Teaching Note: Introduction to Computer Vision

What Is Computer Vision?

Computer Vision is a field of Artificial Intelligence (AI) and computer science that enables computers to interpret and make decisions based on **visual data** such as images and videos.

In simple terms: it's teaching machines to "see" and **understand visual content** like humans do.

Common Applications

- **Face detection & recognition** (e.g., Face ID)
- **Object detection** (e.g., detecting pedestrians in self-driving cars)
- **Medical imaging** (e.g., identifying tumors in X-rays)
- **Optical Character Recognition (OCR)** (e.g., reading text from documents)
- **Image classification** (e.g., determining if a photo contains a cat or a dog)

How It Works

1. **Image Input:** A digital image (pixels with color/brightness)
2. **Preprocessing:** Resize, normalize, or convert images (e.g., grayscale)
3. **Feature Extraction:** Detect edges, shapes, colors, or patterns
4. **Model Prediction:** Use ML/DL models to classify or interpret features
5. **Output:** Label, detection box, segmentation, etc.

Key Concepts

- **Pixels:** Tiny dots that make up an image; each has RGB values.
- **Convolutional Neural Networks (CNNs):** A type of deep learning model specialized for image data.
- **Filters/Kernels:** Used to detect features like edges, corners, and textures.

Python Example: Basic Computer Vision with OpenCV

We'll demonstrate:

1. Loading an image
2. Converting it to grayscale

3. Detecting edges

What Is OpenCV?

OpenCV (Open Source Computer Vision Library) is an **open-source library** primarily used for **computer vision**, **image processing**, and **machine learning** tasks.

Key Features:

- Supports reading, writing, and manipulating images and videos
- Enables operations like:
    - Image filtering (blur, sharpen)
    - Color space conversion (RGB, grayscale, HSV)
    - Feature detection (edges, corners, faces)
    - Object tracking and recognition
- Works with both **images** and **real-time video streams**

Why Use OpenCV?

- **Fast and efficient**
- **Free and open-source**
- Used in applications like:
    - Face recognition
    - Augmented reality
    - Motion tracking
    - Self-driving cars

Example 1 - Edge Detection, Gray Scale
https://colab.research.google.com/drive/1Vj-YE14AhmLvqkyIyXagfvdQKz1RD79k?usp=sharing

Example 2 – Face Detection
https://colab.research.google.com/drive/1jWJR2BM23N8dMYGNIjEkkfY-CnWvDqo-?usp=sharing

Students To Do a Car Detection

Useful Links
https://opencv.org/