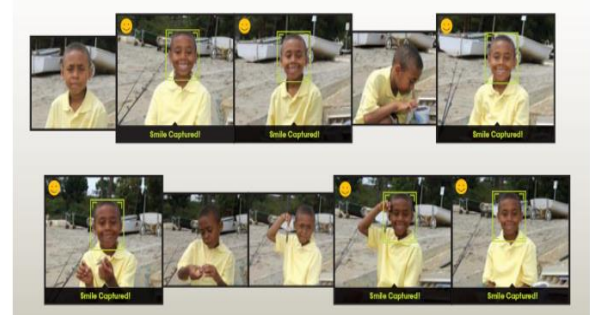


Fig 3.7 Smile Detection

3.8 ACTIVITY RECOGNITION

Activity recognition aims to recognize the actions and goals of one or more agents from a series of observations on the agents actions and the environmental conditions. This research field has captured the attention of several computer science communities due to its strength in providing personalized support for many different applications and its connection to many different fields of study such as human-computer interaction, or sociology.

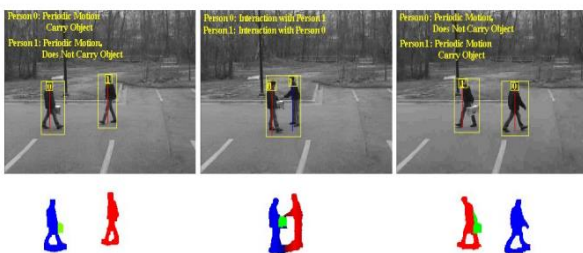


Fig 3.8 Activity Recognition

3.9 PEDESTRIAN DETECTION

Pedestrian detection is an essential and significant task in any intelligent video surveillance system, as it provides the fundamental information for semantic understanding of the video footages. It has an obvious extension to automotive applications due to the potential for improving safety systems.

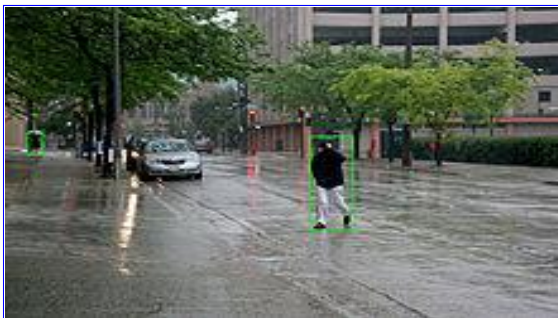


Fig 3.9 Pedestrian Detection

3.10 DIGITAL WATERMARKING

A digital watermark is a kind of marker covertly embedded in a noise-tolerant signal such as audio, video or image data. It is typically used to identify ownership of the copyright of such signal. "Watermarking" is the process of hiding digital information in a carrier signal; the hidden information should, but does not need to, contain a relation to the carrier signal. Digital watermarks may be used to verify the authenticity or integrity of the carrier signal or to show the identity of its owners. It is prominently used for

tracing copyright infringements and for banknote authentication.

Digital watermarking may be used for a wide range of applications such as Copyright protection, Source tracking (different recipients get differently watermarked content), Broadcast monitoring (television news often contains watermarked video from international agencies), Video authentication, Software crippling on screencasting and video editing software programs, ID card security, Fraud and Tamper detection, Content management on social networks.

3.11 MEDICAL IMAGING

Medical image processing tools are playing an increasingly important role in assisting the clinicians in diagnosis, therapy planning and image-guided interventions. Accurate, robust and fast tracking of deformable anatomical objects such as the heart, is a crucial task in medical image analysis.

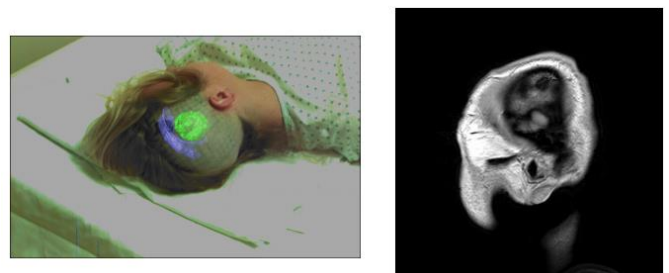


Fig 3.11 Medical Imaging

3.12 BALL TRACKING IN SPORTS

Increase in the number of sport lovers in games like football, cricket, etc. has created a need for digging, analyzing and presenting more and more multidimensional information to them. Different classes of people require different kinds of information and this expands the space and scale of the required information. Tracking of ball movement is of utmost importance for extracting any information from the ball based sports video sequences and we can record the video frame according to the movement of the ball automatically.



Fig 3.12 Ball Tracking in Sports

3.13 OBJECT RECOGNITION AS IMAGE SEARCH

By Recognizing the objects in the images ,combining each object in the image and passing detected objects label in the URL we can make the object detection system as image search.



Fig 3.13 Object Recognition as Image Search

3.14 MANUFACTURING INDUSTRY

Object detection is also used in industrial processes to identify products. Since the industrial revolution, humanity has made tremendous progress in manufacturing. With time we have seen more and more manual work being replaced by automation through advanced engineering, computers, robotics and now IoT which uses object detection system.

We believe that recent advances in AI (Deep Learning to be more precise) will help accelerate this trend towards automation in a fascinating way. In the process of Quality management, sorting, assembly line Object detection is a part of the process.

3.15 ROBOTICS

Autonomous assistive robots must be provided with the ability to process visual data in real time so that they can react adequately for quickly adapting to changes in the environment. Reliable object detection and recognition is usually a necessary early step to achieve this goal.



Fig 3.15 Robotics

3.16 AUTOMATED CCTV

Surveillance is an integral part of security and patrol. Recent advances in computer vision technology have led to the development of various automatic surveillance systems, however their effectiveness is adversely affected by many factors and they are not completely reliable. This study investigated the potential of automated surveillance system to reduce the CCTV operator workload in both detection and tracking activities.

Normally CCTV is Running every time, so we need large size of memory system to store the recorded video. By using object detection system we can automate CCTV in such a way that if some objects are detected then only recording is going to start. Using this we can decrease the repeatedly recording same image frames, which increases the memory efficiency. We can decrease the memory requirement by using this object detection system.

3.17 AUTOMATIC IMAGE ANNOTATION

Automatic image annotation (also known as automatic image tagging or linguistic indexing) is the process by which a computer system automatically assigns metadata in the form of captioning or keywords to a digital image. This application of computer vision techniques is used in image retrieval systems to organize and locate images of interest from a database.

This method can be regarded as a type of multi-class image classification with a very large number of classes - as large as the vocabulary size. Typically, image analysis in the form of extracted feature vectors and the training annotations words are used by machine learning techniques to attempt to automatically apply annotations to new images. The first methods learned the correlations between image features and training annotations, then techniques were developed using machine translation to try to translate the textual vocabulary with the 'visual vocabulary', or clustered regions known as blobs. Work following these efforts have included classification approaches, relevance models and so on.

3.18 AUTOMATIC TARGET RECOGNITION

Automatic target recognition (ATR) is the ability for an algorithm or device to recognize targets or other objects based on data obtained from sensors.

Target recognition was initially done by using an audible representation of the received signal, where a trained operator who would decipher that sound to classify the target illuminated by the radar. While these trained operators had success, automated methods have been developed and continue to be developed that allow for more accuracy and speed in classification. ATR can be used to identify man made objects such as ground and air vehicles as well as for biological targets such as animals, humans, and

vegetative clutter. This can be useful for everything from recognizing an object on a battlefield to filtering out interference caused by large flocks of birds on Doppler weather radar.

Possible military applications include a simple identification system such as an IFF transponder, and is used in other applications such as unmanned aerial vehicles and cruise missiles. There has been more and more interest shown in using ATR for domestic applications as well. Research has been done into using ATR for border security, safety systems to identify objects or people on a subway track, automated vehicles, and many others.

3.19 OBJECT COUNTING

Object detection system can also be used for counting the number of objects in the image or real time video.

People Counting: Object detection can be also used for people counting, it is used for analyzing store performance or crowd statistics during festivals. These tend to be more difficult as people move out of the frame quickly (also because people are non rigid objects).

3.20 ONLINE IMAGES

The Object Detection and Recognition system In Images is web based application which mainly aims to detect the multiple objects from various types of images. It also recognizes the images after performing the detection

Apart from these object detection can be used for classifying images found online. Obscene images are usually filtered out using object detection.

4. CONCLUSION

The future of object detection has massive potential across a wide range of industries. We are thrilled to be one of the main drivers behind real time intelligent vision, high performance computing, artificial intelligence and machine learning, which has allowed us to create a solution for the real time problems. We are going to discuss this from the need of computer vision to how and why to detect objects, and its applications in different fields. In this paper we presented different applications of object detection using computer vision and deep learning.

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BIOGRAPHIES



Abdul Vahab

Department of Computer Science and Engineering,
Anjuman Institute of Technology and Management, Bhatkal.



Maruti S Naik

Department of Computer Science and Engineering,
Anjuman Institute of Technology and Management, Bhatkal.



Prasanna G Raikar

Department of Computer Science
and Engineering,
Anjuman Institute of Technology
and Management, Bhatkal..