**Introduction**

This assignment is to generate a sensible mapping between one image and the other.

**Methodology**

1. Feature point detection

* Locator: Identified x and y coordinates of points that are stable under image transformations like rotation, shift, and scale.
  + Tells us where the interesting points are. It is a localisation problem in computer vision.
  + Locator – keypoint detector (ORB, SIFT and SURF): edge-like structures when you are using FAST or blob like structures if you are using SIFT or SURF.
* Descriptor: Describes the region around the point so that it can be identified again in a different image. It is a recognition problem in computer vision.

2. Matching

Matching features (matcher):  The association of feature points extracted from two different images

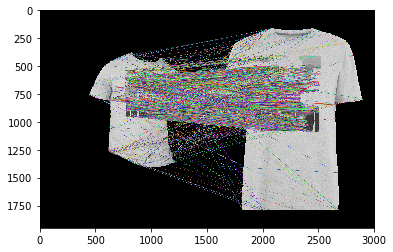
3. Motion Models

There are various motion models like Translation, Euclidean, Affine and Homography. Affine is stored in a **2 x 3** sized matrix. Translation and Euclidean are special cases of the Affine transform.Unlike the first 3 that are only 2D transforms, homography can account for some 3D effects. The transform has 8 parameters and stored in a 3 x 3 matrix

**Experiments -** Baseline

* ORB detector
* BruteForce Matcher
* NORM\_HAMMING, crossCheck = True
* Finding homography (RANSAC)

Generated 2808 matches



**Improvements**

The following algorithms are tested upon the baseline algorithm

* SIFT + Ratio test

Scale Invariant Feature Transform (SIFT) was proposed by Lowe (2004). Improved algorithms in terms of speed are the SURF and BRIEF. SIFT is both a descriptor and a detector. It has been shown to perform better than ORB and SURF in most scenarios except for cases where the angle of rotation is proportional to 90 degrees (Karami 2017).

* SIFT + FLANN based Matcher
* Imreg\_dft: Images must be 2-dimensional. Images must have the same shape

**What worked?**

* SURF + Ratio Test
* SIFT + Ratio test
* SIFT + FLANN based Matcher

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature detector** | **Descriptor extractor** | **Matcher** | **Good matches** |
| SIFT | SIFT | BruteForce with Ratio Test | 483 |
| SIFT | SIFT | FlannBased with Ratio Test | 443 |
| SURF | SURF | BruteForce with Ratio Test | 578 |

**What did not work?**

* **Enhanced Correlation Coeffcient (ECC) :** Evangelidis and Psarakis (2008) proposed using a similarity measure, ECC, to estimate the parameters of the motion model.

findTransformECC estimates a single global transform for alignment. This motion model is not adequate when there is local motion in the images. In our images the features are not in the same positions. Hence, could be a reason the method did not produce any effect.

* **Imreg\_dft:** It performed translations and checked for similarity between the images but was not particularly useful for the point matching.

**References**

Evangelidis, G.D. and Psarakis, E.Z., 2008. Parametric image alignment using enhanced correlation coefficient maximization. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, *30*(10), pp.1858-1865.

Karami, E., Prasad, S. and Shehata, M., 2017. Image matching using SIFT, SURF, BRIEF and ORB: performance comparison for distorted images. *arXiv preprint arXiv:1710.02726*.

Lowe, D.G., 2004. Distinctive image features from scale-invariant keypoints. *International journal of computer vision*, *60*(2), pp.91-110.

imreg <https://imreg-dft.readthedocs.io/en/latest/api.html>