PRACTICAL WORK REPORT

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Introduction

This project focuses on the implementation of a panorama stitching algorithm, where two images with different viewpoints are seamlessly combined into a single panoramic image. Using matching points manually selected by the user, the system calculates the transformation required to align the images and blends them together. This report outlines the core techniques used for image alignment, the stitching process, and the results observed through various experiments.

Overview of Homography

Homography is a mathematical concept used to describe the transformation between two images taken from different perspectives of the same scene. It maps points from one image to another using a projective transformation. The relationship between corresponding points (x,y) in the first image and (x′,y′) in the second image is governed by a matrix H, represented as:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = H \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Where H is a 3x3 homography matrix with eight unknowns (since the last element is fixed at 1). By using at least four pairs of corresponding points between the two images, a linear system can be set up and solved to find the elements of the matrix. These points can be manually selected by the user, ensuring that key features in both images match accurately.

Panorama :

Once the homography is computed, the next step is to create the panorama by stitching the two images. This process involves the following steps:

- **Bounding Box Calculation**: Using the forward homography, we transform the corners of the first image to determine the bounding box that will contain both images.
- **Inverse Mapping**: For each pixel in the panorama, we apply the inverse homography to find the corresponding points in both images. If the point falls within the bounds of either image, we use bilinear interpolation to sample the color value.
- **Blending**: In regions where both images overlap, we blend the colors from both images by averaging their RGB values.

Results:

Using 4 matching points:

Image 1

image 2

Constructed panorama

Using more than 4 matching points:

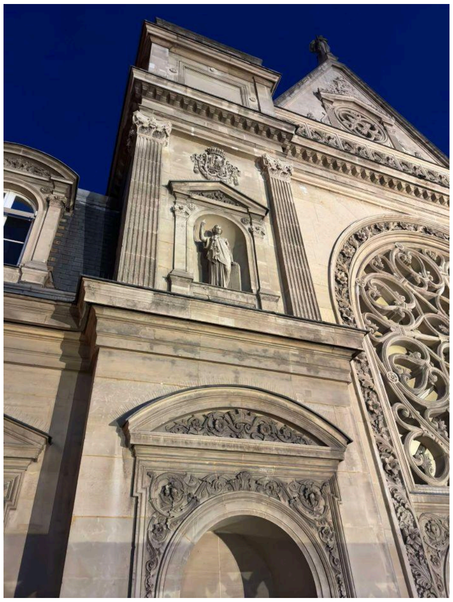
Image 1

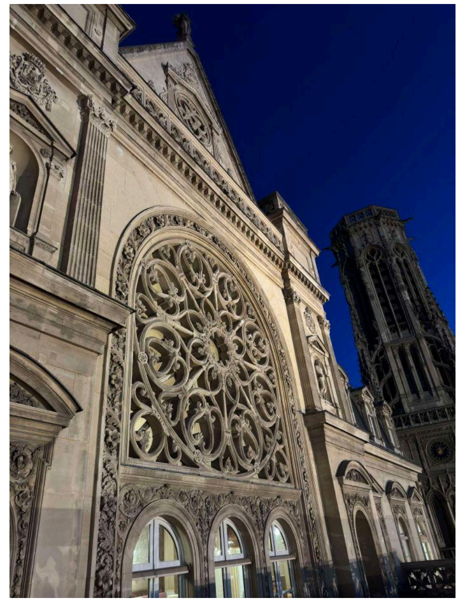
Image 2

Constructed panorama

Different image sets:

1) Image 1 Image 2





Constructed panorama

2)

Image 1

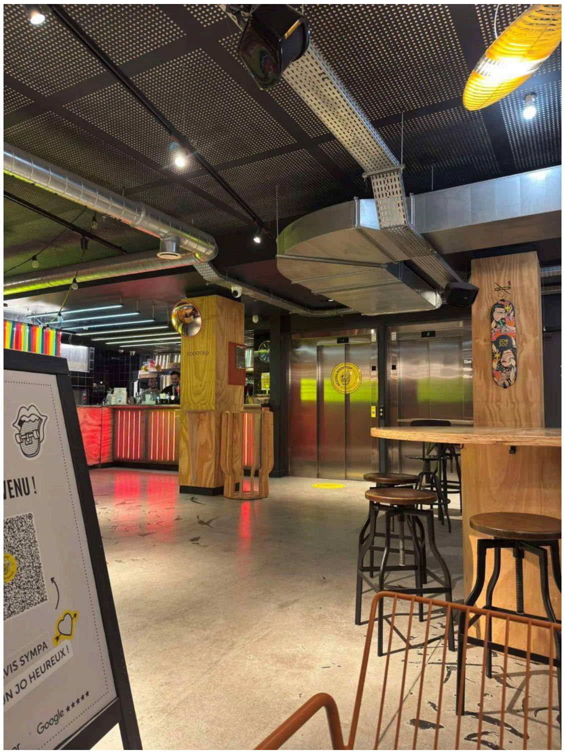
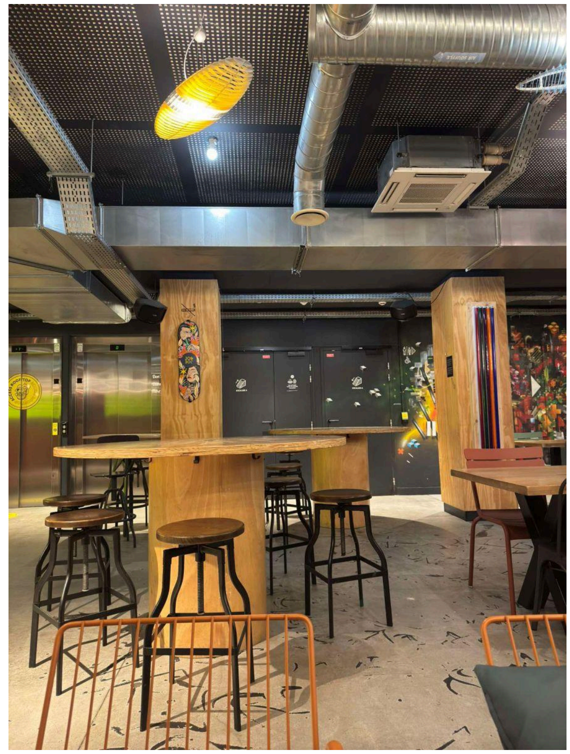
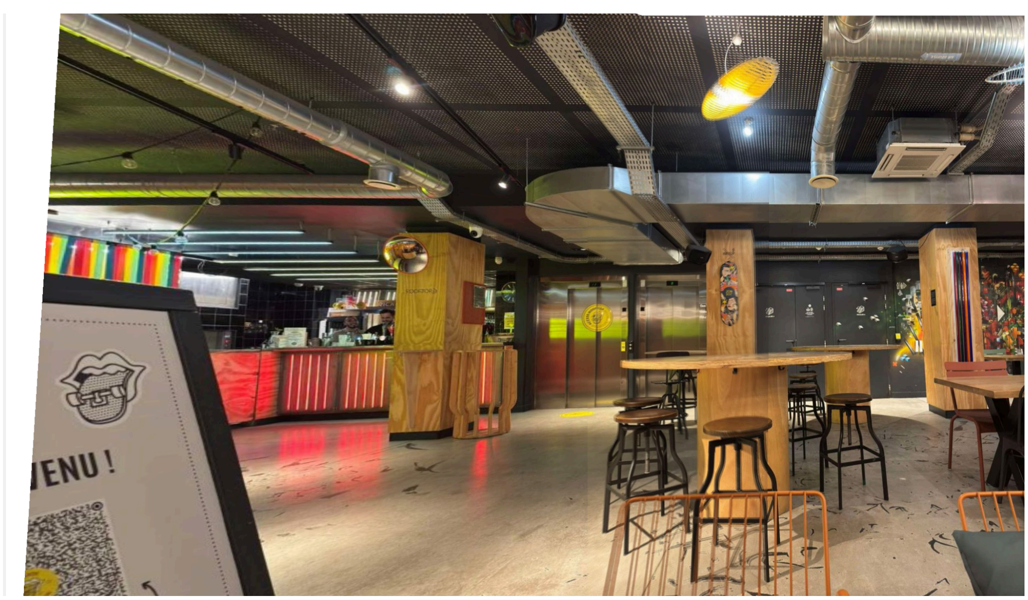


image 2



Constructed panorama



Conclusion

The panorama construction process is highly dependent on the accuracy of the homography matrix. Using more matching points improves the quality of the transformation and reduces artifacts in the final panorama. The blending of overlapping regions using color averaging provides a smooth transition between the images. Further improvements could include more advanced blending techniques or automatic point selection algorithms to enhance the accuracy and efficiency of the system.