**Activity\_3**

In this activity, first, the previous codes from Activity 2 are implemented again to detect and extract the features (SIFT method) from the original and transformed image.

Then, the matchFeatures function is used to match the two sets of control points. This function takes the feature descriptors from the two sets, and calculates the similarity between each pair of features based on a distance metric; meaning it measures how close two feature descriptors are in their multi-dimensional space. With the 'Unique' set to true, the function makes sure that each feature in the first set is matched with at most one feature in the second set and vice versa.

The 'MaxRatio' parameter which will be used later to fine-tune the parameter, is used to accept a match only if the ratio of “the distance of the nearest neighbor” to “the distance of the second-nearest neighbor” is below a certain threshold. This helps to take out weak matches. A lower ratio means stricter matching

Next, the showMatchedFeatures function is used. This function displays lines connecting matching pairs of features between two images, which makes it easier to assess the quality of the matches. The 'montage' option places the images side by side with matching features connected by lines.

Figure 1, shows the initial matched features.

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Figure 1 – Original and transformed images, with all of their matched features.

As can be seen in the image, we have two or three pairs of features that seem to be incorrect matches as the lines cross each other. Therefore, further tuning was needed.

The MaxRatio parameter was set to multiple numbers to take out incorrect matches. With a higher number for this parameter, the number of features is higher. We experimented with different numbers (0.8, 0.7, 0.5, 0.45) and finally set this number to 0.45 as with this number, we got rid of the incorrect matches. Figure 2 shows the final matched features.

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Figure 2 – Original and transformed images, with refined parameters.