

Indian Institute of Technology Jodhpur



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CV Assignment-1

Submitted by

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Question 1 m23mac004_qu1.ipynb

Methodology:

- Define a function to loaded images from specified folders, converting form BGR to gray and return image file names, original images, gray images. It also converted one gif image into jpg image.
- The padding function pads an input image with zeros around its edges, increasing its dimensions by 2 in both height and width. The original image is placed at the center of the padded array, and the resulting padded image is returned.
- The convolution function performs 2D convolution between a padded image and a given kernel. It iterates over each pixel (excluding borders), computes the convolution sum using the kernel, and stores the result in a new array. Finally, it returns the convolved image.
- The harris_corner_detection function performs Harris Corner Detection on an image. It computes gradients in x and y directions using Sobel kernels. Calculates elements of the structure tensor. Smooths these elements using a window(3x3). Determines the corner response function. Applies a threshold to identify corner points. Marks detected corners on the original image and returns the resulting image.

- Final in a loop print image with detected corner by the scratch code and by using OpenCV inbuilt harris function.

Results and Observations:

- Both implementations effectively detected corners. Scratch code corners are looking more realistic for most of the images.

Example

Using skretch code



Using OpenCV

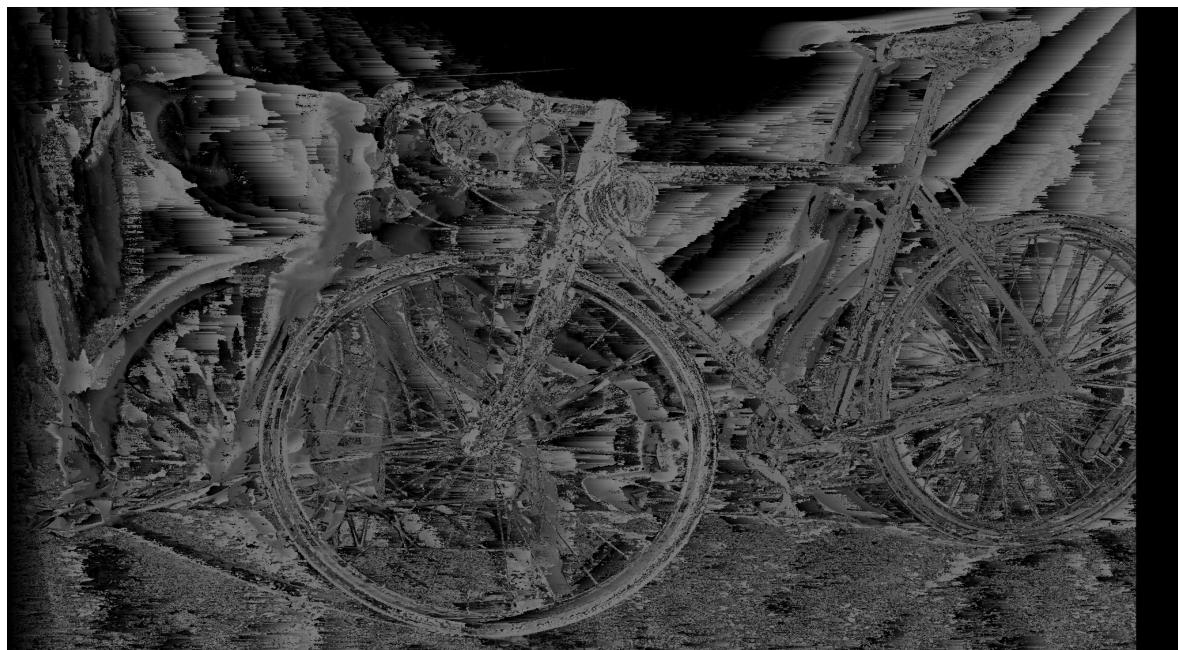


QUESTION 2 m23mac004_qu2.ipynb

Methodology:

- Use Block Matching function ,It iterates through each pixel in the left image and searches for the best match in the corresponding row of the right image within a specified range of disparities.
- For each pixel and disparity value, it calculates a matching score based on the sum of squared differences (SSD) or sum of absolute differences (SAD) between blocks of pixels in the left and right images.
- The disparity value corresponding to the best match (lowest matching score) is assigned to the pixel in the disparity map.
- It returns the computed disparity map, where each pixel represents the horizontal shift (disparity) between the corresponding points in the left and right images.
- Using the disparity map ,depth map and points clouds are formed.

Disparity Map



Depth Map



QUESTION 3 **m23mac004_qu3.ipynb**

Methodology:

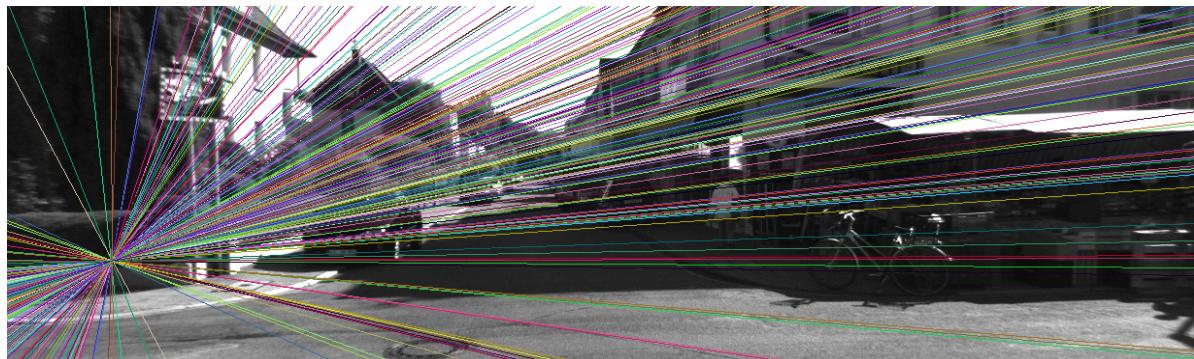
- Feature are extracted using SIFT descriptors.
- A custom function feature match is defined to perform matching between descriptors of two images. It iterates through each descriptor in the first image and finds the closest match in the second image. Matches are considered valid if the distance to the closest match(is significantly smaller than the distance to the second-closest match. After matching it return good matches .
- In a loop for each match in good_matches, it find indices of keypoints indices and using it points (pt1 and pt2) are extracted. Keypoints are converted to homogeneous coordinates.
- Epipolar lines are computed using the fundamental matrix given fundamental matrix and obtained points(pt1 and pt2) Epipolar lines are drawn on images I1 and I2.
- The code selects an epipolar line from the first image (I1) based on a match in good_matches, then finds corresponding points on the epipolar

line in the second image (I2). It visualizes this correspondence by drawing the selected line on I1 and its corresponding points on I2 with unique colors. Finally, it displays both images to show the correspondence between the two images captured by different cameras and similar operation is done by reversing the images .

Results and Observations:

The visualization of epipolar lines and corresponding points helps in understanding the geometric constraints imposed by the fundamental matrix. It provides insights into the relative pose and structure of the scene captured by the two images, aiding in tasks like stereo vision and structure-from-motion.

Epipolar lines on I1



Epipolar lines on I2

