COMPUTER VISION

WHAT IS COMPUTER VIOSION?

- Computer Vision is a field of Artificial Intelligence (AI) that enables computers to interpret and analyze visual data (images and videos) the way humans do.

Coding : Python (tensorflow , opencv,pytorch), neural network

- **Key Steps in Computer Vision:**

Image Acquisition – Capturing images or videos using cameras or sensors.

Preprocessing – Enhancing image quality (e.g., noise reduction, resizing).

Feature Extraction – Identifying important patterns, edges, colors, or textures.

Analysis & Interpretation – Using AI models (like CNNs) to recognize objects, classify images, or track movement.

Detect and classify objects (like cars, people, traffic signs) in real-time using a webcam or video.

1. Install Required Libraries
2. Load a Pre-trained YOLO Model
3. Capture Video from Webcam

How It Works

1. **Captures video** from the webcam.
2. **Passes each frame** to the YOLO model for detection.
3. **Extracts bounding boxes** and labels (like "person", "car").
4. **Draws boxes** around detected objects with labels.
5. **Displays the live video** with detected objects.
6. **Press 'q'** to stop.

Project Uses

- **Security Cameras** → Detect people or unknown objects
- **Self-driving Cars** → Identify pedestrians and traffic signs.
- **Retail Stores** → Monitor customer movements.

DIFFERENCE BETWEEN IMAGE PROCESSING AND COMPUTER VISION.

Feature	Computer Vision 🧠	Image Processing 🎨
Definition	Understanding and analyzing images/videos to extract meaningful information.	Manipulating images to enhance or transform them.
Goal	Recognize objects, classify images, track motion, etc.	Improve image quality, remove noise, change formats, etc.
Techniques Used	Machine Learning, Deep Learning (CNNs, AI models).	Filters, Edge Detection, Morphological Operations.
Example Tasks	Face recognition, object detection, self-driving cars.	Resizing, contrast adjustment, noise reduction.
Real-world Use	Identifying diseases in medical scans.	Enhancing an MRI image for better visibility.

A **real-time example** of **computer vision vs. image processing**:

Self-Driving Cars 

1. **Image Processing**:
    1. The car's camera captures an image of the road.
    2. The system enhances brightness, removes noise, and sharpens edges.
2. **Computer Vision**:
    1. The AI detects lanes, pedestrians, and traffic signs.
    2. It decides whether to **stop**, **slow down**, or **turn** based on the detected objects.

- **Key Difference:**
- **Image processing** improves image quality.
- **Computer vision** understands what’s in the image and makes decisions.

. UNIT-1

- **Introduction:** What is Digital Image Processing?, The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.
- **Digital Image Fundamentals:** Image Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing

• UNIT-2

- **Intensity Transformations and Spatial Filtering:** Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters
- **Filtering in the Frequency Domain:** Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters,

- **UNIT-3**

- **Image Restoration and Reconstruction:** Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering,

- **UNIT-4**

- **Color Image Processing:** Color Fundamentals, Color Models, Pseudocolor Image Processing, **Wavelets and Multiresolution Processing: Wavelet and Other Image Transforms:** Preliminaries, Haar Transform, Multiresolution

- **Morphological Image Processing:**

- Basic Concepts, Dilation and Erosion, Opening and Closing, Hit or miss transformation, sample applications

THANK YOU