Symbiosis
Institute of
Technology

॥वसुधैव कुटुम्बकम्॥

Image Processing

Enhancing reality, one pixel at a time.

Prepared for

Continuous Assignment 3

Presented by

Kanan Bedi
21070126044

Table
of Content

Introduction

The high-quality sunflower image used in this assignment was sourced from Unsplash. Unsplash is a platform known for its collection of high-resolution and quality images.

Fourier Transform

The input image is transformed into the frequency domain using a 2D Fourier transform.
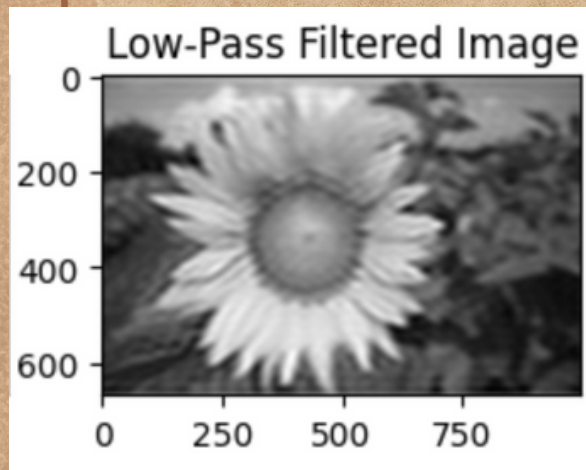
Low-Pass Filter

The low-pass filter is applied to the Fourier-transformed image, effectively filtering out high-frequency noise or details.

High-Pass Filter

A high-pass filter is created in the frequency domain. It's a mask that preserves high-frequency components (details) and suppresses low-frequency components (smooth areas).
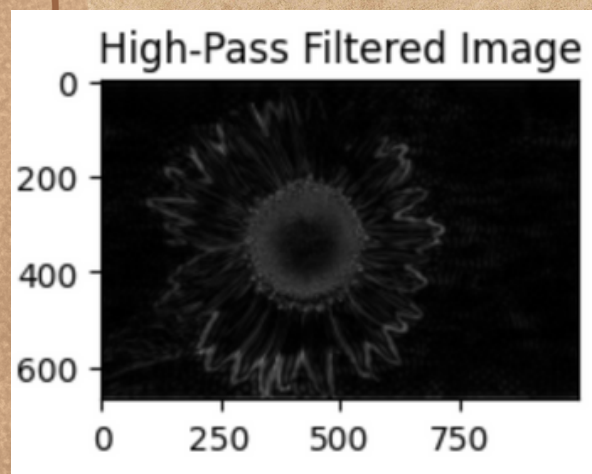
Filtered Images: Low-Pass and High-Pass

Low-Pass Filtered Image

01

The low-pass filter is applied to the Fourier-transformed image, effectively filtering out high-frequency noise or details.

02

The high-pass filter is applied to the Fourier-transformed image, effectively enhancing edges and details while reducing smooth areas.
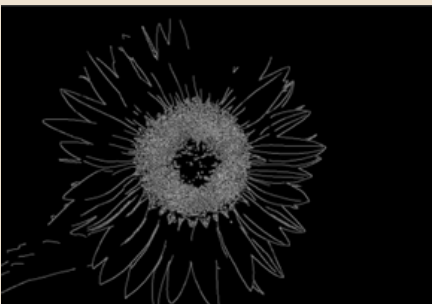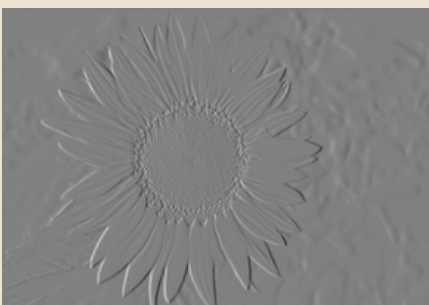

High-Pass Filtered Image

Exploring Filters

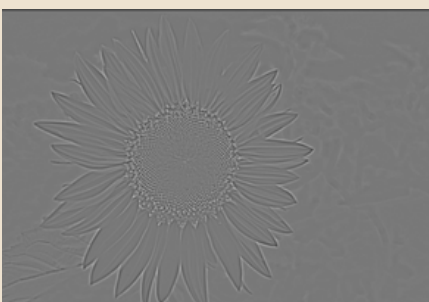**Gaussian Blur:** Reduces high-frequency noise and detail in the image.

Median Blur: Reduces noise while preserving edges and fine details.

Canny Edge Detection: Detects edges in the image.

Sobel Filter: Emphasizes edges and gradients in the horizontal or vertical direction.

Laplacian Filter: Enhances details and detects edges, both light and dark.

Thresholding, Segmentation, and Contour Detection

01 **Thresholding**

Thresholding is applied to the grayscale image to create a binary image.

02 **Region-Based Segmentation**

Region-Based Segmentation is performed by finding and drawing the external contours on a copy of the original image.

03 **Edge Detection**

Edge Detection is achieved using the Canny edge detection method.

04 **Contour Detection**

Contour Detection is applied by finding and drawing external contours on a copy of the original image.

All these results are displayed in a 2x3 grid layout using Matplotlib.
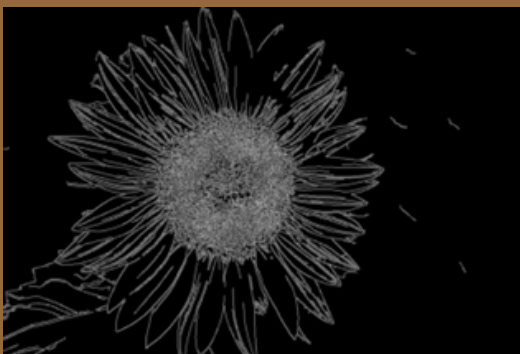
Image Segmentation

The art of turning a canvas of pixels into a masterpiece of meaning

Thresholding

Region Based Segmentation

Edge Detection

Contour Detection

Thresholding

Binary Thresholding

The image is thresholded using a fixed threshold value, where pixel values above the threshold are set to 255 (white) and values below are set to 0 (black).

Adaptive Thresholding

Adaptive thresholding is applied using the mean value of a local neighborhood (defined by block_size) to determine the threshold for each pixel. This adapts to variations in lighting and contrast across the image.

Otsu Thresholding

Otsu's method is used to automatically determine an optimal threshold value based on the image's histogram. This threshold separates the image into foreground and background while minimizing intra-class variance.
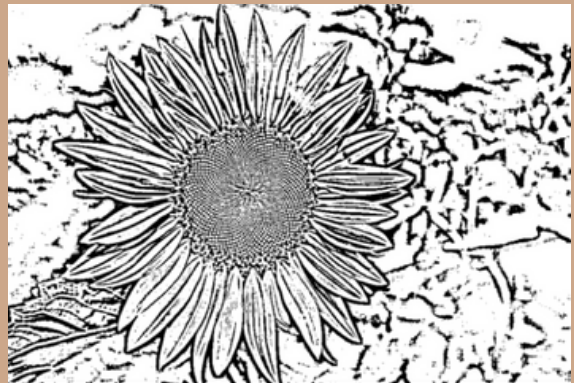
Inverse Binary Thresholding

A fixed threshold of 128 is applied, but in this case, pixel values above the threshold are set to 0 (black), and values below are set to 255 (white), creating an inverse binary image.

Truncated Thresholding

A fixed threshold of 128 is applied, where pixel values above the threshold remain unchanged, but values below are set to the threshold value (128). This truncates pixel values and results in a high-contrast image.

Binary Thresholding

Adaptive Thresholding

Otsu Thresholding

Inverse Binary Thresholding

Truncated Thresholding

Original Grey-Scale Image

Thank you