Project 4 The ImageMosaic Project

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Outline

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- ➢ Description

- ➢ Algorithm

- ➢ Result

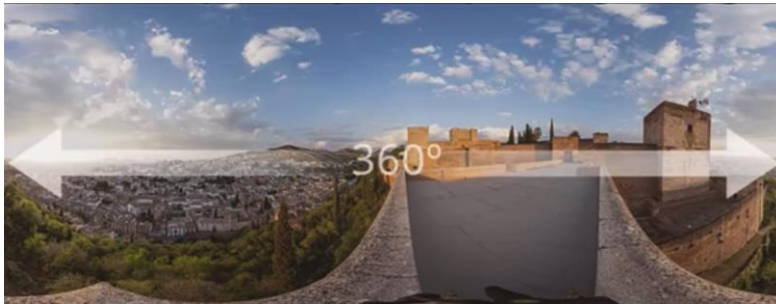- ➢ Contribution

Description

Description

- ➢ Goal: a panoramic picture

- ➢ Two ways of panorama

- ➢ Project we chose to finish

Goal: a panoramic picture

➢ ## Definition

A panorama is the result of stitching multiple photos to get one single image that covers a wide field of view of up to 360 degrees horizontally and 180 degrees vertically.

360 degrees horizontally

180 degrees vertically

Two ways of panorama

spherical panorama

➢ ## Normal One: Flat or Unfolded

Display a panorama in a plane like a flat photo

➢ ## Optional One: Spherical

Display a panorama in a spherical format

flat panorama

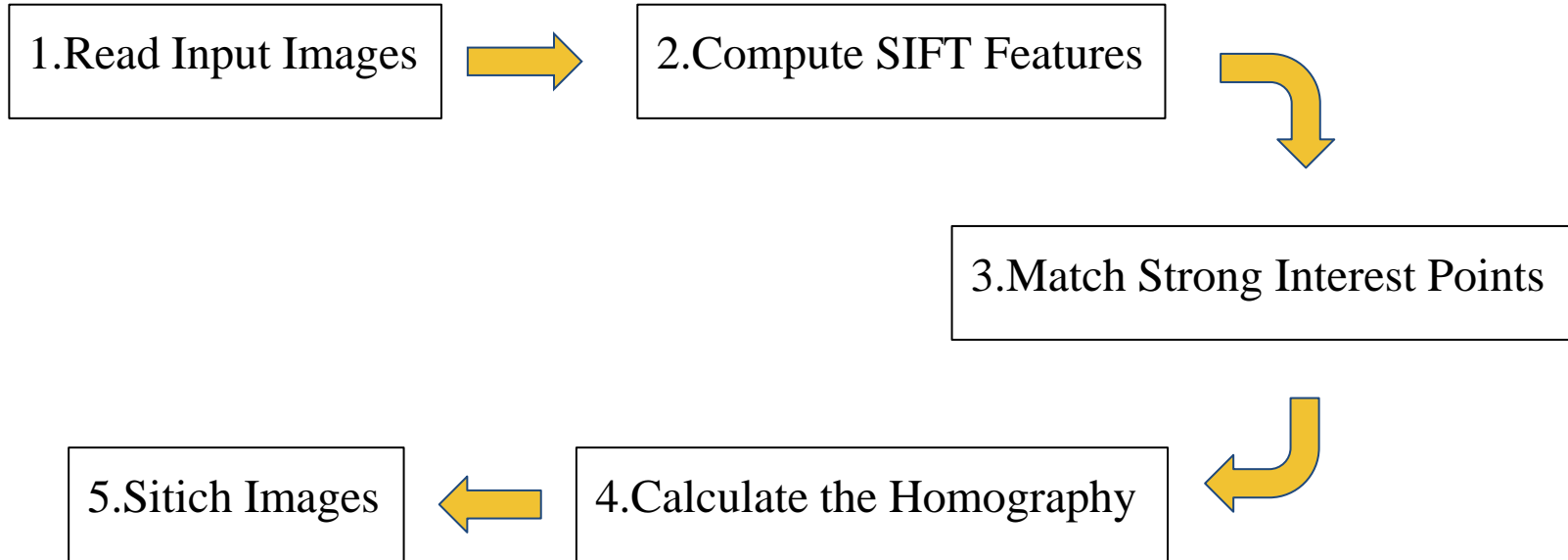# Project we have done

➢ Flat Panorama: Multi-image Panoram Stitching

➢ Example of Results

Northwestern

Algorithm

Algorithm

1.Read Input Images → 2.Compute SIFT Features

3.Match Strong Interest Points

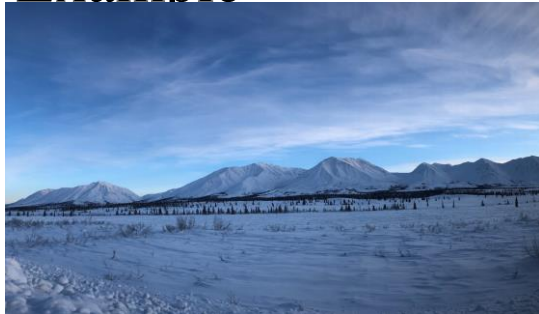5.Sitich Images ← 4.Calculate the Homography

Northwestern

Algorithm: Read Input Images

➢ Key Points

  ○ Do not change camera properties

  ○ Do not take many similar structures in the frame

➢ Example

Left Image

Right Image

Northwestern

Algorithm: Compute SIFT Features

- ➤ Detect Features(markers) with SIFI
  - ○ Theory behind SIFT
    - ■ Use a pyramidal approach using DOG(difference of gaussian)
    - ■ Obtained features are invariant to scale
    - ■ [Details](#)
  - ○ With SIFI, images have features variations in rotations, scale, lighting which are good for panorama
  - ○ Other options: SURF, HOG
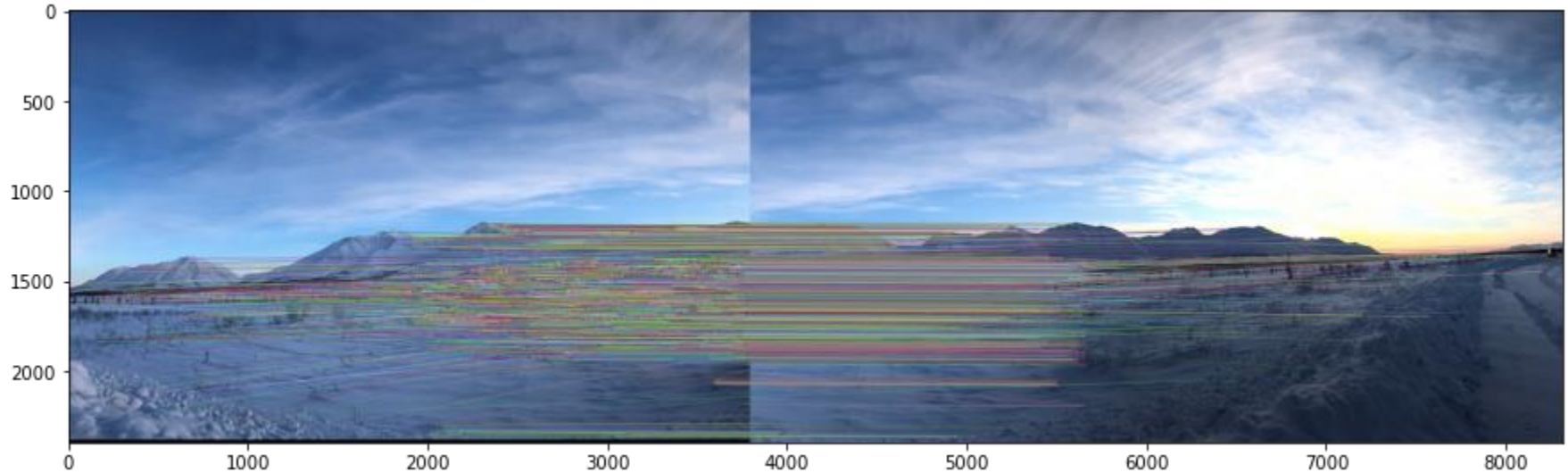
Algorithm: Compute SIFT Features

➢ Example

Algorithm: Match Strong Interest Points

➢ Key Points

- Based on vector represetation

- A certain threshold for deciding whether two points are near or not

- Inbuilt brute-force Matcher in OpenCV

  ■ Compute distance for two points described in SIFT feature space

  ■ Details

Algorithm: Match Strong Interest Points

➢ Example

Algorithm: Calculate the Homography

➢ **Purpose**

Identified Matching Points
(from last step)

➡️

Generic Relationship
between Images

Homography
(matrix)

➢ Process

○ Transform one image into another image's space with homography matrix

○ Keep consistent while passing points to homography

➢ Method

○ Use RANSAC to get homography

Algorithm: Stitch & Blend
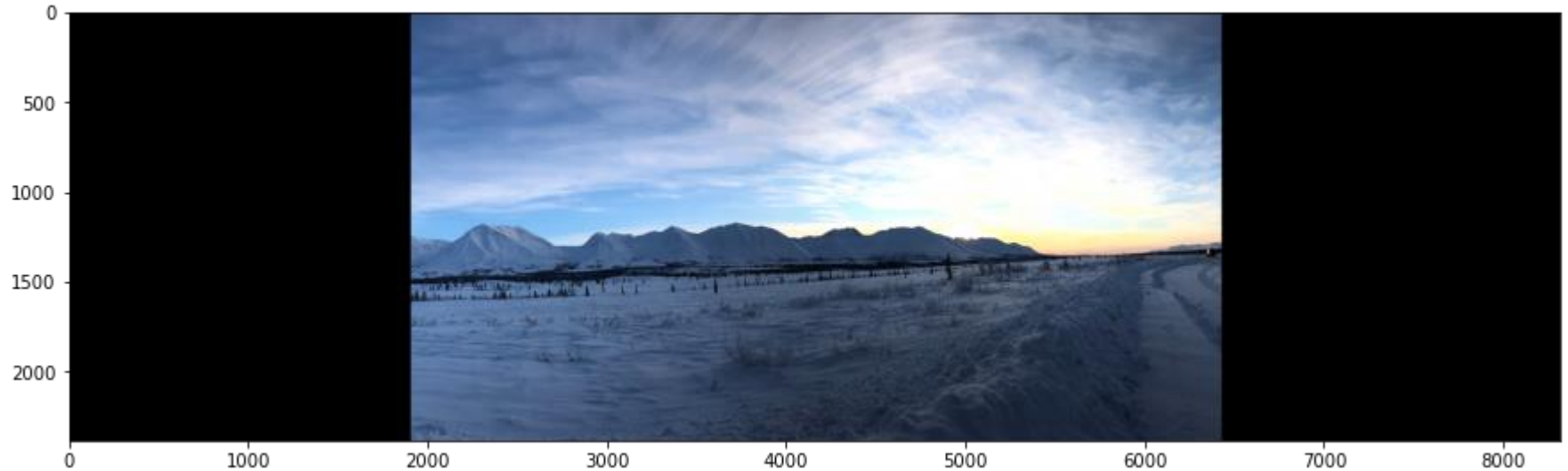
➢ **Transformed Images in the Same Space**

    ○ Each Image has some information separated and some common with respond to other

    ○ Separated part - zero intensity value at the corresponding location

➢ **Fuse Images**

    ○ Pixel level operation

    ○ Loop based approach to choose the maximum pixel from the corresponding input pixels

Algorithm: Stitch & Blend

➢ Example of Warped Images

Algorithm: Stitch & Blend

➢ Example of Stitched Images

Algorithm

➢ ## Two Image Only

We assume that the two images under consideration do have certain features common.

➢ ## Multiple Images

When we have multiple images to combine, the approach we followed is to pairwise add 2 images each time. The output of last addition is used as an input for the next image.
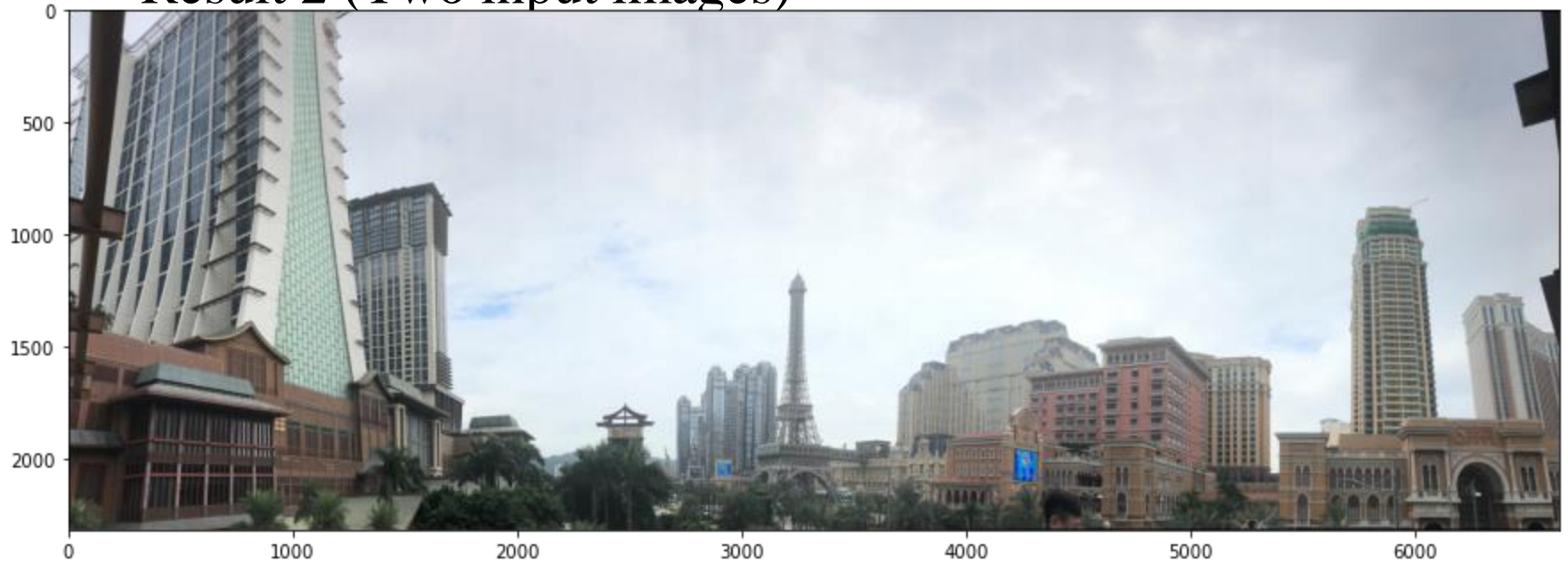
Results

Results

➢ Result 1 (Two input images)

Results

➢ Result 2 (Two input images)

Results

➢ Result 3 (Two input images)

Results

➢ Result 4 (Three input images)

Future Work

Future Work

➢ Spherical Panorama

➢ Optimize the mask algorithm for mutiple-images case

- Left image is from our algorithm, right image is from built-in function in Opencv. From the results, the image on the left is stretched horizontally. Instead, the image on the right has less distortions than the left one.

Northwestern

Q & A