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Feature Extraction and Object Detection

The first step is to load the images which begins by importing necessary libraries, such as cv2 for image processing and matplotlib for visualization. The images are then loaded in grayscale mode, which allows the feature detection process to operate on intensity values. A conditional check confirms if the images loaded correctly; if not, an error message is printed.

The next step is to extract keypoints and descriptors using SIFT, SURF, and ORB. It involves extracting distinctive keypoints and descriptors from the images using three feature detection algorithms. For SIFT, (sift.detectAndCompute) identifies keypoints and descriptors, with the number of keypoints and time taken recorded for each image. For ORB, (orb.detectAndCompute) identifies keypoints and descriptors, with the number of keypoints and time taken recorded for each image. Visualizations of keypoints for each method are displayed using matplotlib.

The third step is to have a feature matching with Brute-Force and FLANN**.** Applying two matching techniques to link corresponding key points between two images. After loading the original images, they are converted from BGR to RGB format for accurate display. The Brute-Force matcher compares SIFT descriptors from both images, applying a ratio test to retain only good matches. FLANN, optimized for fast approximate matching, also uses a ratio test for match quality. The matches identified by both methods are drawn on images through lines, then displayed side by side to compare the Brute-Force and FLANN results.

The last step is the Image Alignment using Homography which aligns one image with another based on feature matches. The process starts by reloading images in grayscale and detecting keypoints and descriptors using SIFT. Brute-Force matching is applied, with the top 50 matches selected for homography computation. Using the matched points, a homography matrix is calculated, which enables warping of the first image to align with the second image.