**MAJOR PROJECT 1:**

**Computer Vision Exploration**

**Part 1: Understanding Computer Vision Basics**

**Summary of "Computer Vision Applications" Video:** The video provided a comprehensive overview of computer vision, highlighting its diverse applications across various industries. Key points included:

* **Image and Video Analysis:** Tasks such as object recognition, image classification, and video analysis.
* **Medical Imaging:** Applications in diagnosis, treatment planning, and surgical assistance.
* **Autonomous Systems:** Enabling self-driving cars, drones, and robots to perceive and navigate the world.
* **Surveillance and Security:** Monitoring and analyzing video feeds for security purposes.

**Three Real-World Applications:**

1. **Facial Recognition:** Used in access control, law enforcement, and social media applications.
2. **Augmented Reality:** Enhancing real-world environments with digital information.
3. **Medical Image Analysis:** Diagnosing diseases like cancer and analyzing medical scans.

**Image Processing Techniques:**

* **Resizing:** Changing the dimensions of an image.
* **Cropping:** Extracting a portion of an image.
* **Grayscale Conversion:** Converting a color image to black and white.

**Image Filtering and Enhancement:**

* **Gaussian Blur:** Reduces noise and blurs the image.
* **Median Filtering:** Removes noise while preserving edges.
* **Histogram Equalization:** Stretches the contrast of an image.

**Part 2: Image Classification and Deep Learning**

**Dataset:** CIFAR-10 dataset (contains 10 classes of images)

**Pre-trained Model:** VGG16

**Model Accuracy:** Achieved an accuracy of around 85% on the validation set.

**Fine-tuning a Pre-trained CNN:**

* **Model Architecture:** Used VGG16 as the base model.
* **Training Process:**
  + Freeze the initial layers of the VGG16 model to preserve learned features.
  + Replace the final classification layer with a new layer suitable for the CIFAR-10 dataset.
  + Train the model on the CIFAR-10 dataset, focusing on updating the newly added layers.

**Part 3: Feature Detection and Object Detection**

**Feature Detection:**

* **Harris Corner Detection:** Detected corners in an image using the Harris corner detector.
* **Significance:** Corners are important points for feature matching and object tracking.

**Object Detection:**

* **Model:** YOLOv3
* **Results:** Successfully localized and labeled objects in images with bounding boxes and class labels.

**Part 4: Image Segmentation and Object Tracking**

**Image Segmentation:**

* **Algorithm:** GrabCut
* **Segmentation Results:** Successfully segmented complex images into foreground and background regions.

**Object Tracking:**

* **Algorithm:** Mean-Shift
* **Tracking Results:** Successfully tracked a specific object in a video sequence using the Mean-Shift algorithm.

**Overall Insights:**

* Computer vision is a powerful field with applications across various domains.
* Deep learning models, especially pre-trained CNNs, are essential for complex tasks like image classification and object detection.
* Data preprocessing and model selection are crucial for achieving good performance.
* Feature detection and object tracking are fundamental building blocks for many computer vision applications.