HW1 Report

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Q:

- Detect motion vectors between trucka.bmp and truckb.bmp.
- Use trucka.bmp as the basis, sample it by an 9×9 , 11×11, 15×15, 21×21, 31×31 block.
- Threshold of search range: 50 pixels. (This is a reference value only!)
- Dimension of truck is 386×386 with 216 bytes of leading header.

Algorithm:

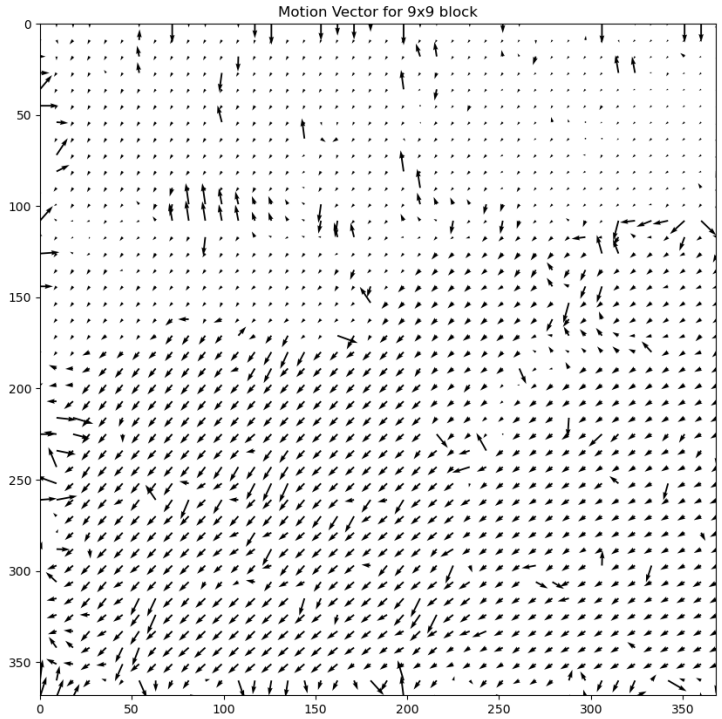
```
def get_patches(img, block_width, block_height, step):
    patch_list=[]
    patch_pixel=[]
    for i in range (0, img.shape[0]-block_width, step):
        for j in range (0, img.shape[1]-block_height, step):
            # patch_pixel saves the top-left pixel of the patch
            # patch saves the pixels info of every pixel

            patch_pixel.append((i, j))
            patch = img[i:i+block_width,j:j+block_height]
            patch_list.append(patch)

    return patch_list, patch_pixel
```

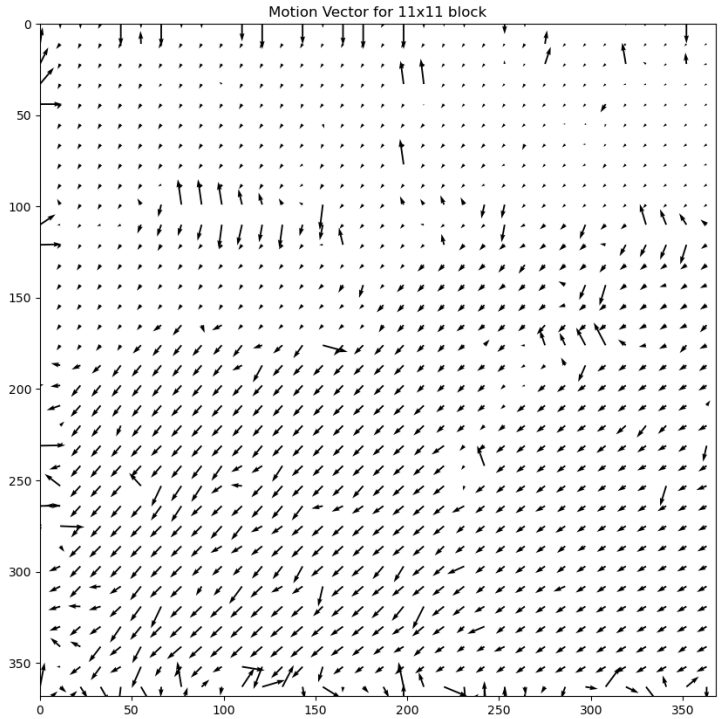
- get_patches() gets patch information according to the block size.
- Blocks in trucka.bmp are closely connected, so the step is the block size while getting truck A patch information.
- Records the patch starting pixel position and all pixel intensities.

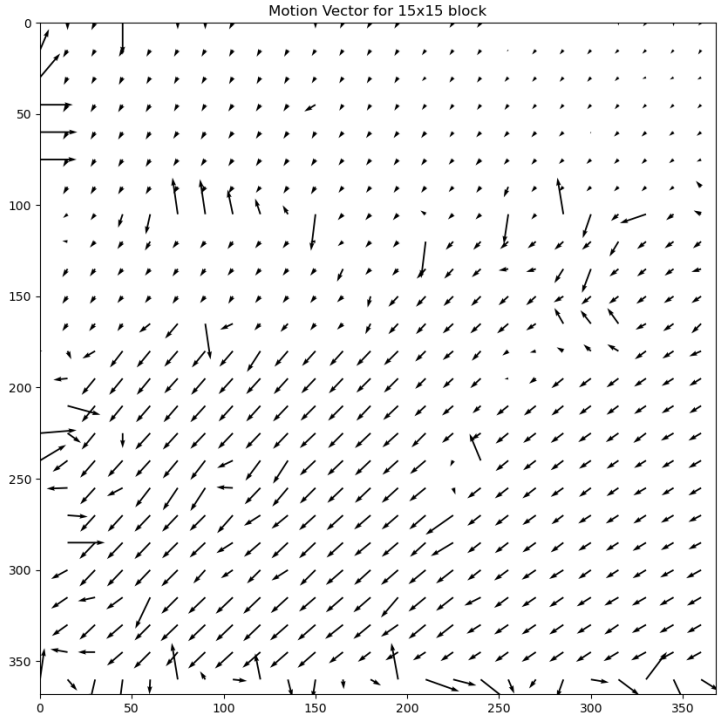
```
def get_motion(patch_list_a,patch_pixel_a,patch_list_b,patch_pixel_b,search_range):
    motions=[]
    # patch a is reference, show motion in patch of b
    # Traversal search all patches of a, if distance<=search range then do futher calculations
    # Remember the pixel in a which has the smallest differnece
    for patch_a, pixel_a in zip(patch_list_a, pixel_tup_a):
        min_diff = float("inf")
        for patch_b, pixel_b in zip(patch_list_b,patch_pixel_b):
            distance = math.sqrt((pixel_a[0]-pixel_b[0])**2+(pixel_a[1]-pixel_b[1])**2)
            if distance<=search_range:
                diff = np.sum(abs(patch_a-patch_b))
                if diff<min_diff:
                    min_diff = diff
                    match_position = pixel_b
        dx, dy = match_position[0]-pixel_a[0], match_position[1]-pixel_a[1]
        motions.append((pixel_a, match_position,dx, dy))
    return motions
```

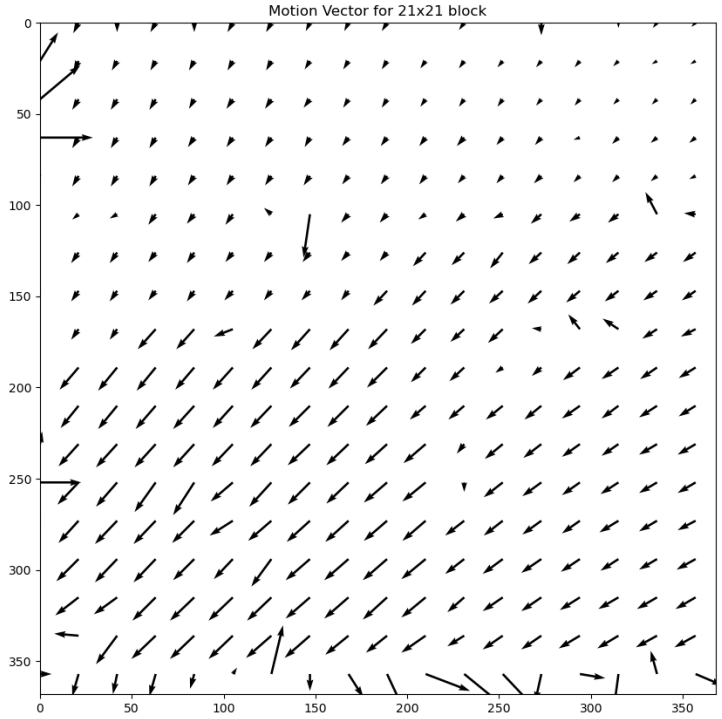
- get_motion() gets motion of patches in truck A with respect to truck B.
- Patch a is reference, show motion in patch of b.
- Traversal search all patches of a, if distance<=search range then do futher calculations
- Remember the pixel in a which has the smallest difference

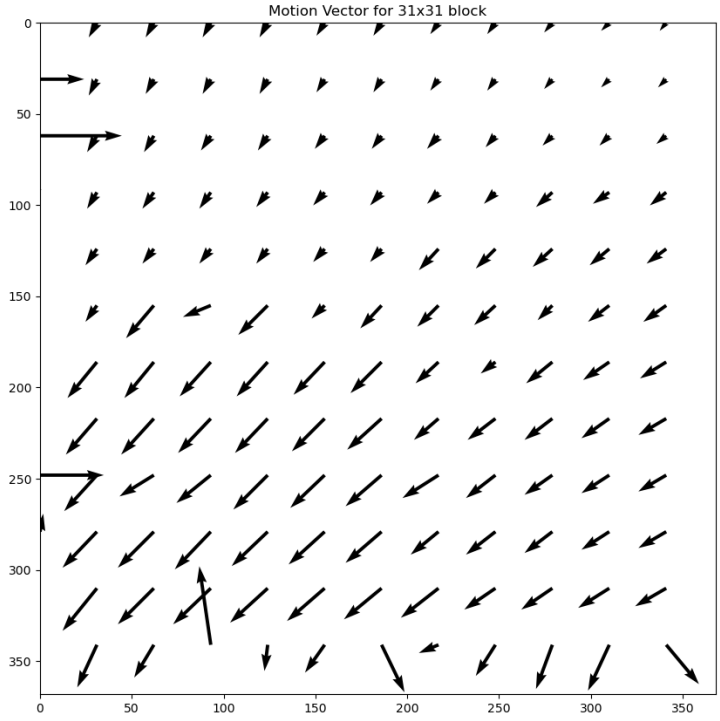
Result:


Motion Vector for 9x9 block
0
50
100
150
200
250
300
350
0
50
100
150
200
250
300
350


Motion Vector for 11x11 block
0
50
100
150
200
250
300
350
0
50
100
150
200
250
300
350


Motion Vector for 15x15 block
0
50
100
150
200
250
300
350
0
50
100
150
200
250
300
350


Motion Vector for 21x21 block
0
50
100
150
200
250
300
350
0
50
100
150
200
250
300
350


Motion Vector for 31x31 block
0
50
100
150
200
250
300
350
0
50
100
150
200
250
300
350