ACIP

Activity 4

Anna, Kimia, Hamza

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1 Introduction

In this activity, we focus on estimating and refining the geometric transformations between images. We build on decisions made in previous activities, where we chose to use the SIFT method for feature matching, established specific transformations such as shearing and rigid movements, and selected the MaxRatio parameter (0.4) for matching accuracy. Our goal now is to apply the image alignment process.

2 Methodology

The steps we followed in this activity were important for aligning the images accurately:

2.1 Transformation Estimation

Firstly, we used the control points that had been matched through the SIFT method to estimate the transformations. For estimating the transformations such as shearing and rigid movements, we employed the function `estgeotform2d` in MATLAB, which is designed to compute affine transformations. We passed the matched control points from the sensed and reference images to this function.

2.2 Image Registration

After estimating the transformations, the next step was to apply these transformations to align the sensed image with the reference image. We used MATLAB's `imwarp` function for this purpose. The transformation estimated in the previous step was used to warp the sensed image so that it matches the frame of the original image. The `OutputView` parameter was set using `imref2d` to ensure that the size of the output registered image matched that of the original.

2.3 Visualization of Results

Finally, to visually evaluate the effectiveness of the image registration, we used the `imshowpair` function. This function overlays the original image and the registered image with the option "falsecolor" to highlight the differences between them. This visualization helps in assessing how accurately the images have been aligned.

3 Results

3.1 Shearing Transformation

Here's what we did and found for the shearing transformation:

- We used matched control points to estimate an affine transformation.
- We then visually checked the alignment using MATLAB's `imshowpair` function.

Figure 1: Overlay of the original and sheared image, showing how well the transformation worked.

3.2 Rigid Transformation

For the rigid transformation, we followed a similar process:

- Again, we used control points to estimate a transformation focused on rigid movements.
- We assessed the results visually to confirm the effectiveness of the registration.

Figure 2: Overlay of the original and rigidly transformed image, showing how well the transformation worked.

4 Discussion

Our work in estimating transformations for both shearing and rigid movements showed that we can effectively align transformed images back to their references. The SIFT method proved very efficient.

5 Conclusion

This activity confirmed that our approach using SIFT is effective for complex image registration tasks. We've developed a solid method for future projects that might involve different or more complex transformations.