```python
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Upload an image in Google Colab
from google.colab import files
uploaded = files.upload()

# Load the image
filename = list(uploaded.keys())[0]
image = cv2.imread(filename)
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

# Edge-based segmentation using Canny edge detector
edges = cv2.Canny(gray, 50, 150)

# Display the edges
plt.figure(figsize=(10, 5))
plt.subplot(1, 2, 1)
plt.imshow(edges, cmap='gray')
plt.title("Edge-based Segmentation (Canny)")
plt.axis("off")

# Region-based segmentation using thresholding
_, thresh = cv2.threshold(gray, 127, 255, cv2.THRESH_BINARY)

plt.subplot(1, 2, 2)
plt.imshow(thresh, cmap='gray')
plt.title("Region-based Segmentation (Thresholding)")
plt.axis("off")
plt.show()

# Hough Transform for line detection
lines = cv2.HoughLinesP(edges, 1, np.pi/180, 68, minLineLength=15, maxLineGap=250)

# Draw detected lines on the image
line_img = image.copy()
if lines is not None:
    for line in lines:
        x1, y1, x2, y2 = line[0]
        cv2.line(line_img, (x1, y1), (x2, y2), (0, 255, 0), 2)

# Hough Transform for circle detection
circles = cv2.HoughCircles(gray, cv2.HOUGH_GRADIENT, 1, 20, param1=50, param2=30, minRadius=5, maxRadius=100)

# Draw detected circles
circle_img = image.copy()
if circles is not None:
    circles = np.uint16(np.around(circles))
    for i in circles[0, :]:
        cv2.circle(circle_img, (i[0], i[1]), i[2], (255, 0, 0), 2)
        cv2.circle(circle_img, (i[0], i[1]), 2, (0, 0, 255), 3)  # Center of the circle

# Display the results
plt.figure(figsize=(10, 5))
plt.subplot(1, 2, 1)
plt.imshow(cv2.cvtColor(line_img, cv2.COLOR_BGR2RGB))
plt.title("Hough Transform - Line Detection")
plt.axis("off")

plt.subplot(1, 2, 2)
plt.imshow(cv2.cvtColor(circle_img, cv2.COLOR_BGR2RGB))
plt.title("Hough Transform - Circle Detection")
plt.axis("off")
plt.show()
```

Files logo.jpg
- **logo.jpg**(image/jpeg) - 488402 bytes, last modified: 1/23/2025 - 100% done
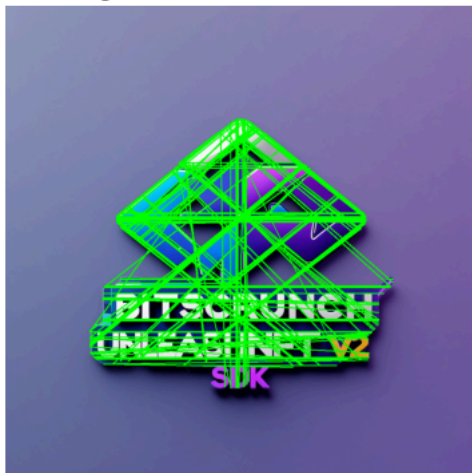
```
Saving logo.jpg to logo.jpg
```

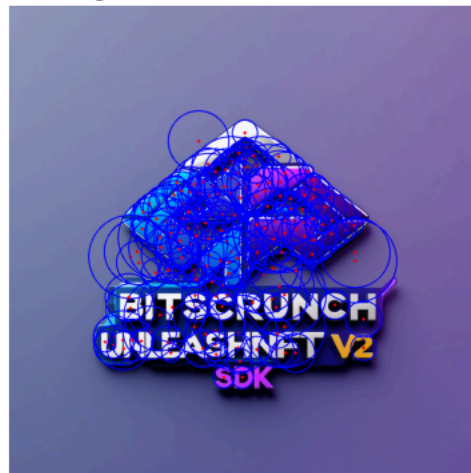### Edge-based Segmentation (Canny)

Region-based Segmentation (Thresholding)

Hough Transform - Line Detection

Hough Transform - Circle Detection


```
# Install dependencies
!pip install opencv-python ultralytics

# Import necessary libraries
import cv2
import torch
import matplotlib.pyplot as plt
from ultralytics import YOLO
from google.colab import files
import numpy as np
```

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-----------------------------------------------------------
r                                     Traceback (most recent call last)
thon-input-2-d54fee41f57c> in <cell line: 0>()
 19 # Read and process the image
 20 image = cv2.imread(filename)
 21 image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
 22
 23 # Perform object detection

r: OpenCV(4.11.0) /io/opencv/modules/imgproc/src/color.cpp:199: error: (-215:Assertion failed) !_src.empty() in function
Color'
```

Explain error

```python
# Upload an image
uploaded = files.upload()
filename = list(uploaded.keys())[0]

# Load the YOLOv8 model (pre-trained weights)
model = YOLO('yolov8n.pt')  # 'yolov8n.pt' is the nano version for fast convergence

# Read and process the image
image = cv2.imread(filename)
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Perform object detection
results = model(image)

# Draw bounding boxes on the detected objects
for result in results:
    for box in result.boxes:
        x1, y1, x2, y2 = map(int, box.xyxy[0])  # Get bounding box coordinates
        class_id = int(box.cls[0])  # Get class ID
        confidence = float(box.conf[0])  # Confidence score
        label = f"{model.names[class_id]} {confidence:.2f}"
        cv2.rectangle(image_rgb, (x1, y1), (x2, y2), (0, 255, 0), 2)
        cv2.putText(image_rgb, label, (x1, y1 - 10), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 255, 0), 2)

# Display the detected objects
plt.figure(figsize=(8, 6))
plt.imshow(image_rgb)
plt.title("YOLO Object Detection")
plt.axis("off")
plt.show()
```

Choose Files 20250215_...294_iOS.jpg
- **20250215_183846294_iOS.jpg**(image/jpeg) - 1333789 bytes, last modified: 2/20/2025 - 100% done
Saving 20250215_183846294_iOS.jpg to 20250215_183846294_iOS.jpg

```
0: 480x640 18 persons, 422.1ms
Speed: 28.5ms preprocess, 422.1ms inference, 41.7ms postprocess per image at shape (1, 3, 480, 640)
```

YOLO Object Detection


```python
# Install dependencies
!pip install opencv-python torch torchvision

# Import necessary libraries
import cv2
import torch
import torchvision
import matplotlib.pyplot as plt
from torchvision.transforms import functional as F
from google.colab import files

# Upload an image
uploaded = files.upload()
```

```
              st(uploaded.keys())[0]

# Load the Faster R-CNN model (pre-trained on COCO dataset)
model = torchvision.models.detection.fasterrcnn_resnet50_fpn(pretrained=True)
model.eval()  # Set the model to evaluation mode

# Read the image and convert to RGB
image = cv2.imread(filename)
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Convert image to tensor
image_tensor = F.to_tensor(image_rgb).unsqueeze(0)

# Perform object detection
with torch.no_grad():
    predictions = model(image_tensor)

# Process detections
threshold = 0.5  # Confidence threshold for displaying detections
for idx in range(len(predictions[0]['boxes'])):
    score = predictions[0]['scores'][idx].item()
    if score > threshold:
        x1, y1, x2, y2 = map(int, predictions[0]['boxes'][idx])
        label = f"Object {idx+1} {score:.2f}"
        cv2.rectangle(image_rgb, (x1, y1), (x2, y2), (0, 255, 0), 2)
        cv2.putText(image_rgb, label, (x1, y1 - 10), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 255, 0), 2)

# Display the detected objects
plt.figure(figsize=(8, 6))
plt.imshow(image_rgb)
plt.title("Faster R-CNN Object Detection")
plt.axis("off")
plt.show()
```

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  Downloading nvidia_cusolver_cu12-11.6.1.9-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cusparse-cu12==12.3.1.170 (from torch)
  Downloading nvidia_cusparse_cu12-12.3.1.170-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Requirement already satisfied: nvidia-nccl-cu12==2.21.5 in /usr/local/lib/python3.11/dist-packages (from torch) (2.21.5)
Requirement already satisfied: nvidia-nvtx-cu12==12.4.127 in /usr/local/lib/python3.11/dist-packages (from torch) (12.4.127)
Collecting nvidia-nvjitlink-cu12==12.4.127 (from torch)
  Downloading nvidia_nvjitlink_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Requirement already satisfied: triton==3.1.0 in /usr/local/lib/python3.11/dist-packages (from torch) (3.1.0)
Requirement already satisfied: sympy==1.13.1 in /usr/local/lib/python3.11/dist-packages (from torch) (1.13.1)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.11/dist-packages (from sympy==1.13.1->torch) (1.3.0)
Requirement already satisfied: pillow!=8.3.*,>=5.3.0 in /usr/local/lib/python3.11/dist-packages (from torchvision) (11.1.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/dist-packages (from jinja2->torch) (3.0.2)
```