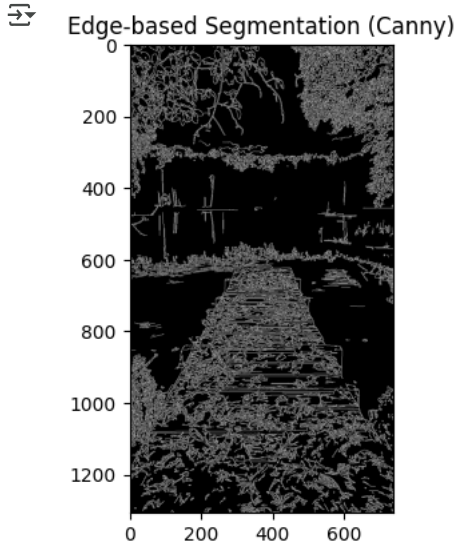
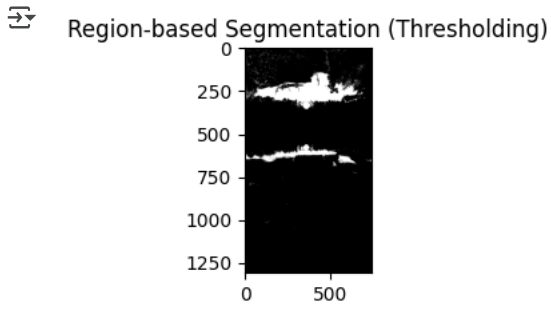
```
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Read the image
image = cv2.imread('image.jpg')
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
plt.figure(figsize=(10, 10))
plt.subplot(221), plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB)), plt.title('Original Image')
plt.show()
```

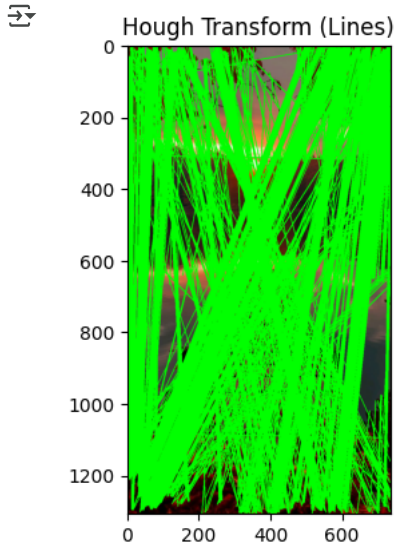

```
# T1.1 - Edge-based Segmentation (Canny Edge Detection)
edges = cv2.Canny(gray, 50, 150)
plt.figure(figsize=(10, 10))
plt.subplot(222), plt.imshow(edges, cmap='gray'), plt.title('Edge-based Segmentation (Canny)')
plt.show()
```



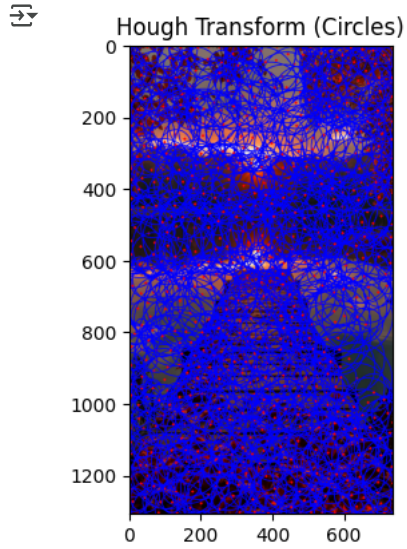

```
# T1.2 - Region-based Segmentation (Thresholding)
_, thresholded = cv2.threshold(gray, 127, 255, cv2.THRESH_BINARY)
plt.subplot(223), plt.imshow(thresholded, cmap='gray'), plt.title('Region-based Segmentation (Thresholding)')
plt.show()
```




```
# T1.3 - Hough Transform for Line Detection
lines = cv2.HoughLinesP(edges, 1, np.pi / 180, 68, minLineLength=15, maxLineGap=250)

line_image = image.copy()
if lines is not None:
    for line in lines:
        x1, y1, x2, y2 = line[0]
        cv2.line(line_image, (x1, y1), (x2, y2), (0, 255, 0), 2)


plt.figure(figsize=(10, 10))
plt.subplot(224), plt.imshow(cv2.cvtColor(line_image, cv2.COLOR_BGR2RGB)), plt.title('Hough Transform (Lines)')
plt.show()
```




```
# Hough Transform for Circle Detection
circles = cv2.HoughCircles(gray, cv2.HOUGH_GRADIENT, dp=1.2, minDist=30, param1=50, param2=30, minRadius=10, maxRadius=100)

circle_image = image.copy()
if circles is not None:
    circles = np.uint16(np.around(circles))
    for circle in circles[0, :]:
        cv2.circle(circle_image, (circle[0], circle[1]), circle[2], (255, 0, 0), 2)
        cv2.circle(circle_image, (circle[0], circle[1]), 2, (0, 0, 255), 3)

plt.figure(figsize=(10, 10))
plt.subplot(224), plt.imshow(cv2.cvtColor(circle_image, cv2.COLOR_BGR2RGB)), plt.title('Hough Transform (Circles)')
plt.show()
```

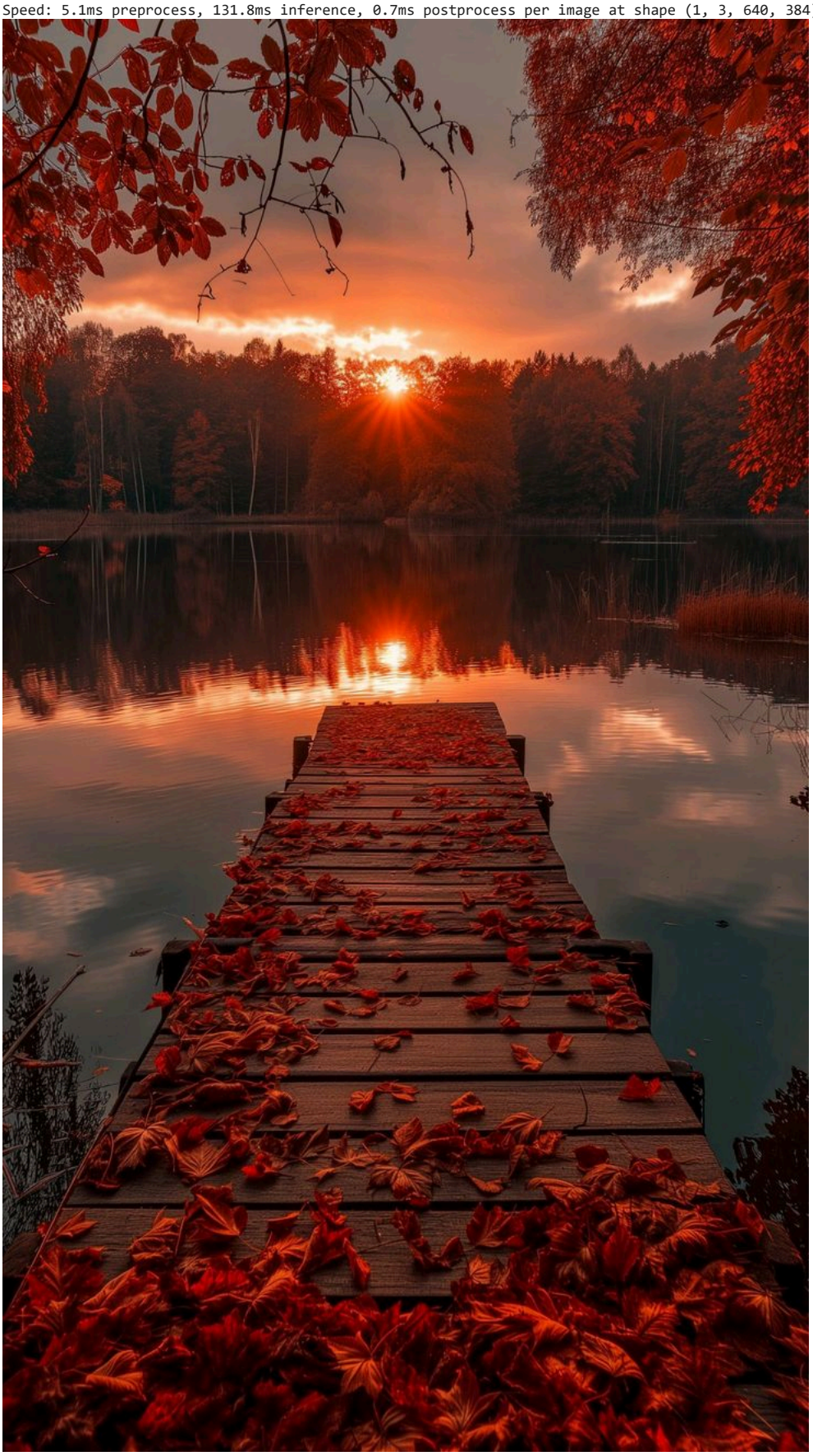



```
# Step 1: Setup the Environment
! pip install opencv-python
! pip install ultralytics
```

```
Requirement already satisfied: opencv-python in /usr/local/lib/python3.11/dist-packages (4.11.0.86)
Requirement already satisfied: numpy>=1.21.2 in /usr/local/lib/python3.11/dist-packages (from opencv-python) (1.26.4)
Collecting ultralytics
  Downloading ultralytics-8.3.77-py3-none-any.whl.metadata (35 kB)
Requirement already satisfied: numpy<=2.1.1,>=1.23.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (1.26.4)
Requirement already satisfied: matplotlib>=3.3.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (3.10.0)
Requirement already satisfied: opencv-python>=4.6.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (4.11.0.86)
Requirement already satisfied: pillow>=7.1.2 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (11.1.0)
Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (6.0.2)
Requirement already satisfied: requests>=2.23.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (2.32.3)
Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (1.13.1)
Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (2.5.1+cu124)
Requirement already satisfied: torchvision>=0.9.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (0.20.1+cu124)
Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (4.67.1)
Requirement already satisfied: psutil in /usr/local/lib/python3.11/dist-packages (from ultralytics) (5.9.5)
Requirement already satisfied: py-cpuinfo in /usr/local/lib/python3.11/dist-packages (from ultralytics) (9.0.0)
Requirement already satisfied: pandas>=1.1.4 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (2.2.2)
Requirement already satisfied: seaborn>=0.11.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (0.13.2)
Collecting ultralytics-thop>=2.0.0 (from ultralytics)
  Downloading ultralytics_thop-2.0.14-py3-none-any.whl.metadata (9.4 kB)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (0.12
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
Requirement already satisfied: kiwisolver>=1.3.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (2
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytic
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.1.4->ultralytics) (2025.1)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.1.4->ultralytics) (2025.1
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultraly
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (3.17.0)
Requirement already satisfied: typing-extensions>=4.8.0 in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics
Requirement already satisfied: networkx in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (3.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (3.1.5)
Requirement already satisfied: fsspec in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (2024.10.0)
Collecting nvidia-cuda-nvrtc-cu12==12.4.127 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cuda_nvrtc_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-runtime-cu12==12.4.127 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cuda_runtime_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-cupti-cu12==12.4.127 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cuda_cupti_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cudnn-cu12==9.1.0.70 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cudnn_cu12-9.1.0.70-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cublas-cu12==12.4.5.8 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cublas_cu12-12.4.5.8-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cufft-cu12==11.2.1.3 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cufft_cu12-11.2.1.3-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-curand-cu12==10.3.5.147 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_curand_cu12-10.3.5.147-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cusolver-cu12==11.6.1.9 (from torch>=1.8.0->ultralytics)
  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>=1.8.0->ultralytics)
  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>=1.8.0->ultralytics
```

```
import cv2
from ultralytics import YOLO
from google.colab.patches import cv2_imshow


# Step 2: Load YOLO model (you can also use a variant like yolov8n.pt, yolov8s.pt, etc.)
model = YOLO('yolov8n.pt')

# Step 3: Load Image
image_path = 'image.jpg'
image = cv2.imread(image_path)

# Step 4: Perform Object Detection
results = model.predict(image)

# Step 5: Visualize the Results
for result in results:
    annotated_image = result.plot()

    # Display the image with bounding boxes
    cv2_imshow( annotated_image)
    cv2.waitKey(0)
    cv2.destroyAllWindows()

# Optional: Save the annotated image
cv2.imwrite('output_image.jpg', annotated_image)
```

```
0: 640x384 (no detections), 131.8ms
Speed: 5.1ms preprocess, 131.8ms inference, 0.7ms postprocess per image at shape (1, 3, 640, 384)
```



```
True
```

```
import cv2
import matplotlib.pyplot as plt
import numpy as np
from keras.datasets import fashion_mnist
from keras.models import Sequential
from keras.layers import Conv2D, MaxPooling2D, Flatten, Dense

# Load Fashion MNIST Dataset
```

```
(train_images, train_labels), (test_images, test_labels) = fashion_mnist.load_data()
train_images = train_images.reshape(-1, 28, 28, 1).astype('float32') / 255.0
test_images = test_images.reshape(-1, 28, 28, 1).astype('float32') / 255.0

# Build a simple CNN model
model = Sequential([
    Conv2D(32, (3, 3), activation='relu', input_shape=(28, 28, 1)),
    MaxPooling2D((2, 2)),
    Flatten(),
    Dense(128, activation='relu'),
    Dense(10, activation='softmax')
])

model.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])

# Train the CNN
model.fit(train_images, train_labels, epochs=3, validation_split=0.1)

# Load any image
image_path = 'image.jpg'  # Change to your image path
image = cv2.imread(image_path)
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Display the original image
plt.figure(figsize=(6, 6))
plt.imshow(image_rgb)
plt.title("Original Image")
plt.axis('off')
plt.show()

# Selective Search for Region Proposals
ss = cv2.ximgproc.segmentation.createSelectiveSearchSegmentation()
ss.setBaseImage(image)
ss.switchToSelectiveSearchFast()
rects = ss.process()

# Displaying region proposals
proposals_image = image.copy()
for (x, y, w, h) in rects[:20]:  # Display only the top 20 proposals
    cv2.rectangle(proposals_image, (x, y), (x + w, y + h), (0, 255, 0), 2)

plt.figure(figsize=(6, 6))
plt.imshow(cv2.cvtColor(proposals_image, cv2.COLOR_BGR2RGB))
plt.title("Region Proposals")
plt.axis('off')
plt.show()
```