

SOFTWARE PROJECT LAB - 01

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Project Title – **ImgProc++**

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Project Overview

Objective : Building a Command-Line image processing system capable of:

- Scaling (Upscaling\Downscaling)
- Denoising
- Sharpening
- Edge Detection

Key Features :

- CLI menu for selecting operations
- Basic vs Advanced algorithm comparisons
- Multithreading toggle
- Performance log to CSV file for comparison



○ Algorithms/Methods

| Features | Basic | Advanced |
|------------|------------------------|-----------------|
| Scaling | Bilinear Interpolation | Lanczos |
| Denoise | Median Filter | Non-Local Means |
| Sharpening | Laplacian | Unsharp Masking |

❑ For **Edge Detection**, only sobel operator will be used.



○ Progress So Far

Scaling:

- So far bilinear interpolation is in working condition



Before
Resolution: 512 x 512



After down sampling
Resolution : 128 x 128



○ Progress So Far

Denoising:

- ❑ Median Filtering and Gaussian blur have been implemented



Before

Filled with sand-pepper noise



After applying median filter

A bit blurry but with less noise



○ Progress So Far

Sharpening:

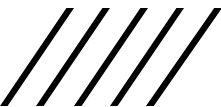
- Unsharp Masking is in working order for now



Before
Blurry Image



After sharpening
Less blurry but a bit choppy



○ Progress So Far

Edge Detection:

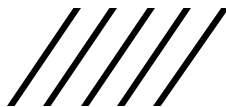
- Sobel Operator is fully functional



Before



After outlining the edges



○ File Structure and Code Organization

High Level Structure:

src/

- | main.c
- | scaling.c
- | denoise.c
- | sharpen.c
- | edge.c
- | utils.c
- | bmp.c

include/

- | scaling.h
- | denoise.h
- | sharpen.h
- | edge.h
- | utils.h
- | bmp.h





File Structure and Code Organization

Module Breakdown

main.c (Controller Layer)

- Entry point of the program
- Displays the menu-driven interface
- Handles user input
- Calls appropriate image processing functions
- Does not contain image-processing logic

BMP Handling Module (bmp.c / bmp.h)

- Handles:
 - Reading BMP headers
 - Writing output images
- Keeps file-format logic separate from image processing





File Structure and Code Organization

Image Processing Modules

Each major feature has its own source and header file.

Scaling Module

- Handles image resizing
- Implements bilinear interpolation
- Responsible only for pixel mapping and size conversion

Denoising Module

- Applies smoothing filters
- Uses convolution with a kernel
- Reduces noise while preserving image structure





File Structure and Code Organization

Sharpening Module

- Enhances edges and fine details
- Uses high-pass filtering techniques

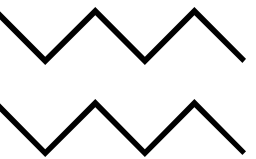
Edge Detection Module

- Detects object outlines
- Uses Sobel Operator (gradient based)

Utility Module (`utils.c` / `utils.h`)

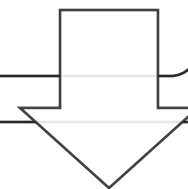
- Common helper functions:
 - ASCII representation
 - Menu Overhaul
 - Copying Image
- Avoids code duplication across modules



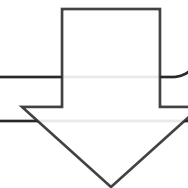


Next Steps

Implementing remaining advanced algorithms



Multithreading support for functions



Exporting the data to CSV file for comparison





**THANK
YOU**

