Assignment 4

Introduction:

Our goal in this assignment is to perform registration using affine transformation matrix and Iterative Closest Point (ICP) method. We are provided with a source and target image along with their labels.

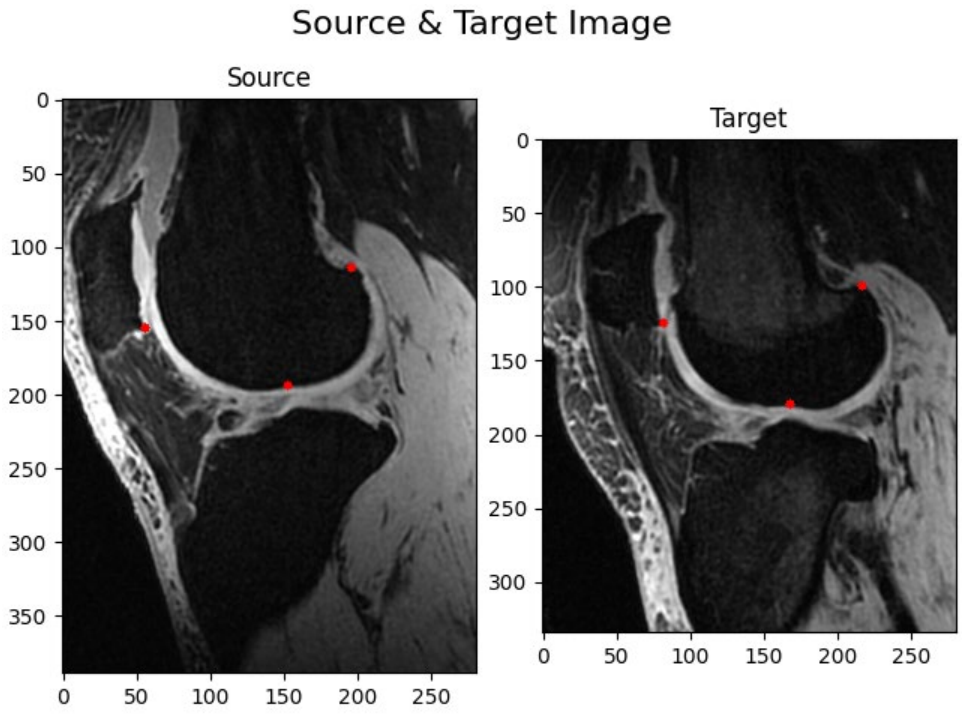

Figure 1: Source and Target Images with corresponding annotations

Assignment is divided into following parts:

1. Part1:
    a. Annotate three corresponding points in image.
    b. Find an affine transform.
    c. Transform source to target image using bilinear interpolation.
    d. Transform source and target label using nearest neighbor interpolation.
2. Part2:
    a. Extract boundary points from source and target labels.
    b. Implement ICP and find transform matrix.
    c. Transform source to target image using bilinear interpolation.
    d. Transform source and target label using nearest neighbor interpolation.

Part1:

In the first part, we have to manually annotate three corresponding points on both images (Figure 1). Using these points, we can find affine transformation of the points. Here I used OpenCV built-in method for calculating affine transformation matrix. Later this matrix was used for transforming source image and label to target image and label respectively (Figure 2,3).

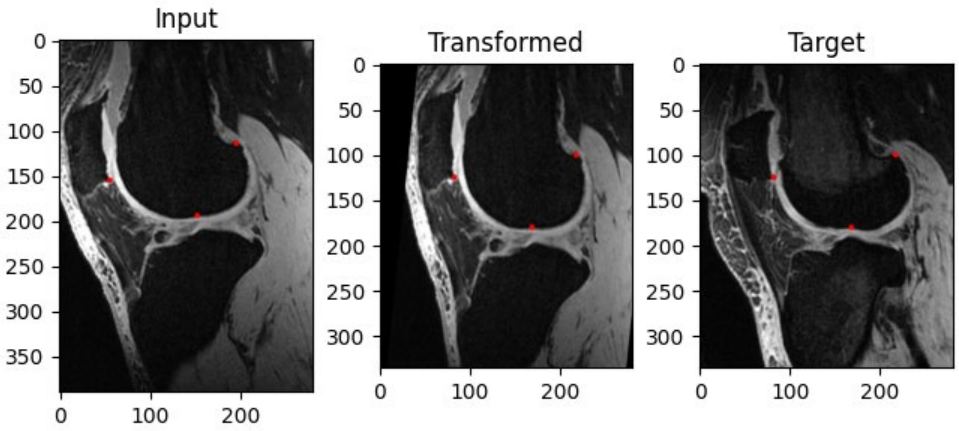

Figure 2: Image transform

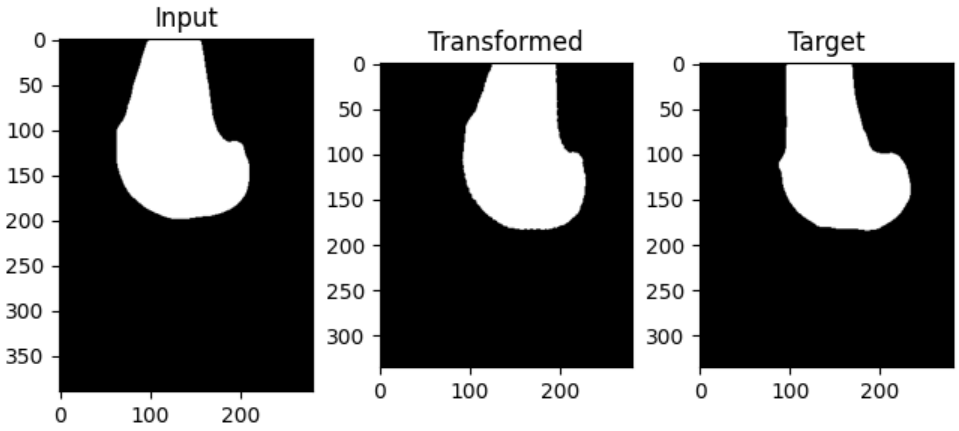

Figure 3: Label transform

Results:

Using this approach, I obtained a DSC score of **0.894**.

Part2:

In this part, first, we have to extract boundry points of the labels of both images. I used OpenCV built-in library for this purpose (Figure 4). These boundry points were used for training ICP algorithm to obtain transformation matrix. This transformation matrix was used for transforming source image and label into target image and label (Figure 5,6). I used this opensource code for ICP algorithm (https://stackoverflow.com/questions/20120384/iterative-closest-point-icp-implementation-on-python).

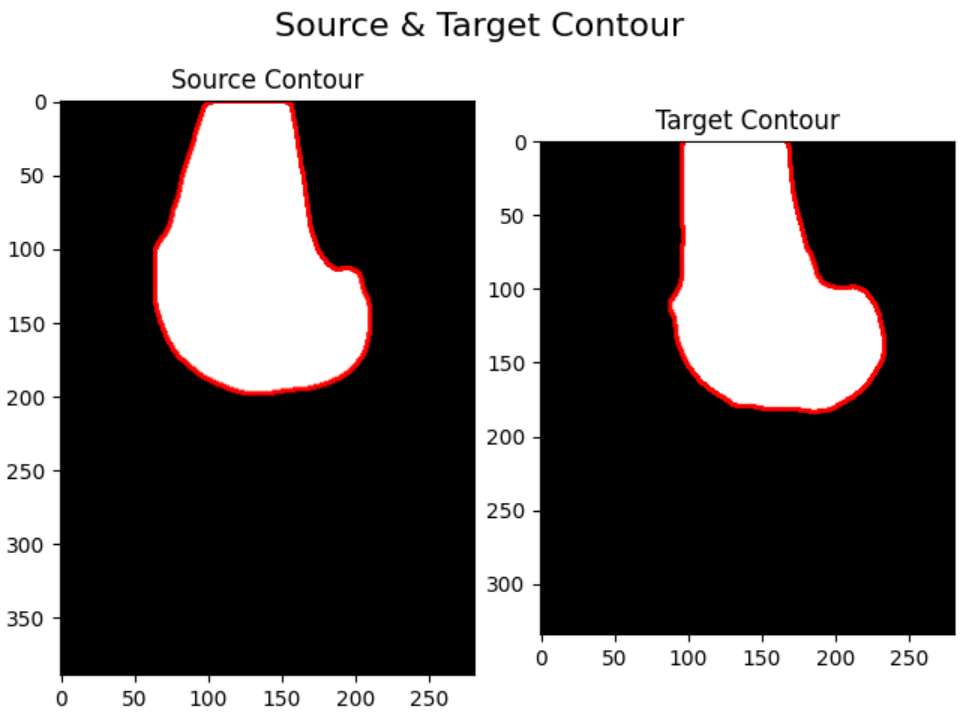

Figure 4: Boundry points

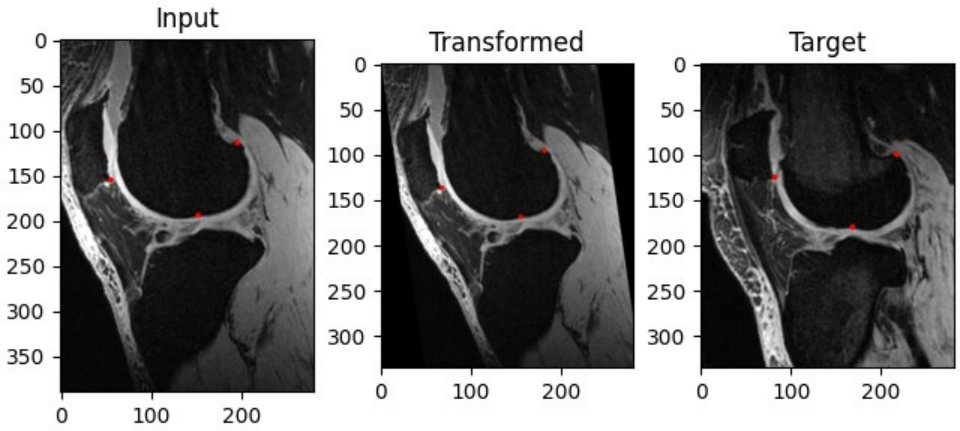

Figure 5: Image transform

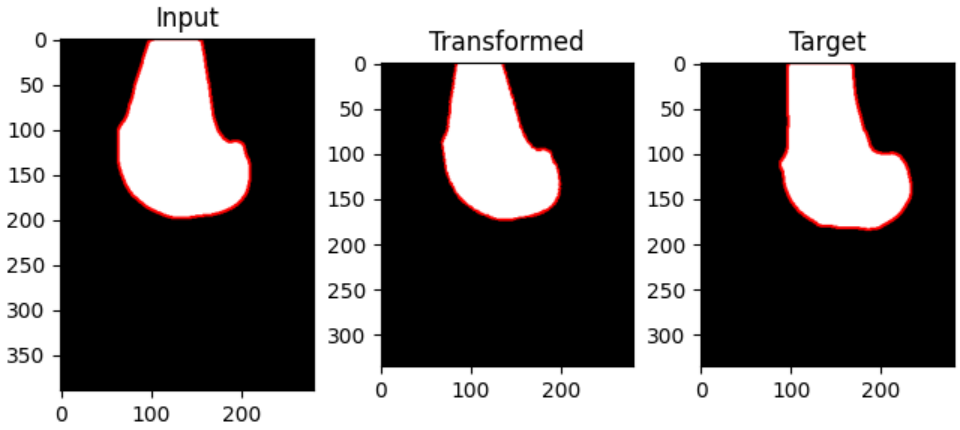

Figure 6: Label transform

Results:

Using this approach, I obtained a DSC score of **0.726**.

Conclusion:

In this assignment, we have to apply different image registration techniques for aligning source and target images. In this assignment, I applied two techniques who's results are shown in the table below:

Method	Dice Score
Manual Transform	**0.894**
Iterative Closest Point (ICP)	0.726