1. **The project idea in details:**

**a) Overview**

**Object detection technique helps in the detection, and localization of multiple visual instances of objects in an image. It provides a much better understanding of the object as a whole, rather than just basic object classification. This method can be used to count the number of instances of unique objects and mark their precise locations, along with labeling. With time, the performance of this process has also improved significantly, helping us with real-time use cases. All in all, it answers the question: “What object is where and how much of it is there?”.**

**Object detection is commonly confused with image recognition, so before we proceed, it’s important that we clarify the distinctions between them.**

Timeline

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**Image recognition assigns a label to an image. A picture of a dog receives the label “dog”. A picture of two dogs, still receives the label “dog”. Object detection, on the other hand, draws a box around each dog and labels the box “dog”. The model predicts where each object is and what label should be applied. In that way, object detection provides more information about an image than recognition.**

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**b) How it works**

**The main concept behind object detection is that every object will have its features. These features can help us to separate objects from the other ones. Object detection methodology uses these features to classify the objects.**

**In order to achieve this, we can have a variety of approaches, but there are two main approaches- a machine learning approach and a deep learning approach. In more traditional ML-based approaches, computer vision techniques are used to look at various features of an image, such as the color histogram or edges, to identify groups of pixels that may belong to an object. These features are then fed into a regression model that predicts the location of the object along with its label.**

**one of the machine learning approach (which requires the features to be defined explicitly) algorithms is ANN, we make an architecture of artificial neural networks (which are brain-inspired mathematical models intended to replicate the way that humans learn) and train it with some open source dataset to make a real-time output in order to be able to detect any given object in real time and thus making the output with the name of the object around it.**

**As a user view: we get a set of data images for different objects and code our system to learn these images by knowing the features of every object that could be used to differentiate it with other objects.**

**Ex: a car has some features like shape of tiers, window, color … etc.**

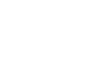
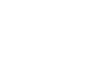
A picture containing text

Description automatically generated**After that the computer now the features of every object so, we pass the source of an image or video (input pc& mobile camera in our case) and then through an algorithm our Ai system can clearly detect the object in this image.**

**banana**

Diagram

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**2- Main functionalities:**

**# Get Data**

**First, we get data from dataset to detect on it to review the out-put.**

**# OS library**

**Python OS module allows us to use the operating system dependent functionalities and to interact with the underlying operating system in several different ways.**

**# CV2**

**OpenCV is an open-source Python library, which used to understand the content of the digital image.**

**# Preprocessing**

**Then we get image from dataset we are doing some processing on it to simulate the algorithm.**

**# Resize**

**now we resize image to make sure that all images will get the same size to provide the algorithm.**

**# Normalization**

**refers to rescaling real-valued numeric attributes into a [0 ,1] range. is used in machine learning to make model training less sensitive to the scale of features.**

**#Label encoding**

**Label Encoding refers to converting the labels into a numeric form so as to convert them into the machine-readable form. Machine learning algorithms can then decide in a better way how those labels must be operated. It is an important pre-processing step for the structured dataset in supervised learning.**

**#Test and split (train\_test\_split)**

**That we get the dataset and divide it in two part like 70 % training and 30 % testing.**

**#Feature extract**

**#VGG16**

**VGG16 is a convolution neural net (CNN) architecture which was used to win ILSVR(Imagenet)**

**One very important area of application is image processing, in which algorithms are used to detect and isolate various desired portions or shapes (features) of a digitized image or video stream. It is particularly important in the area of optical character recognition.**

**Artificial Neural Networks**

**#Fit**

**Given a Dataset comprising of a group of points, find the best fit representing the Data.**

**We often have a dataset comprising of data following a general path, but each data has a standard deviation which makes them scattered across the line of best fit.**

**#Predict**

**When you get the image and get the Feature extraction from testing images, we predict the image**

**#Get accuracy**

**Accuracy is a measure for the closeness of the measurements to a specific value, while precision is the closeness of the measurements to each other, i.e. not necessarily to a specific value.**

**For example: how many times that the program is doing the algorithm as percentage.**

**#Decoding**

**Applications in the market :**

**Person Detection: Person detection is undertakings of Computer vision frameworks for finding and following individuals. Person detection is the task of finding all examples of individuals present in a picture, and it has been most broadly achieved via looking through all areas in the picture, at all potential scales, and contrasting a little region at every area with known layouts or examples of individuals.**

**Vehicle Detection: Vehicle Detection is one of the most important part in our daily life. As the world is moving faster and the numbers of cars keep on increasing day by day, Vehicle detection is very important. By using the**[Vehicle Detection](https://www.bing.com/ck/a?!&&p=75510e099eacc57cJmltdHM9MTY2MTI1MjExNiZpZ3VpZD03OWNkOWUyOC1hNWU5LTQ2YmUtODM2Yi05ODgwMzEzOTg2N2EmaW5zaWQ9NTE5MA&ptn=3&hsh=3&fclid=11f43b6f-22d2-11ed-ae3f-58ca661d2d8b&u=a1aHR0cHM6Ly9lbi53aWtpcGVkaWEub3JnL3dpa2kvVmVoaWNsZV90cmFja2luZ19zeXN0ZW0&ntb=1)**technique we can detect the number plate of a speeding car or accident-affected car. This also enables for the security of society and decreases the number of crimes done by car. By using Vehicle Detection Technology Pixel Solutions have successfully detected the speed of the vehicle and we have also detected the number plate of the car using Optical Character Recognition (OCR).**

**Self-Driving Cars: In order for a vehicle to drive autonomously in its environment, it must know the location of all the objects surrounding it accurately to be able to decide the next move and execute it safely. Carmakers are integrating more and more sensors like cameras, lidar, and radar into their cars, and algorithms like object detection to detect cars, pedestrians, traffic signals, etc, and estimate their locations … to reach the ultimate goal and deliver the vehicle of the future.**

**Object Counting: allow us to analyze the performance of a store or estimate the number of people in a crowd for example.**

**Police and forensic: Object detection can track and locate specific objects such as a person, vehicle, or backpack from frame to frame. It allows police officers and forensic professionals to inspect every nook and corner of a crime site to collect evidentiary proofs. However, due to the presence of a large volume of data, the process of object detection is a bit tricky and requires hours of footage to identify what can aid in the success of a case.**

**Parking system: Pre-integrated visual detectors in cars can detect open parking spaces in surface lots or parking garages. It can also provide the driver with a front and rear view of the parking space and other vehicles to securely park the car.**