

# IMAGE PROCESSING TASK DOCUMENTATION

## Image Processing Challenge:

### Objective:

- From the sample/test images provided, you have to identify the features and align the images according to the original.
- The test images may be scaled, offset or rotated or a combination of these.
- Ideally, the test image should be aligned to the original image in the same orientation and scale.
- You may use any language of your preference to accomplish this task.

### Programming Language:

- Python.

### Methods Used:

- ORB and Homography.

### Description:

- Image alignment (also known as image registration) is the technique of warping one image ( or sometimes both images ) so that the features in the two images line up perfectly.
- ORB and Homography are used.
- Two images of a scene are related by a homography under two condition.
  1. The two images are that of a plane (e.g. sheet of paper, credit card etc.).
  2. The two images were acquired by rotating the camera about its optical axis. We take such images while generating panoramas.
- Internally the function **findHomography** solves a linear system of equations to find the homography, but in this post we will not go over that math.
- **keypoints** or **feature points**. There are several keypoint detectors implemented in OpenCV ( e.g. SIFT, SURF, and ORB).
- ORB stands for Oriented FAST and Rotated BRIEF
- A feature point detector has two parts
  1. **Locator**: This identifies points on the image that are stable under image transformations like translation (shift), scale (increase / decrease in size), and rotation. The locator finds the x, y coordinates of such points. The locator used by the ORB detector is called FAST.
  2. **Descriptor**: The locator in the above step only tells us where the interesting points are. The second part of the feature detector is the descriptor which encodes the appearance of the point so that we can tell one feature point from the other. The descriptor evaluated at a feature point is simply an array of numbers. Ideally, the same physical point in two images should have the same descriptor. ORB uses a modified version of the feature descriptor called BRISK.
- Steps for Feature Based Image Alignment
  1. Read Images
  2. Detect Features
  3. Match Features
  4. Calculate Homography
  5. Warping image
- The resultant images are stored in result\_images folder.