**Object Detection (objdetect module)**

**Overview:**

Object detection means finding and recognising things in images or videos. The objdetect module in OpenCV has ready-to-use tools for this, like finding faces, eyes, or other specific objects. It works by using trained models that know what the object looks like. It often uses something called Haar Cascades, which are pre-trained models that can detect things like faces, eyes, or even cars. We can detect the objects using the photos, videos or real time analysis using cv2.VideoCapture().

This module is used to detect and recognize different objects in photos or videos. It works by scanning the image step-by-step and looking for patterns that match the object we are searching for. The detection process can be used for many things like finding faces, number plates, animals, etc.

**1. Cascade Classifiers**

* These are ready-made models trained to find specific objects like faces, eyes, or even cars.
* The image is checked in small sections and at different sizes so that it can detect objects that are close or far.
* It’s called cascade because the detection happens in multiple steps. If one stage does not match, the search for that section stops early.
* Benefits: Works fast and is easy to use for beginners.
* Limitation: Not always accurate in poor lighting or if the object is tilted too much.

**2. Face Detection**

* One of the most common uses of cascade classifiers.
* Detects facial features like the position of eyes, nose, and mouth to confirm it’s a human face.
* Can detect multiple faces in one frame.
* Works best when the face is looking straight at the camera.
* Common uses:
  + Cameras that auto-focus on faces.
  + Phone face unlock.
  + Security CCTV systems.

**3. Other Object Detectors**

* Cascade classifiers can be trained to detect almost anything like:
  + Animals (cats, dogs, birds)
  + Vehicles (cars, bikes, buses)
  + Any other things like (scissors, helmets, bottles)
* To make a custom detector:
  + We have to collect a lot of pictures of the object or directly take one dataset available (different angles, lighting).
  + Labels should be given to them properly.
  + Training the classifier in OpenCV.
* The more and better the training data, the more accurate the results.

**4. Real-World Uses of objdetect**

* Traffic monitoring (detecting cars and number plates).
* Attendance systems (detecting faces of students/employees).
* Animal monitoring in wildlife cameras.
* Detecting helmets in construction sites for safety rules.
* Finding specific products in store security footage.