COMPUTER VISION AND IMAGE PROCESSING (CS676A)

INTEREST POINTS BASED MATCHING

GROUP 6

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INTRODUCTION:

Images taken in different light conditions and slightly different orientation were matched. The detailed description of the execution steps and the resulting images are shown below. The parameters used for tuning are written in capital. To run the codes, use following **commands:**

g++ matchinglines.cpp -o ml `pkg-config --cflags --libs opencv`

./ml set1/img1.png set1/img3.png

EXECUTION:

STEP 1: Interest points detection

Intensity gradients I_x and I_y were computed by convolving the image with $[-1\ 0\ 1]$ and $[1\ 0\ -1]^T$ respectively. Gradients for boundary points were set to 0. Gradient magnitude and direction were stored along with the partial differentials. A window of size $2*PATCHSIZE\ X\ 2*PATCHSIZE$ was used to center each pixel and Harris operator was used to prune points with values less than THRESHOLD. Local maximas were then identified as final interest points of the image. Maximas were searched in a neighbourhood of $2*MAXPATCH\ X\ 2*MAXPATCH$.

It was observed that for blurry images, threshold had to be decreased in order to obtain sufficient number of interest points.

(THRESHOLD:50,000, PATCH_SIZE:8, INTEREST POINTS:200)

(THRESHOLD:50,000, PATCH_SIZE:8, INTEREST POINTS:237)

(THRESHOLD:60,000, PATCH_SIZE:16, INTEREST POINTS:158)

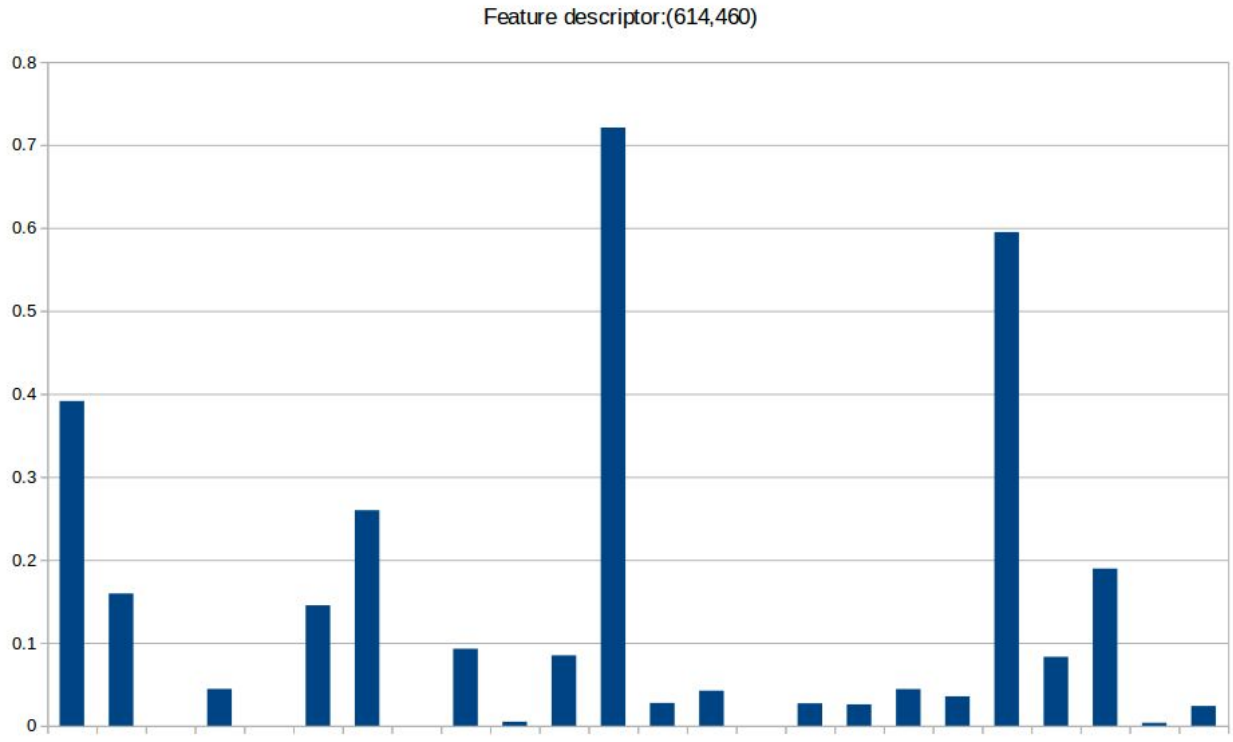
(THRESHOLD:60,000, PATCH_SIZE:16, INTEREST POINTS:125)

(THRESHOLD:80,000, PATCH_SIZE:8, INTEREST POINTS:179)

(THRESHOLD:8,000, PATCH_SIZE:8, INTEREST POINTS:95)

STEP 2: Feature Descriptor

For the final interest points obtained in Step 1, a window of size $2 * PATCHSIZE\ X\ 2 * PATCHSIZE$ was used and divided into $4\ X\ 4$ block. Histograms with 8 bins were obtained for these 16 blocks using angle ($tan^{-1}\frac{I_y}{I_x}$) as the classification measure. Various PATCHSIZEs were tested namely {4,8,16,32}. Analysing final matching, PATCHSIZE '16' gave the best results. The histogram below shows the 24 bin representation for three blocks of interest point situated at (614,460). Every gradient was weighted according to its magnitude and the final vector was normalised.



STEP 3: Matching

Interest points and their descriptors were computed and then for each interest point in image1, correspondence or similarity was calculated with all the interest points in the second image. The similarity measure chosen was the ratio of distance between nearest to the next nearest interest point (NNDR - Nearest neighbour distance ratio) . All the points with NNDR less than SCREENING were matched.

EFFECT OF VARYING PATCH SIZE

(DONE UNDER CONSTANT VALUES OF OTHER PARAMETERS)

PATCHSIZE = 4, NUMBER OF MATCHES = 95

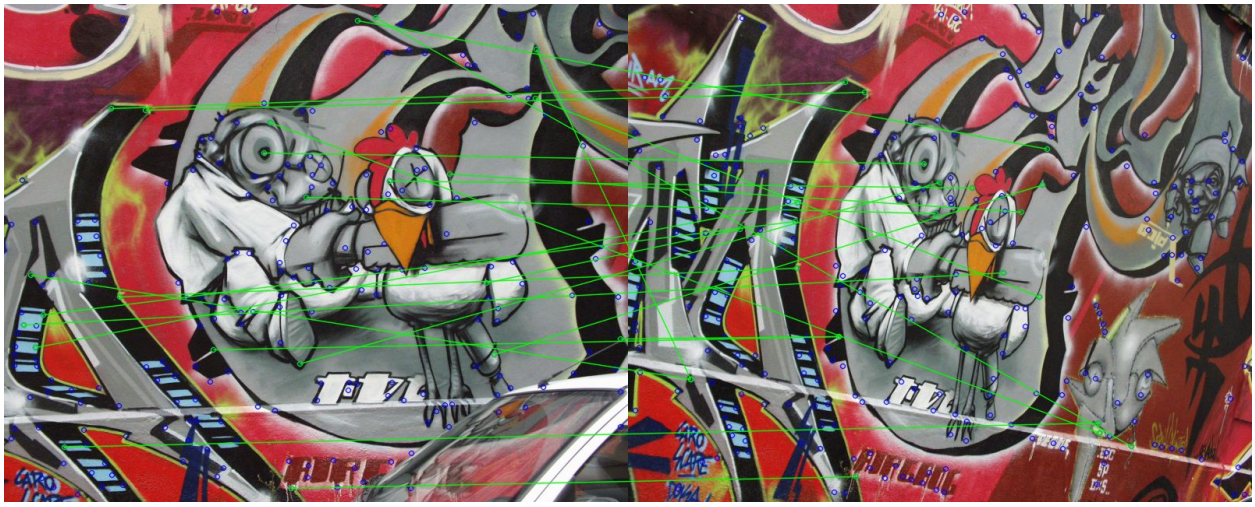
PATCHSIZE = 8, NUMBER OF MATCHES = 6

PATCHSIZE = 16 , NUMBER OF MATCHES = 15

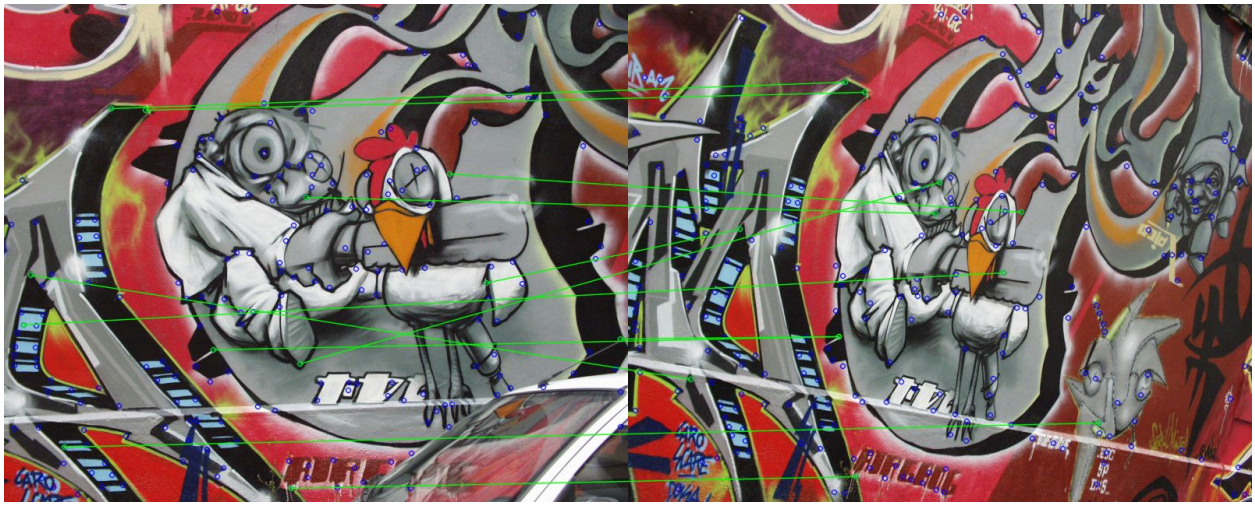
PATCHSIZE=32, NUMBER OF MATCHES = 5

BEST MATCHES

SET 1



(PATCHSIZE = 8, SCREENING = 0.85, NUMBER OF MATCHES = 23)



(PATCHSIZE = 8, SCREENING = 0.8, NUMBER OF MATCHES = 12)

SET 2

(PATCHSIZE = 16, SCREENING = 0.85, NUMBER OF MATCHES = 93)

(PATCHSIZE = 32, SCREENING = 0.85, NUMBER OF MATCHES = 48)

SET 3

(PATCHSIZE = 16, SCREENING = 0.85, NUMBER OF MATCHES = 15)

(PATCHSIZE = 32, SCREENING = 0.85, NUMBER OF MATCHES = 11)