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CS 5330 PRCV

Project 2 Report

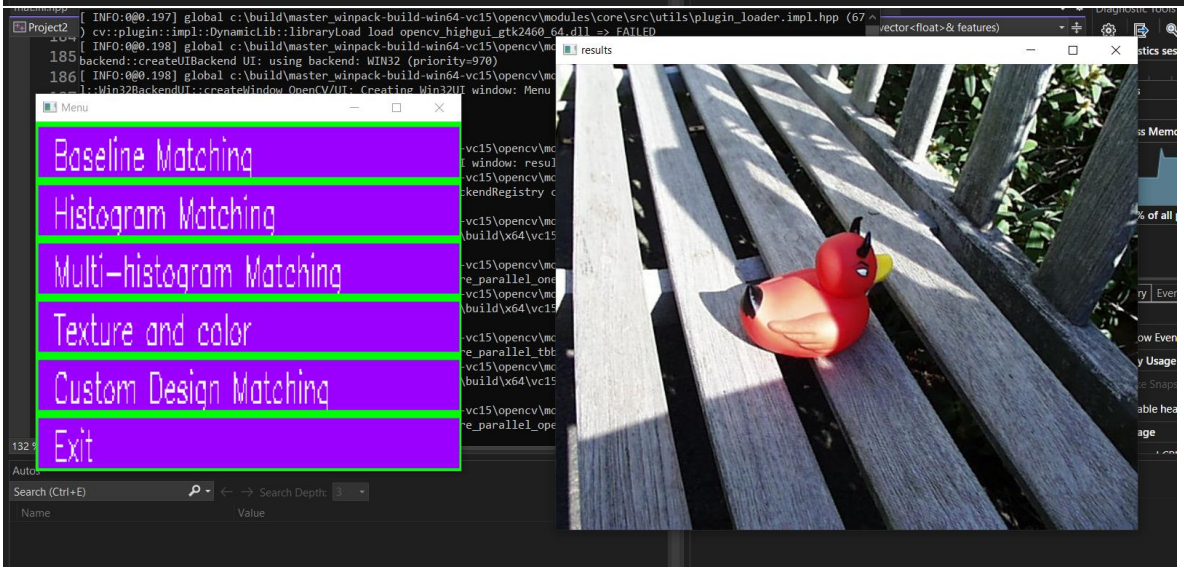
Content-Based Image Retrieval

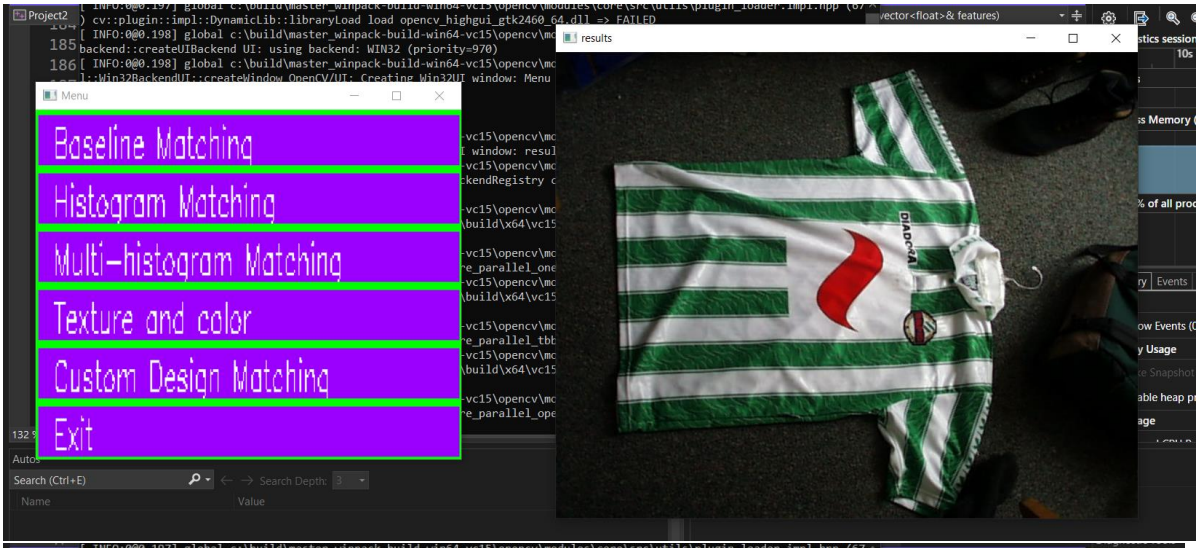
The aim of this project is to construct a mechanism for retrieving images based on their content from a database. To achieve this, the project involves creating and using different feature vectors and distance metrics to pinpoint and obtain images that are similar to the target image. The project prioritizes working with images on a pixel level and incorporating features such as color, texture, and spatial arrangement to determine similarities between images. Furthermore, particular emphasis will be given to the design of special features that are tailored to a particular type of image, which will enhance the retrieval process. The result of this effort will be a reliable and efficient image retrieval system that is capable of accurately identifying and retrieving images based on their content.

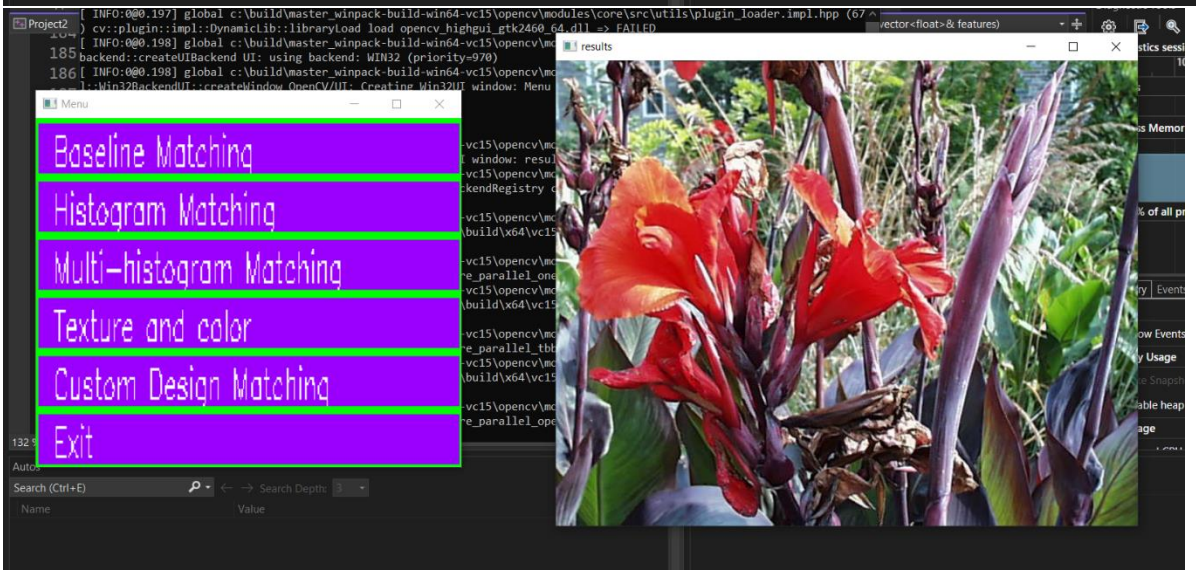
Baseline Matching Feature Vector

Observation: The 9x9 square located in the center of the image has been identified as the feature vector for this study. The distance metric sum-of-squared differences are the sum of squared differences. It was noted that when the image is compared to itself, the resulting distance should be 0.

Output 1:



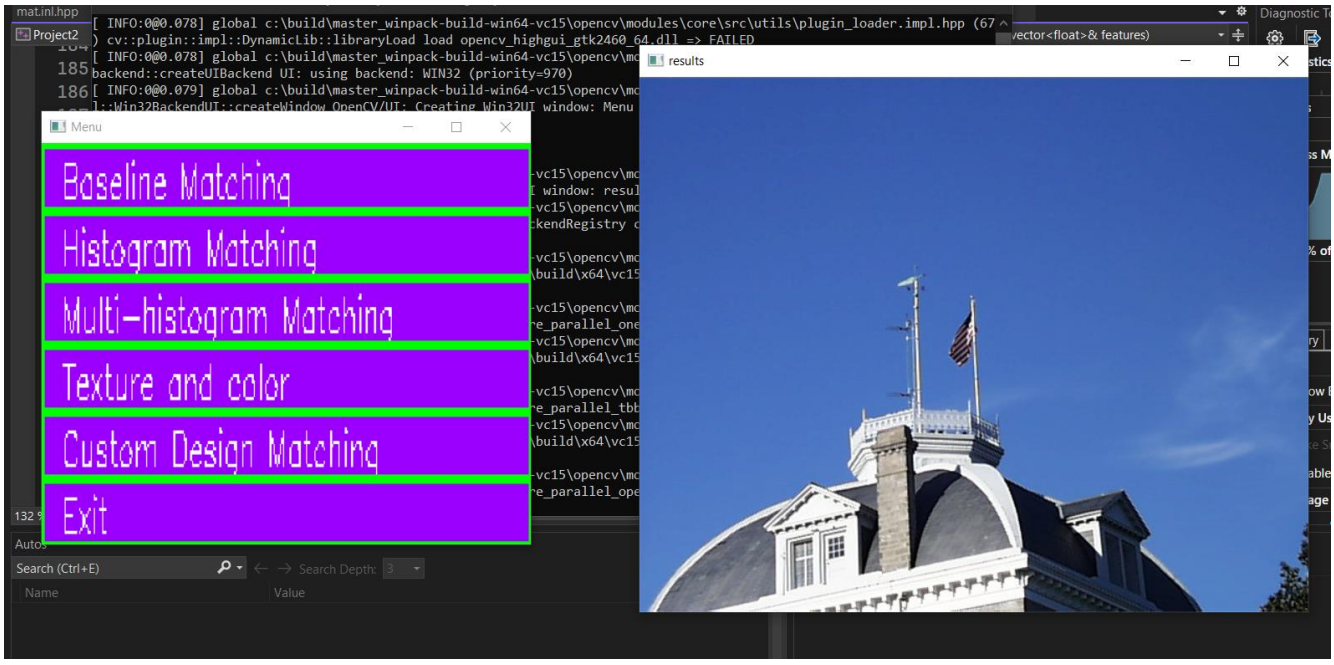


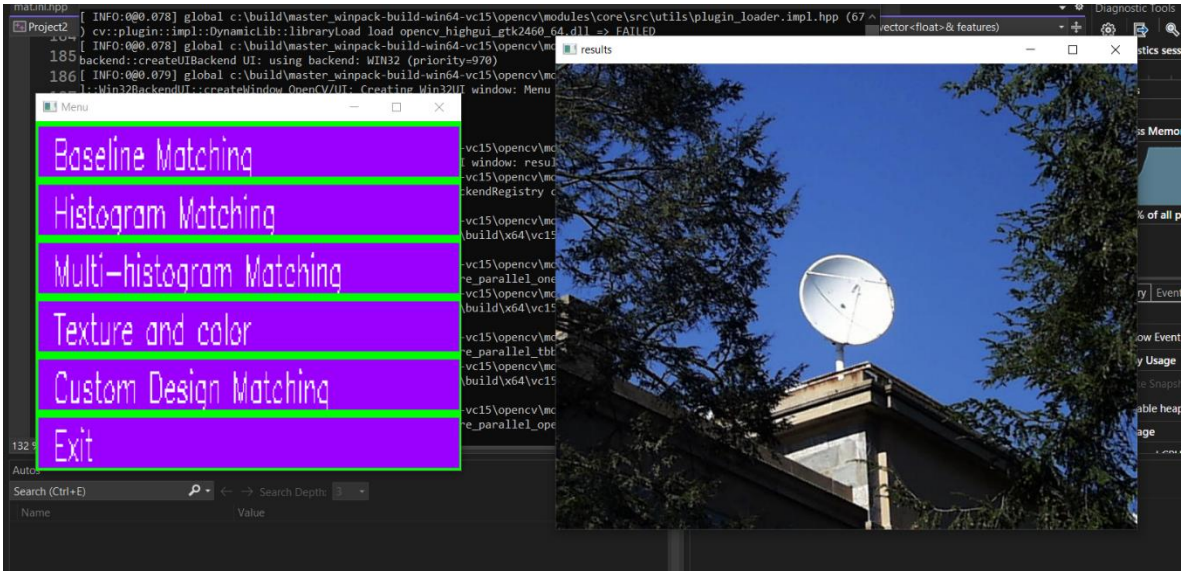


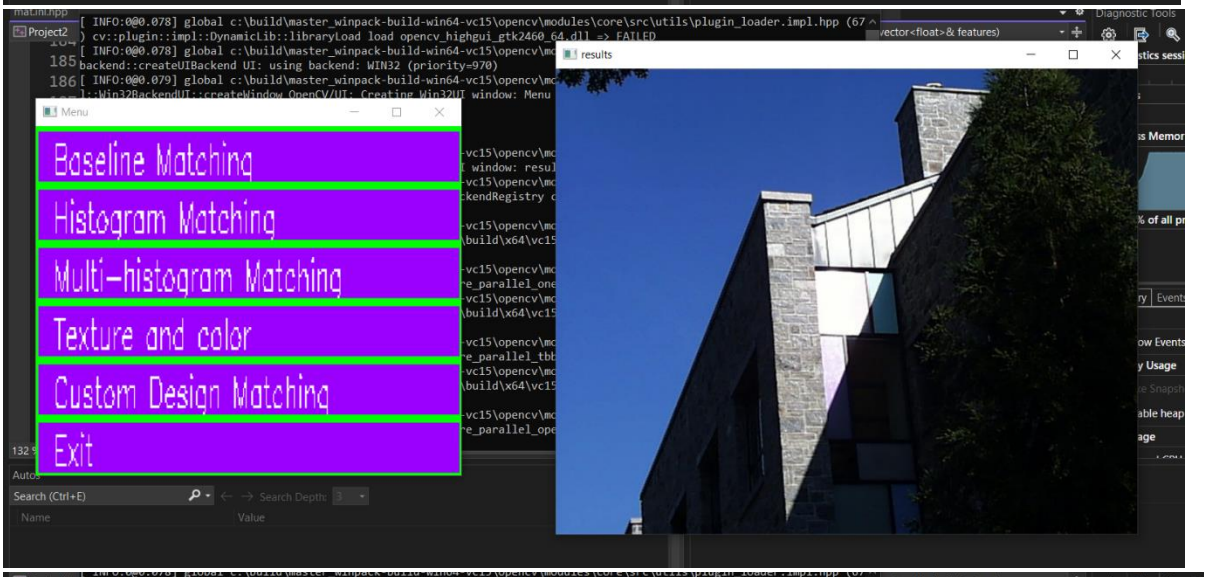
Histogram Matching

Observation: This output involves the creation of a three-dimensional histogram to represent the distribution of blue, green, and red (BGR) color values in the image. The histogram has 8 bins for each color channel, offering a detailed representation of the image's color information.

Output 2:




Menu
Baseline Matching
Histogram Matching
Multi-histogram Matching
Texture and color
Custom Design Matching
Exit
results


Menu
Baseline Matching
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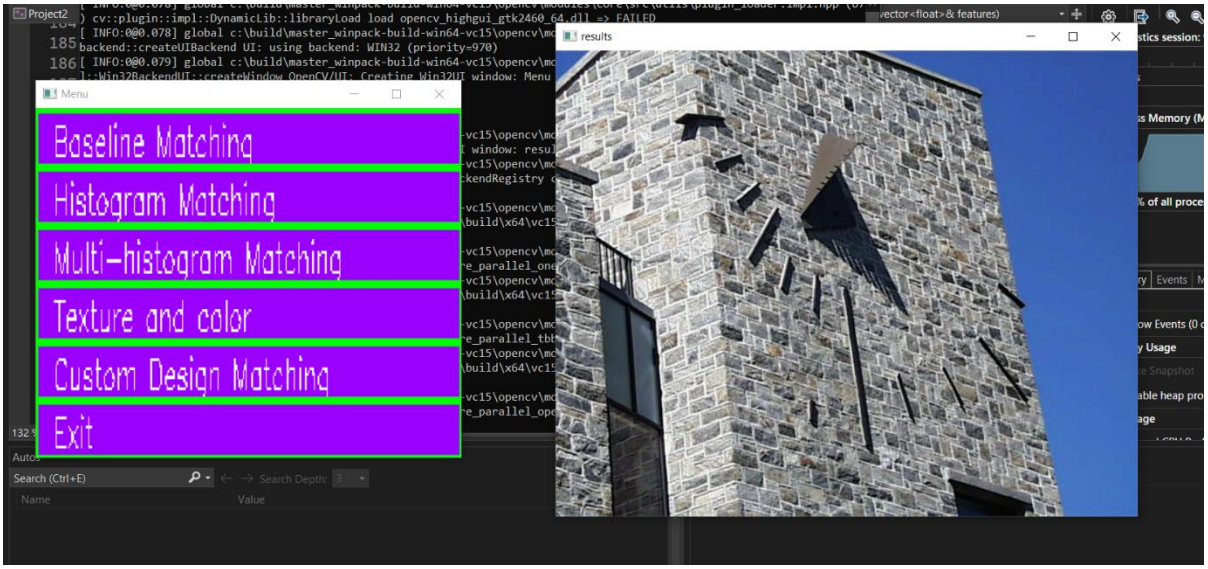
Menu
Baseline Matching
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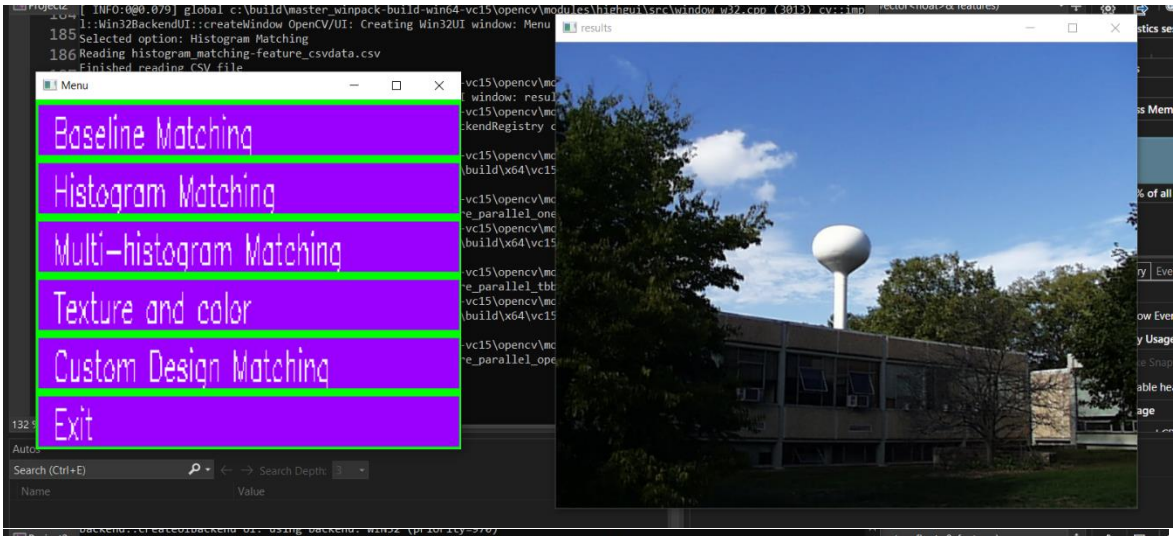
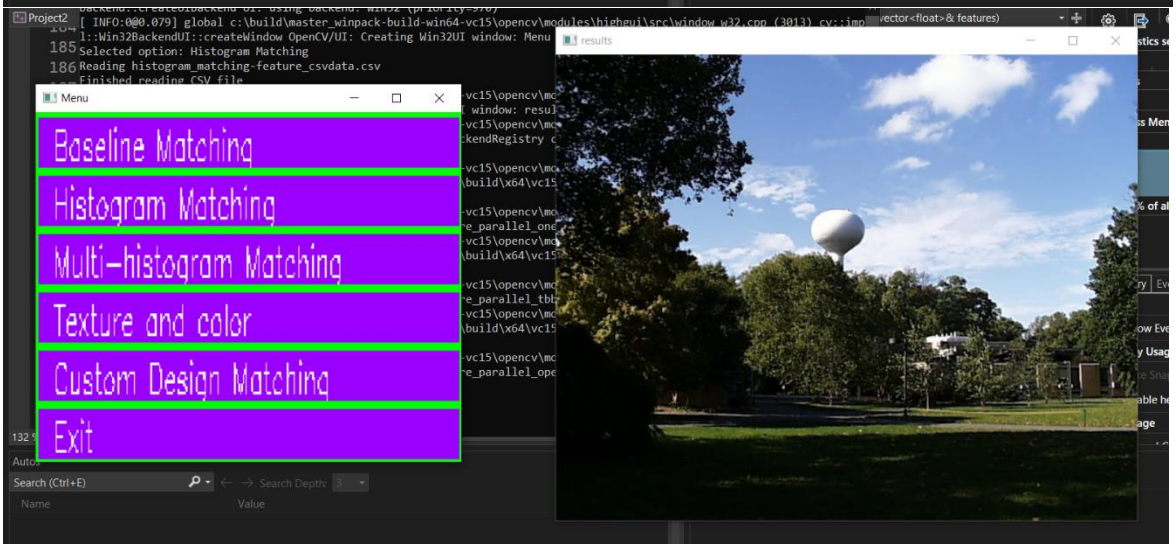
Exit
results

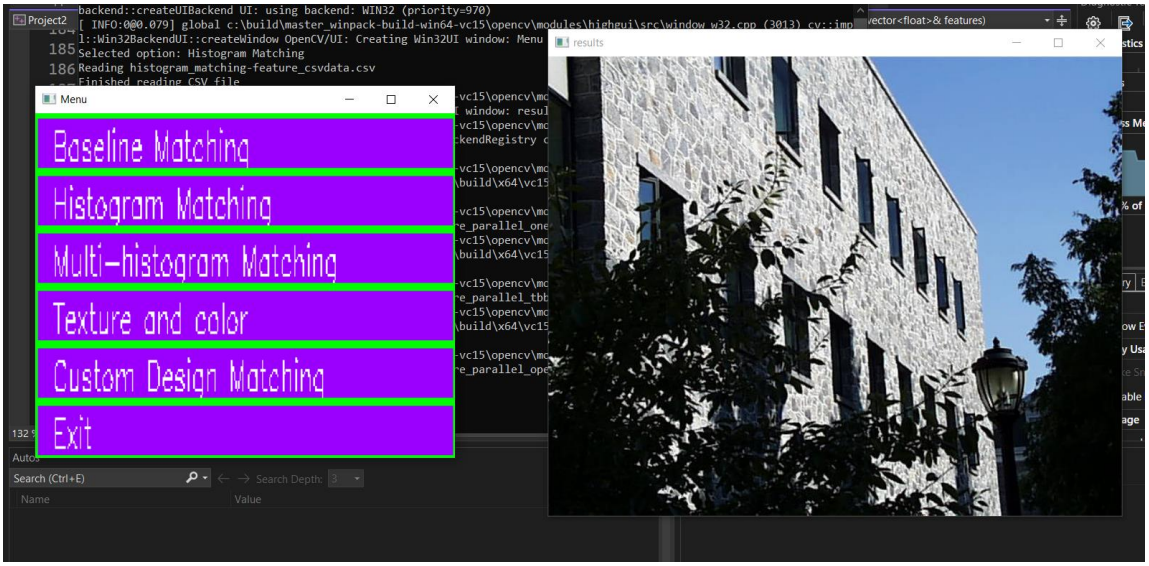
Multi-histogram Matching

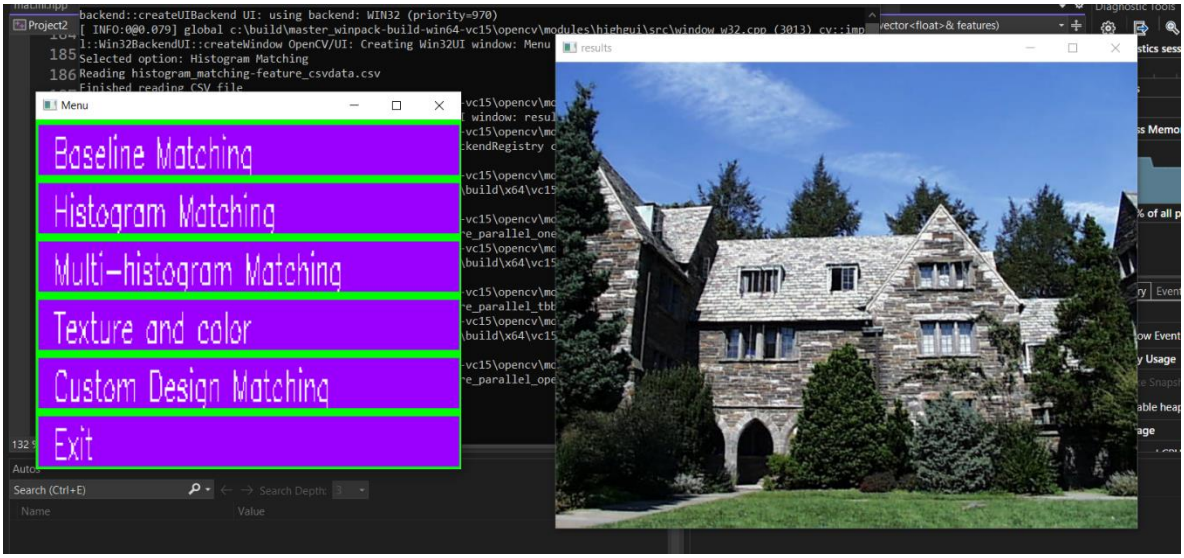
Observation: This module employs a technique called multi-histogram matching, where the image is divided into a 2x2 grid and a 3D histogram of BGR color is calculated for each part with 8 bins for each color. The histograms are L2 normalized for comparison.

Output 3:





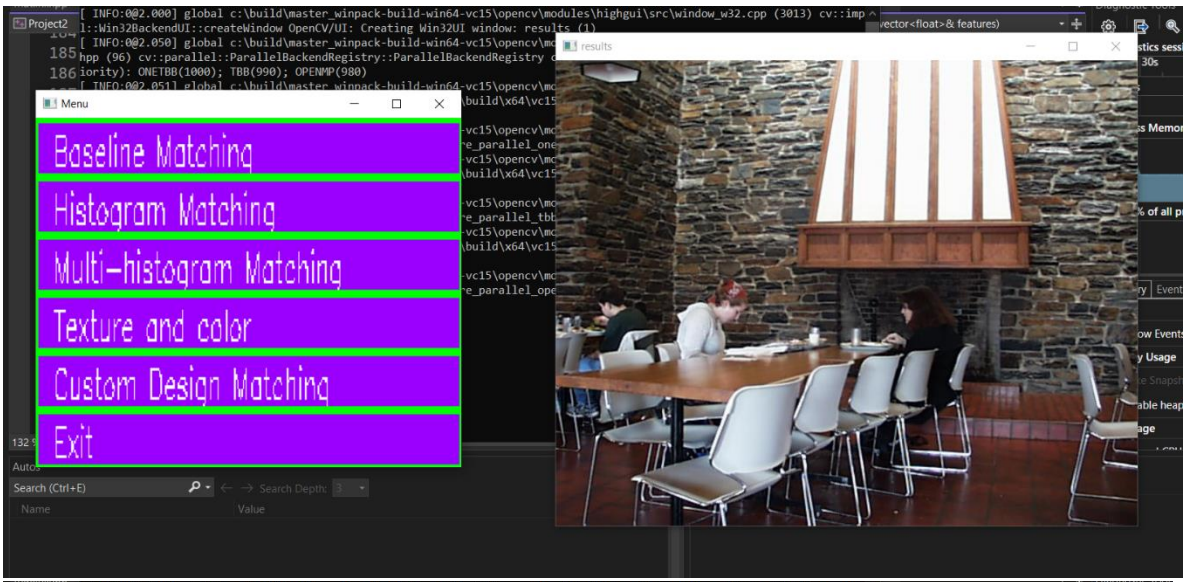


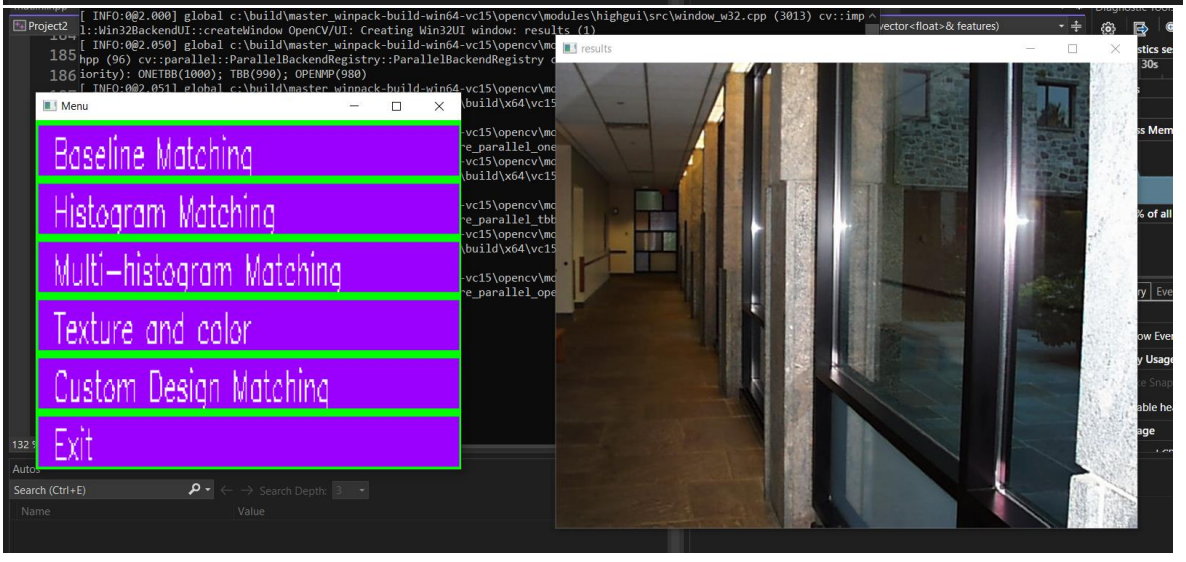


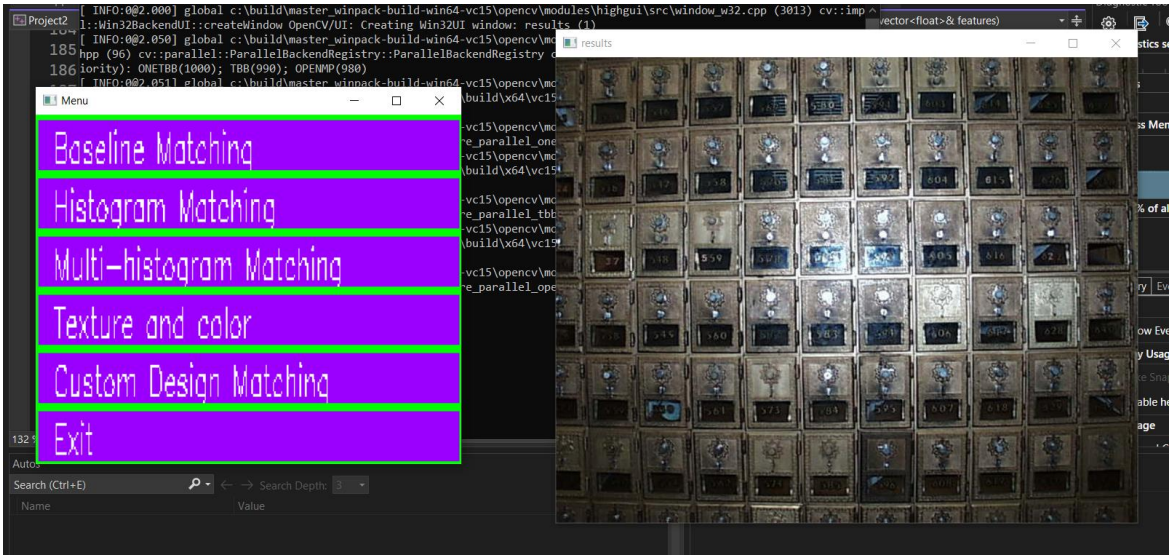
Texture and Color

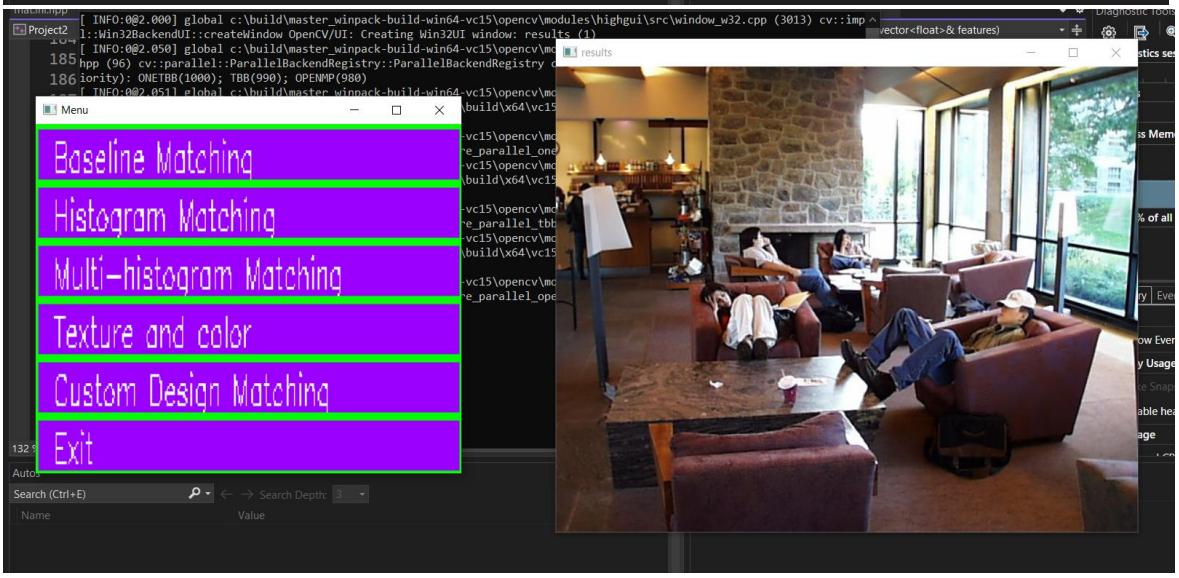
Observation: This output uses a feature representation that combines both texture and color information. A 2D histogram of the Sobel gradient orientation and magnitude of the whole image serves as the first feature vector, capturing texture information. A 3D histogram of the BGR color values of the whole image serves as the second feature vector, capturing color information.

Output 4:





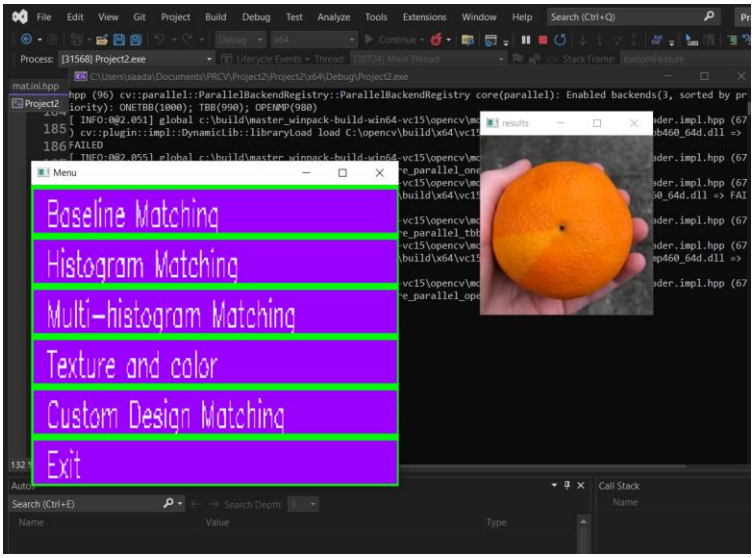


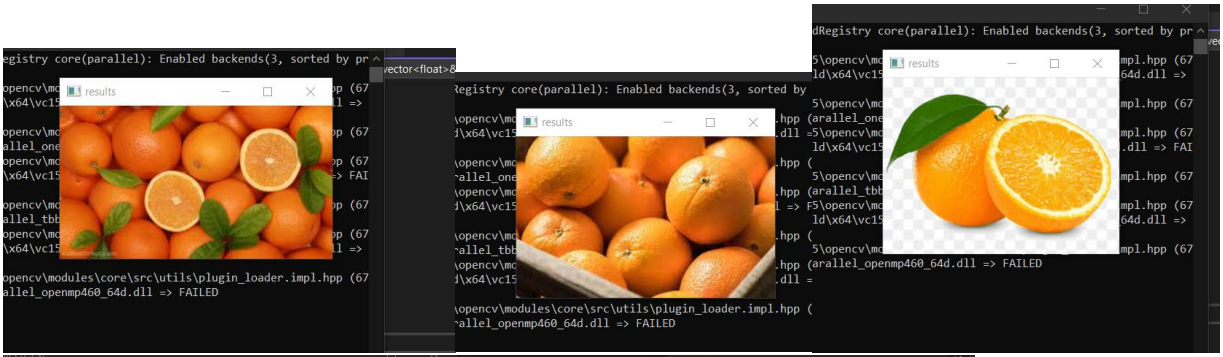


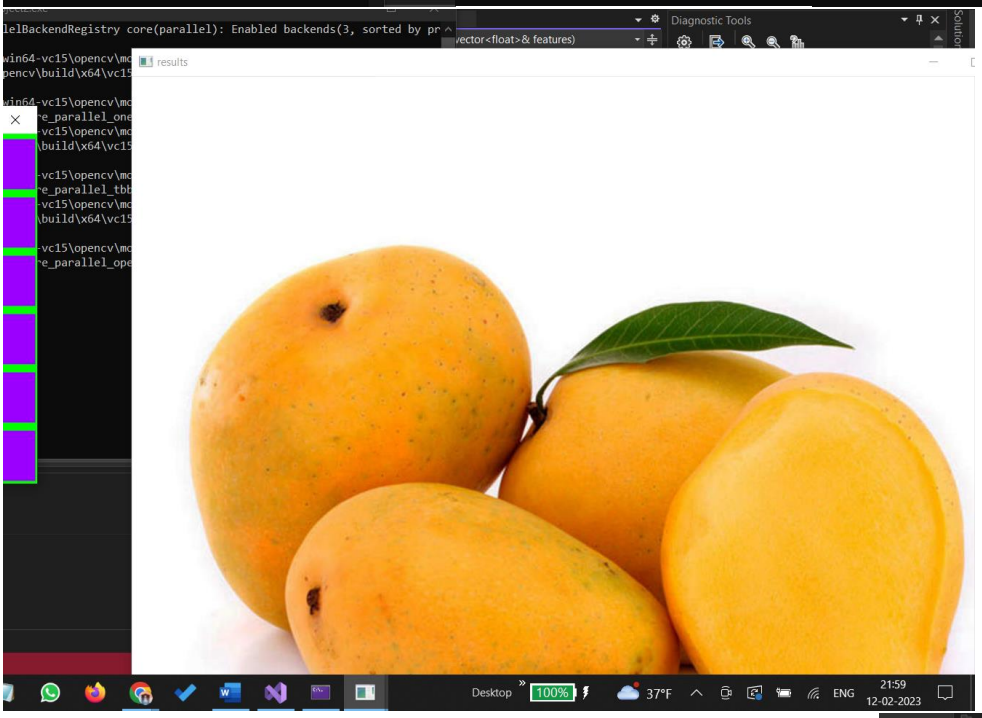
Custom Design

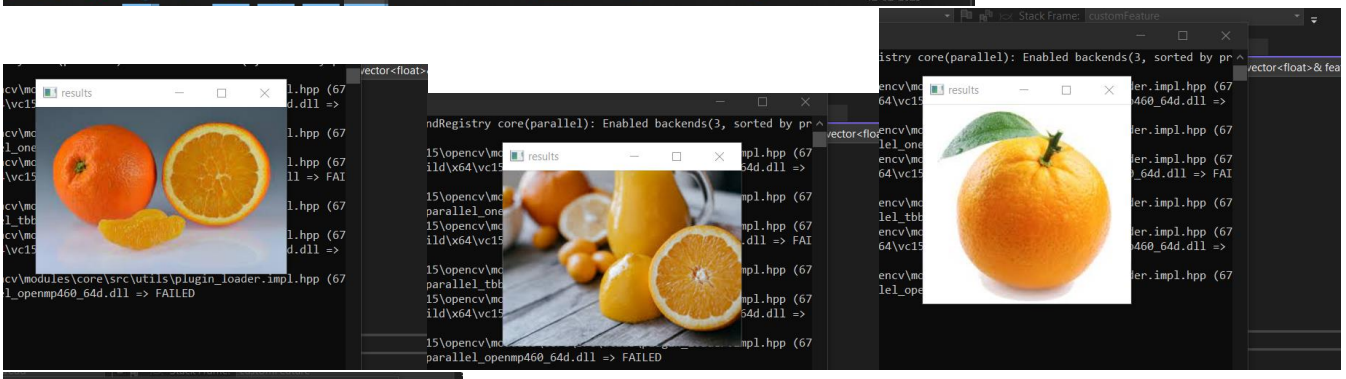
In task 5, I selected the orange color as my focus subject. In this, I implemented a custom feature extraction for an image. It starts by applying bilateral filtering to reduce noise, then converts the image from BGR to HSV color space. Finally, it computes an HSV histogram feature and stores it in a provided vector. The histogram represents the distribution of hue, saturation, and value in the image, serving as a descriptor for image retrieval or classification tasks.

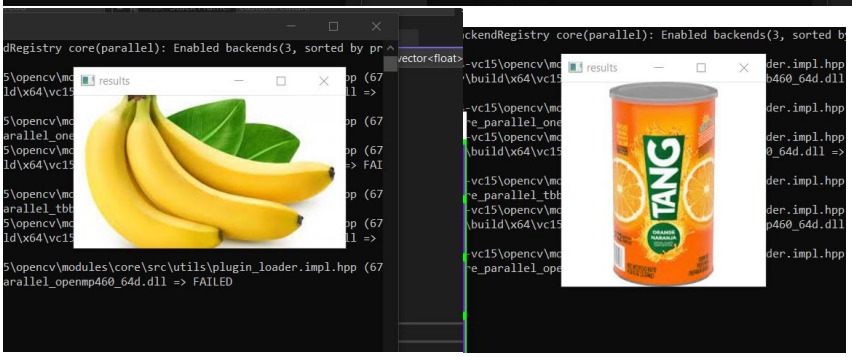
Output 5:







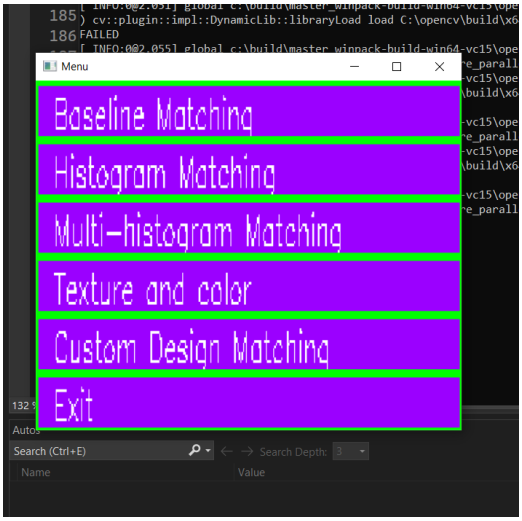




Extension:

For the extensions, I worked on making the GUI to access all the features from a menu.

I was also working on the Gabor feature but want able to get the output. I tried implementing work for a few cases.



What I learned-Experience:

I learned about designing and using feature histograms in OpenCV and the impact of different features on content-based image retrieval. I also got a new perspective on texture analysis by experimenting with texture-based features. Designing and working on the GUI was real fun.

This was definitely more challenging than project 1. Hoping for more challenges with the future assignments

Reference Sources:

https://stackoverflow.com/questions/37400974/error-unicode-error-unicodeescape-codec-cant-decode-bytes-in-position-2-3

https://github.com/RohitMidha23/Image-Directory-to-CSV

https://stackoverflow.com/questions/38322397/how-to-display-an-image-using-c-right-in-console-window

GeekforGeeks

StackOverflow for errors