Assignment06 (1)

May 9, 2019

Assignment06
Assignment06: K-means clustering on the spatial domain
Software Engineering
20154652 Lee Dong Jae

```
In [1]: import numpy as np
        import matplotlib.pyplot as plt
```

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In [2]: row_num = 30
        col_num = 30


        #make a matrix that contain value of row
        color_row = [ [col for row in range(row_num)] for col in range(col_num)]
        color_row = np.array(color_row)

        #make a matrix that contain value of col
        color_col = [ [row for row in range(row_num)] for col in range(col_num)]
        color_col = np.array(color_col)
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In [3]: def l2_distance(x, y):
            d = (x - y) ** 2
            #s = np.sum(d)
            #r = np.sqrt(s)

            return d
```

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In [4]: def l1_distance(x, y):
            d = abs(x-y)

            return d
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In [5]: def initialize_label(k, norm):

            #assign a list that contain centroids
            global x_centroid
            global y_centroid
            x_centroid={i :[] for i in range(k)}
            y_centroid={i :[] for i in range(k)}

            #Assign a dictionary that contain energy
            #initialize label randomly
            first_label = np.random.randint(k, size = (row_num, col_num))
            clusters_row = {idx: [] for idx in range(k)}
            clusters_col = {idx: [] for idx in range(k)}
            new_clusters = {idx: [] for idx in range(k)}
            #append corresponding [hor, ver] of image to cluster
            for i in range(k):
                clusters_row[i], clusters_col[i] = np.where(first_label == i)
                for j in range(len(clusters_row[i])):
                    new_clusters[i].append([clusters_row[i][j], clusters_col[i][j]])
            make_new_centroid(new_clusters, k, norm)

In [6]: def make_new_centroid(clusters, k, norm, centroid = 0):


            new_centroid = np.zeros((k,2))

            #sum previous data contained in same cluster
            for i in range(k):
                for j in clusters[i]:
                    new_centroid[i][0] += color_row[j[0]][j[1]]
                    new_centroid[i][1] += color_col[j[0]][j[1]]
            for m in range(k):
                if(len(clusters[m])!=0):
                    new_centroid[m] = new_centroid[m]/ len(clusters[m])
                    x_centroid[m].append(new_centroid[m][0])
                    y_centroid[m].append(new_centroid[m][1])

            #if clustering does not change over, plot images and information
            if np.array_equal(centroid, new_centroid):
                print('end')
                plot_image(new_centroid, clusters, k, norm, end = 1)
            else:
                plot_image(new_centroid, clusters, k, norm)
                do_clustering(new_centroid, k, norm)

In [7]: def do_clustering(centroid, k, norm):

            #make a place for put indexes of data to each clusters
            clusters = {idx: [] for idx in range(0, k)}

            #a temporary array for keeping the distance
            temp_distance = np.zeros(k)
            for i in range(row_num):
                for j in range(col_num):
                    for t in range(k):
                        if norm == 'l2':
                            temp_distance[t] += l2_distance(color_row[i][j], centroid[t][0])
                            temp_distance[t] += l2_distance(color_col[i][j], centroid[t][1])
                        elif norm == 'l1':
                            temp_distance[t] += l1_distance(color_row[i][j], centroid[t][0])
                            temp_distance[t] += l1_distance(color_col[i][j], centroid[t][1])

                    #find the argmin of distance. And append a idx of data to the cluster[argm
                    clusters[np.argmin(temp_distance)].append([i, j])
                    temp_distance = np.zeros(k)

            make_new_centroid(clusters, k, norm, centroid)

In [8]: def plot_image(new_centroid, clusters, k, norm, end=0):
            new_image = np.zeros((row_num, row_num), dtype = np.uint8)

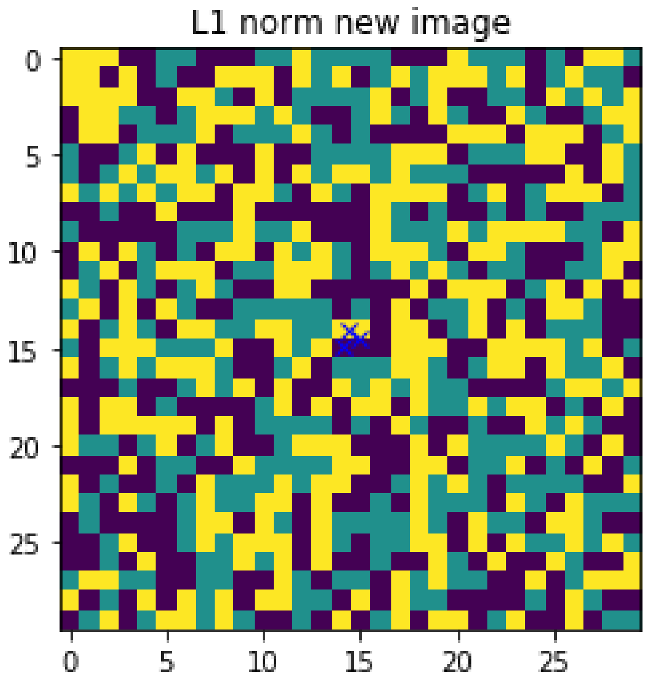
            for i in range(k):
                for j in clusters[i]:
                    new_image[j[0],j[1]] = i

            [plt.plot(y_centroid[i], x_centroid[i],'r') for i in range(k)]
            [plt.plot(y_centroid[i][-1], x_centroid[i][-1],'bx') for i in range(k)]

            if norm == 'l2':
                plt.title("L2 norm new image")
            elif norm == 'l1':
                plt.title("L1 norm new image")

            plt.imshow(new_image)
            plt.show()

In [9]: initialize_label(3, 'l1')
```


L1 norm new image
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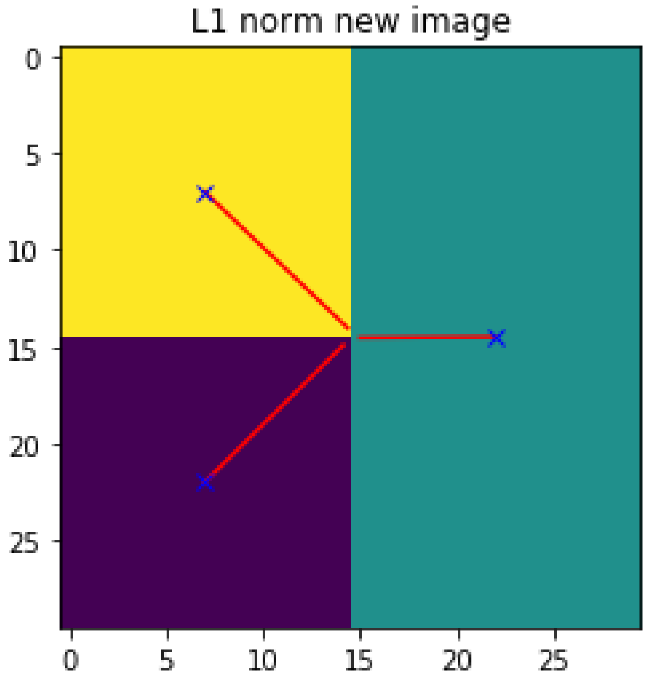
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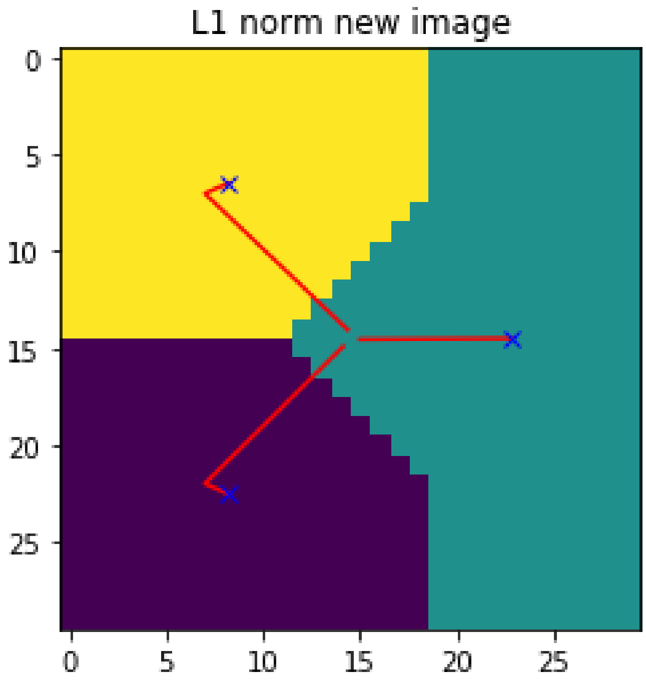
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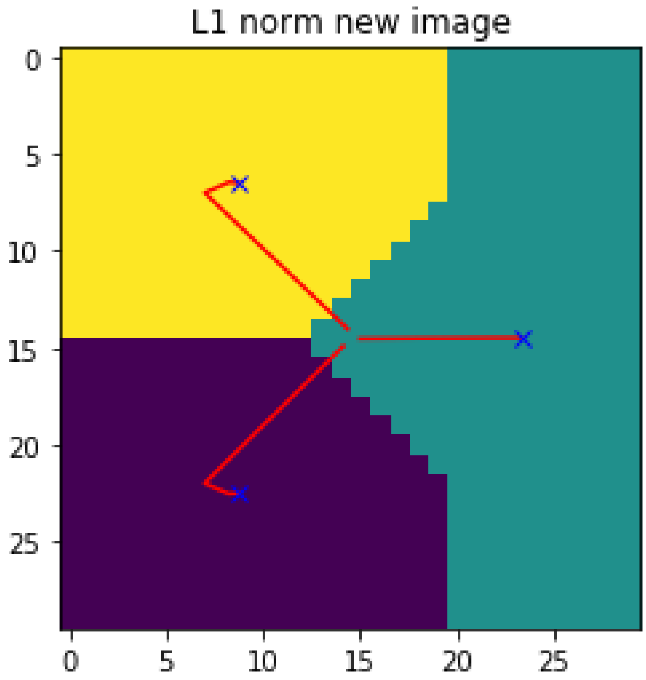
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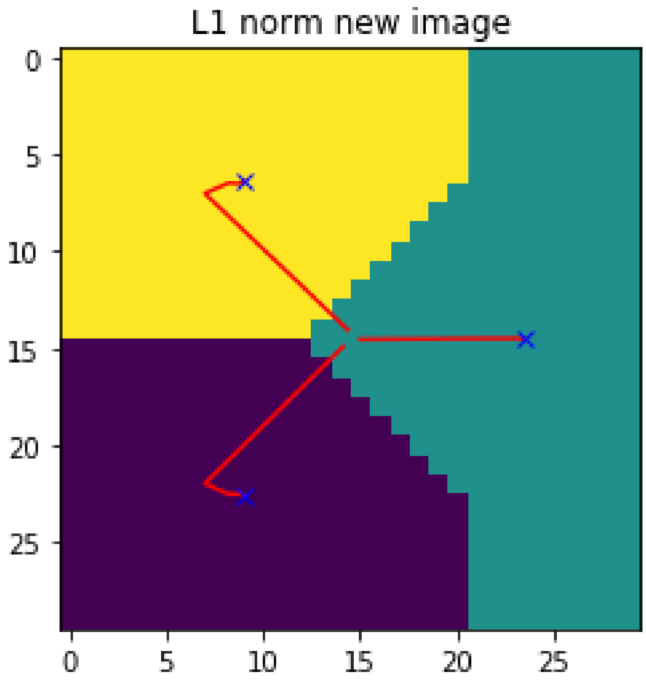
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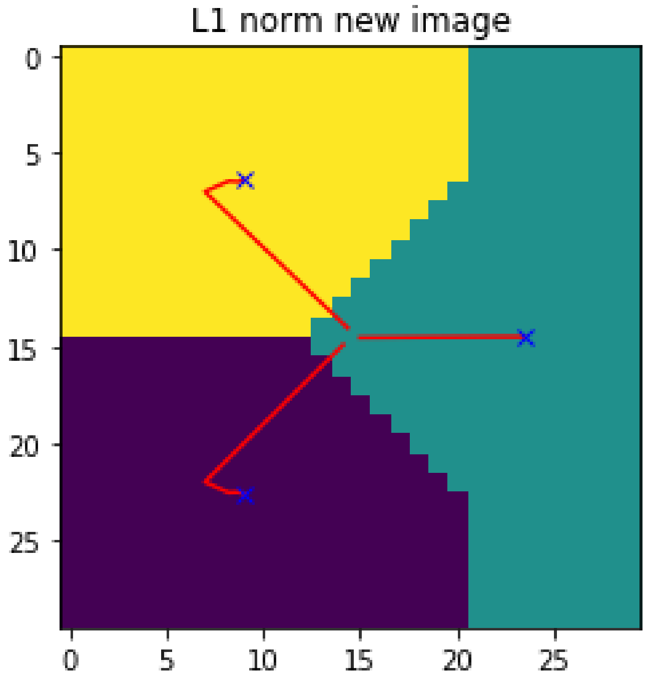
L1 norm new image
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In [10]: initialize_label(3, 'l2')
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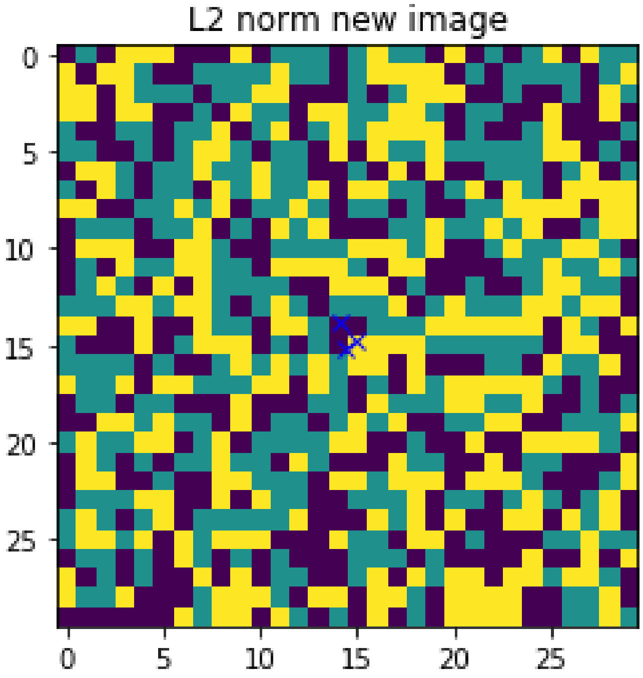

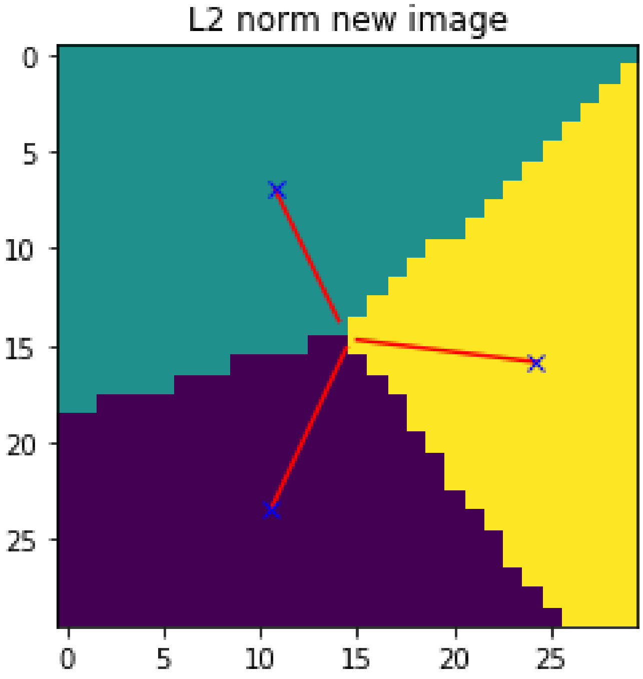

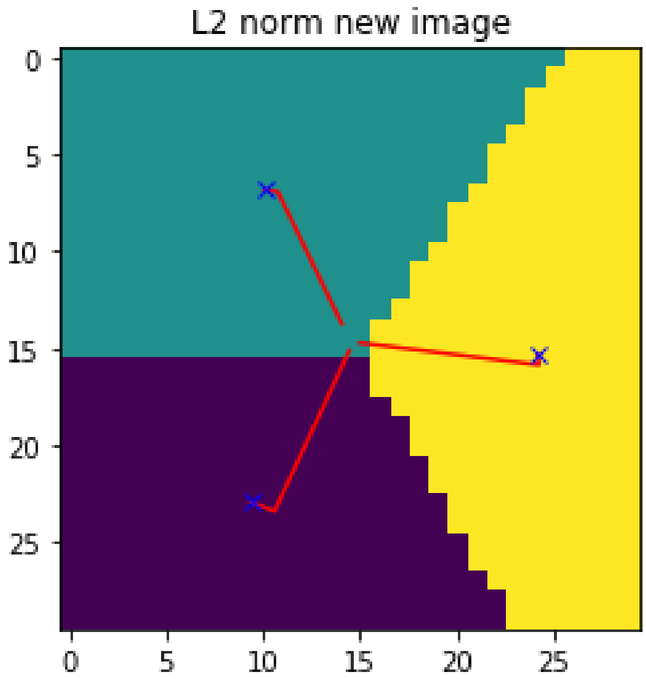
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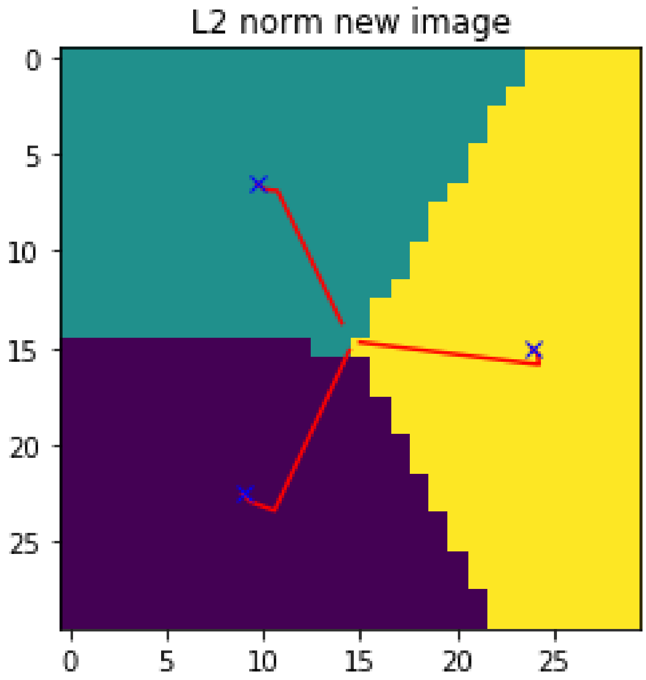
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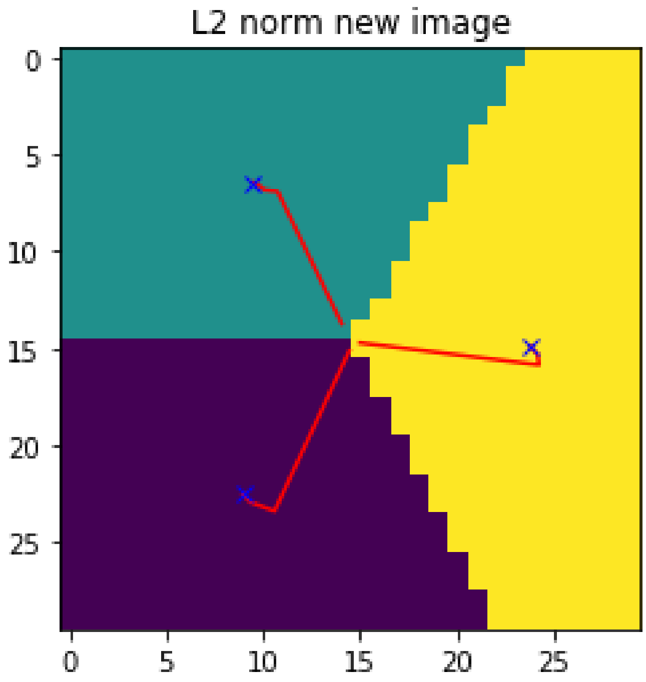

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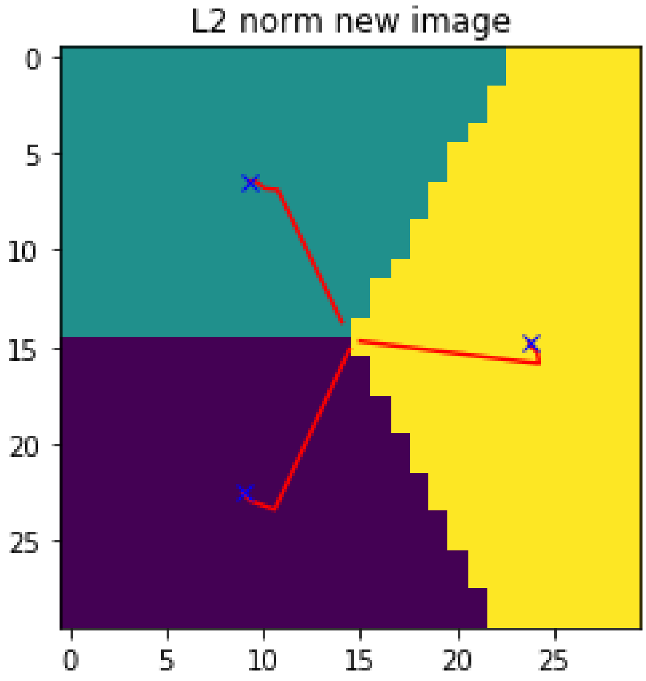

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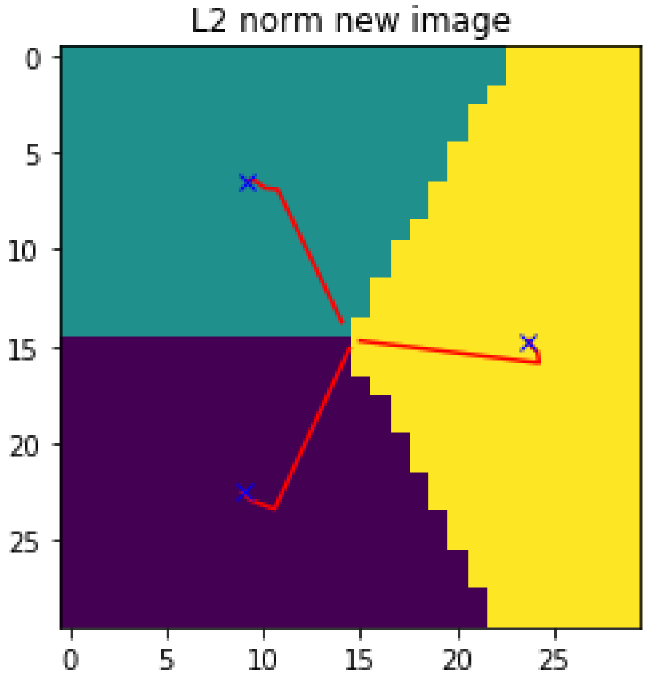
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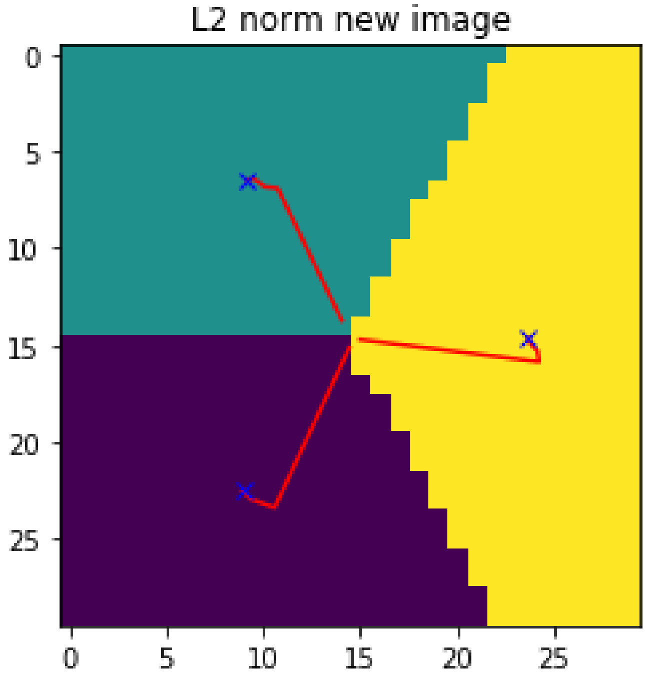
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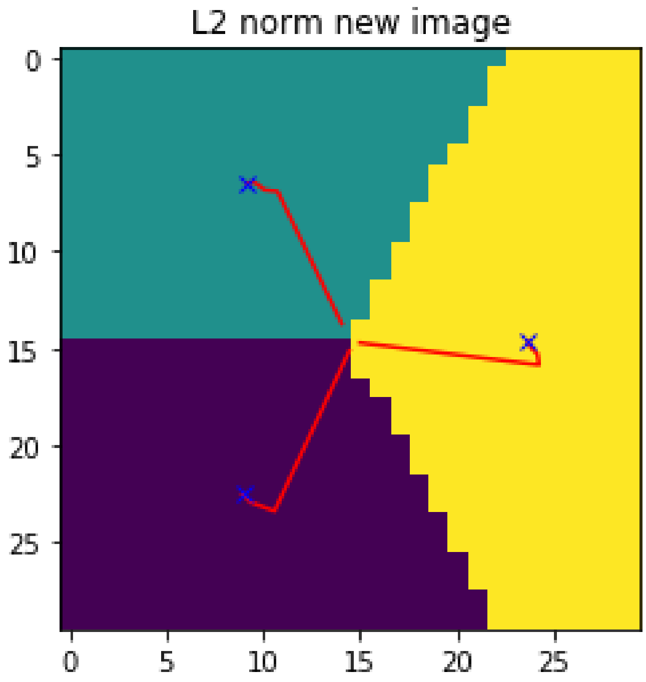
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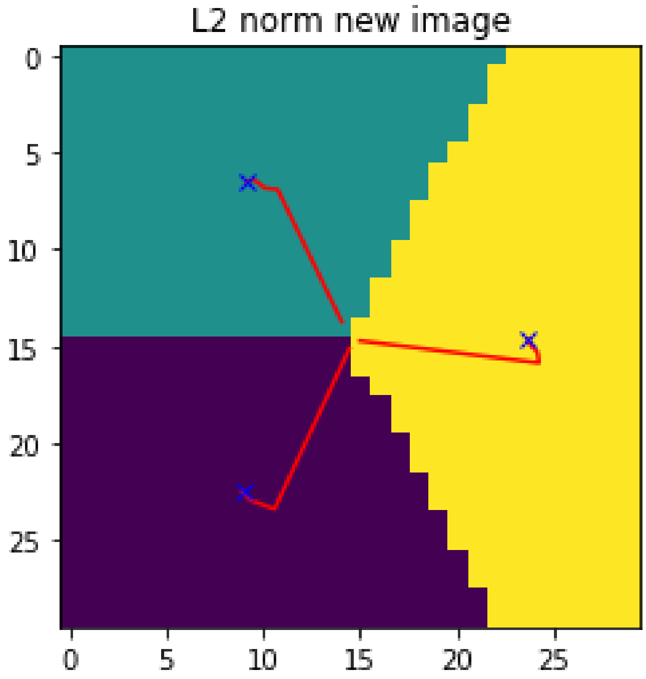
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In [11]: initialize_label(6, 'l1')
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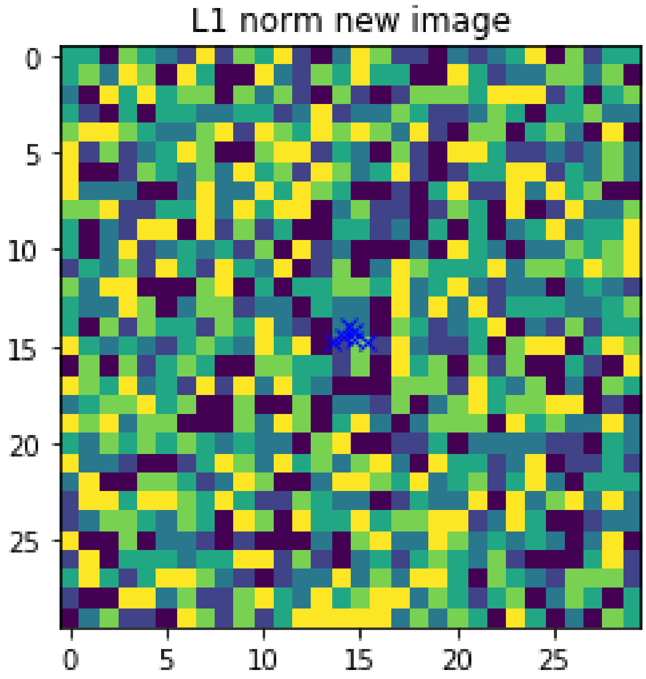

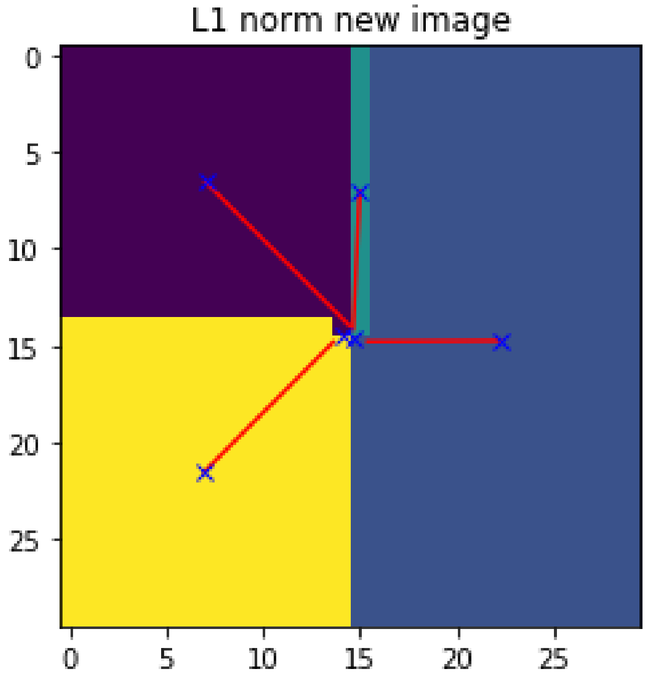

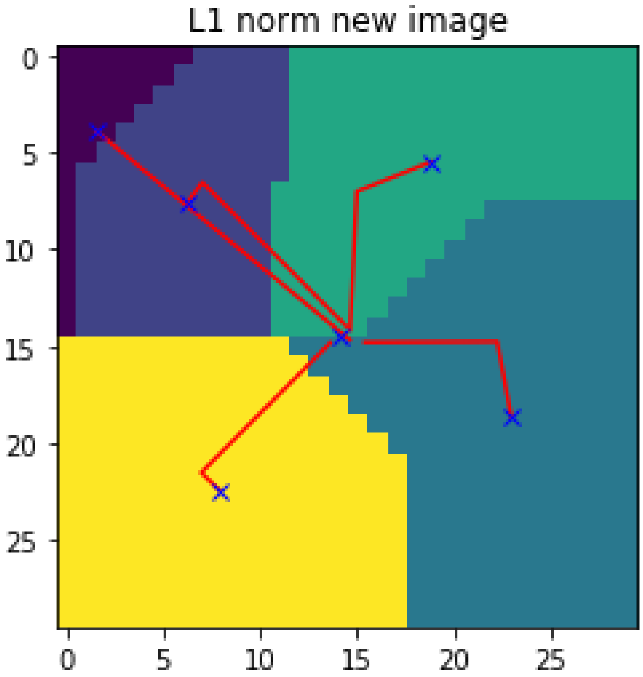
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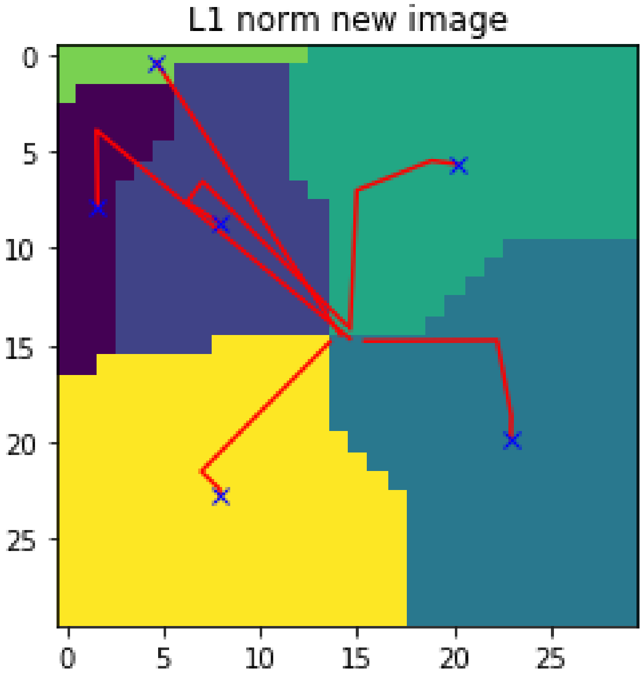
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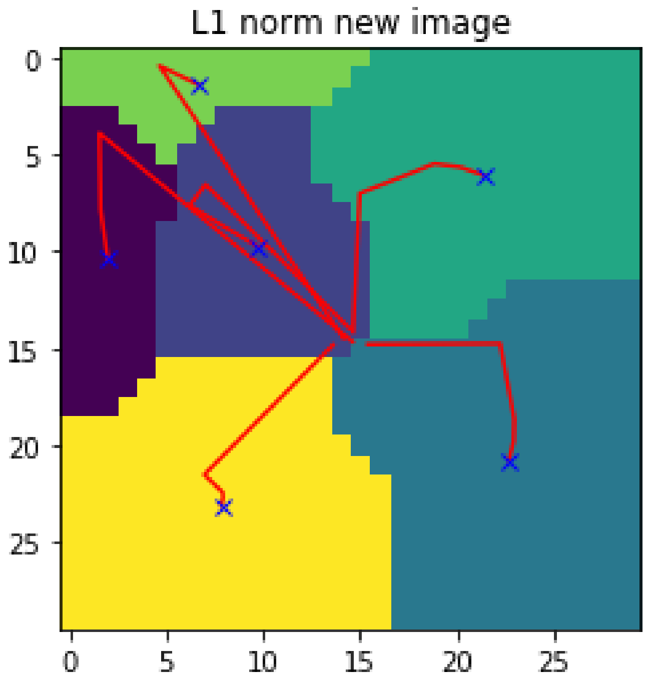
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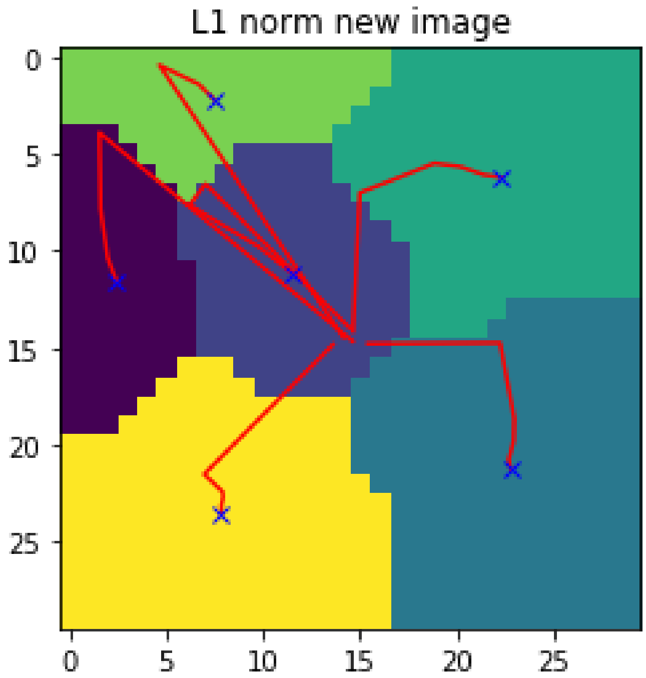
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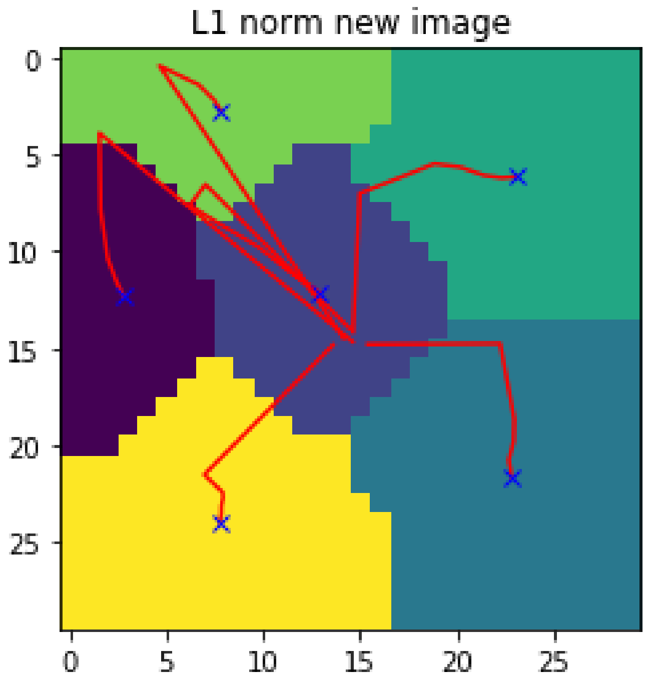
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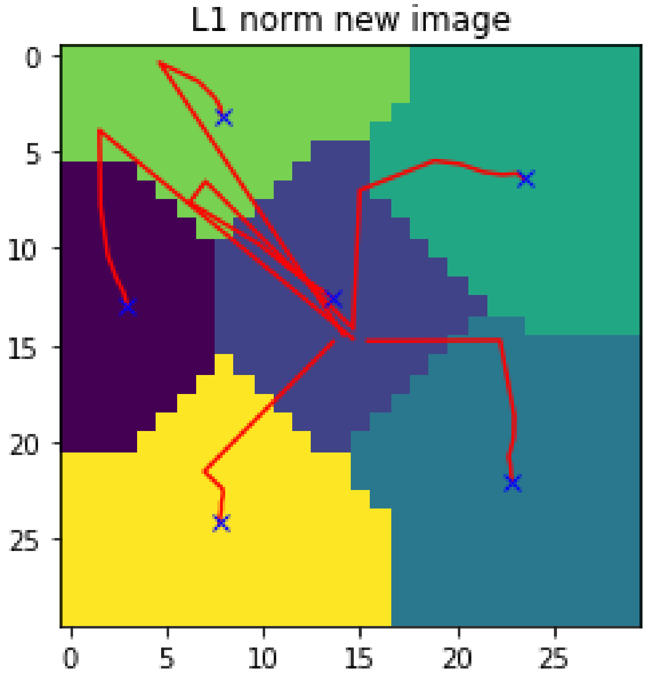
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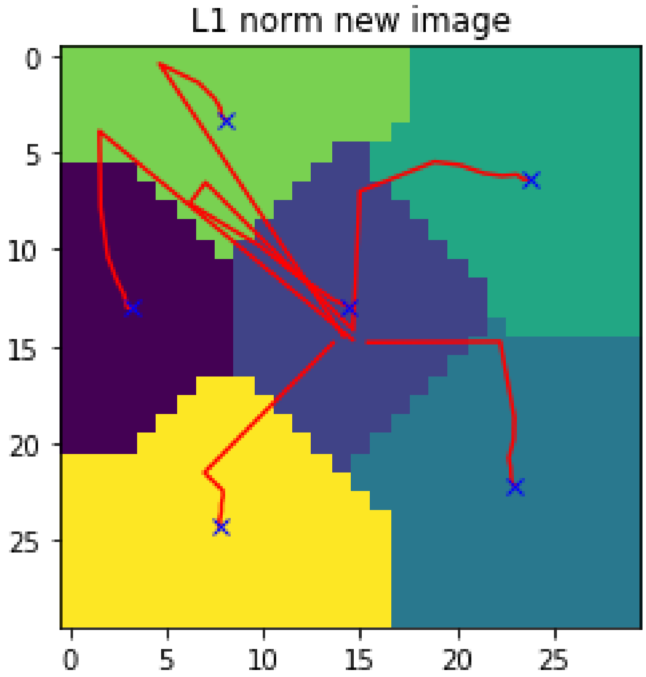
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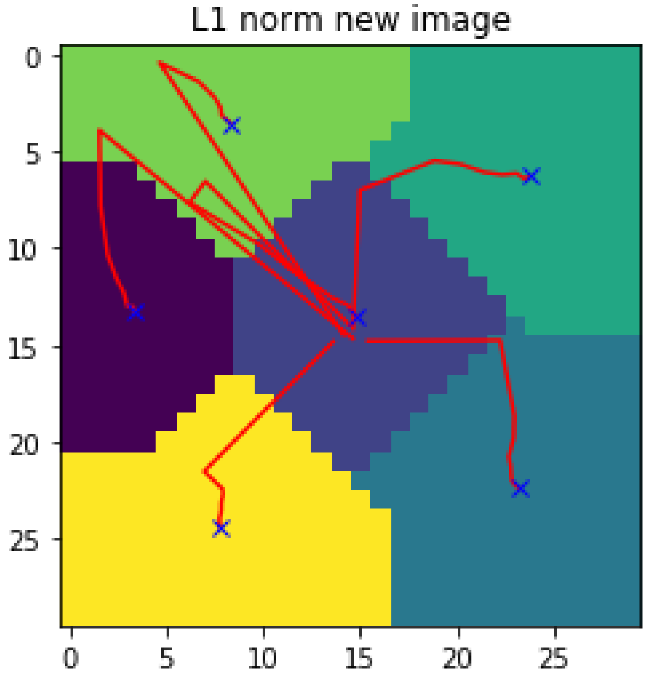
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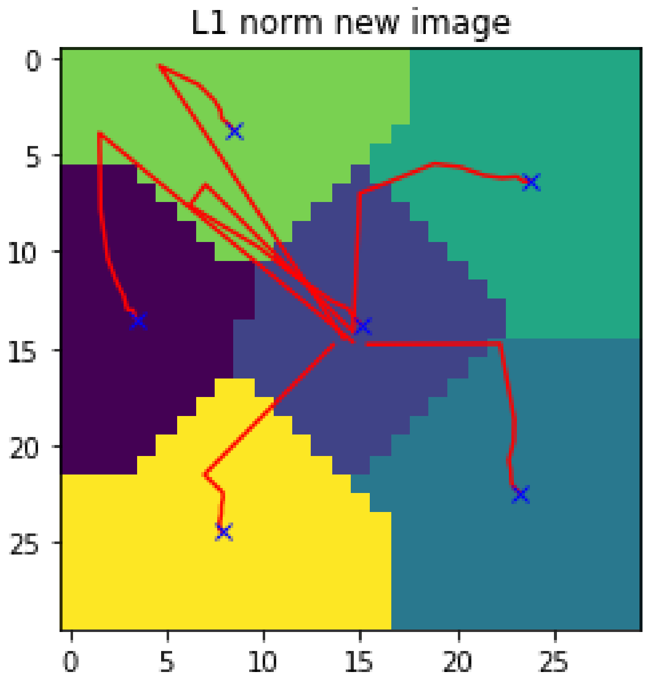
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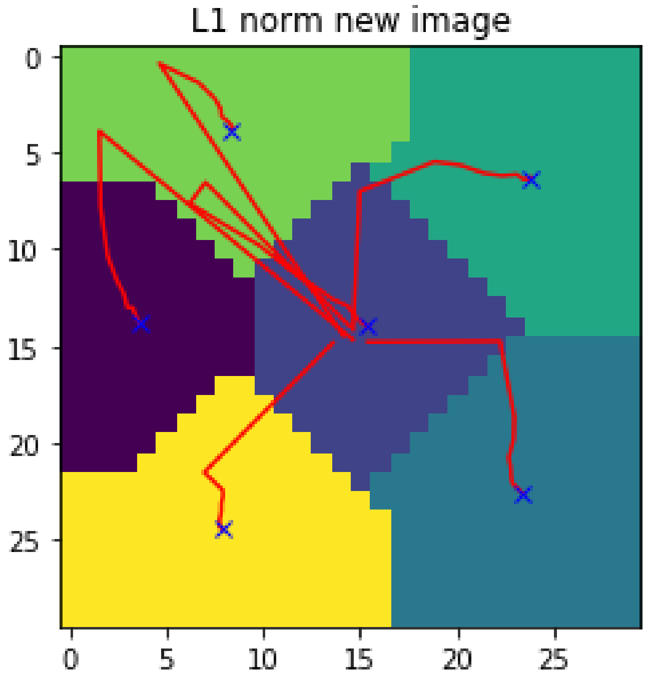
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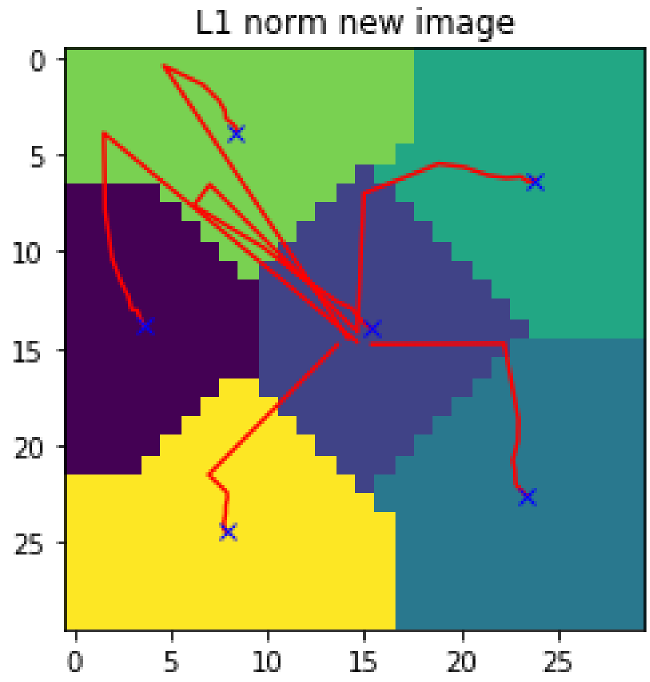

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In [12]: initialize_label(6, 'l2')
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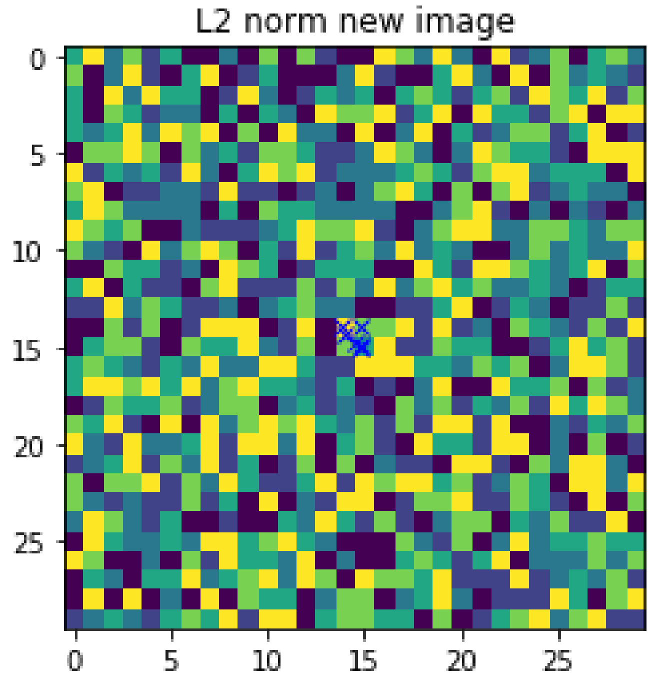

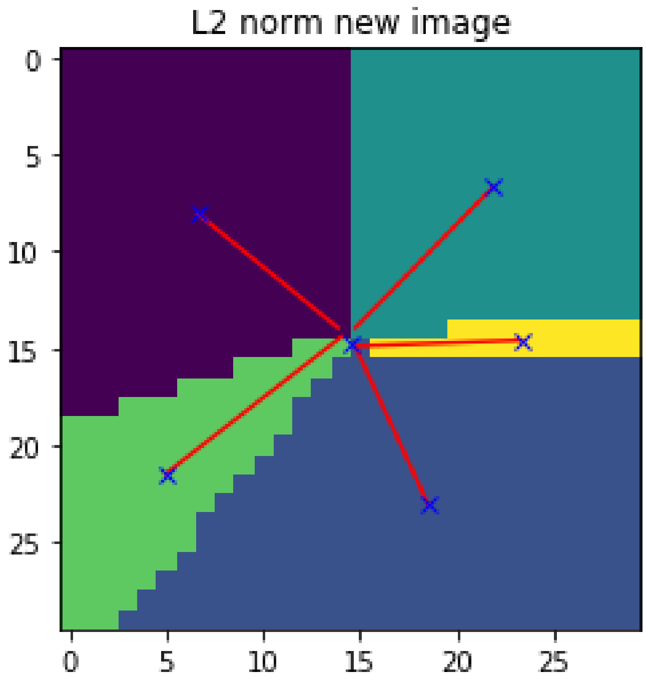
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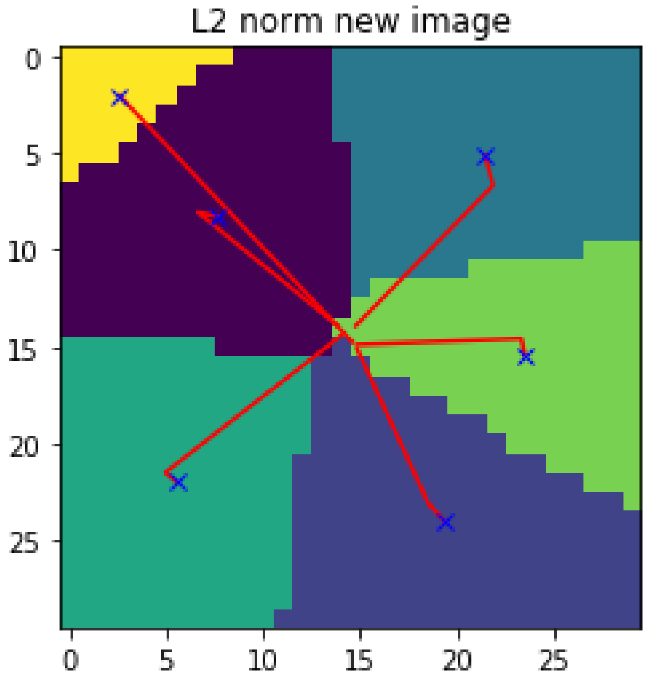
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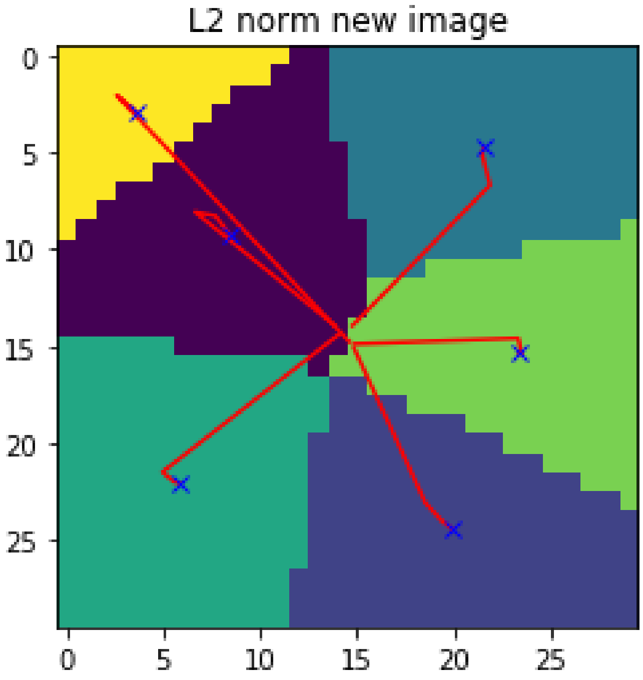
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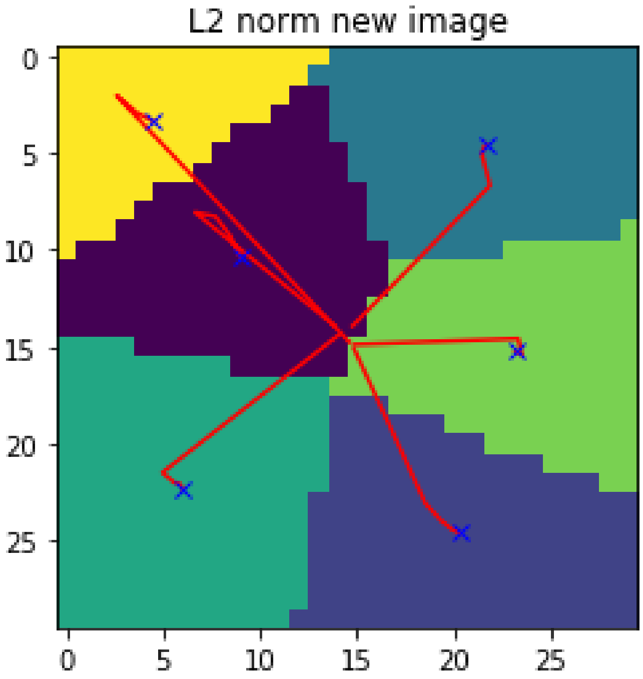
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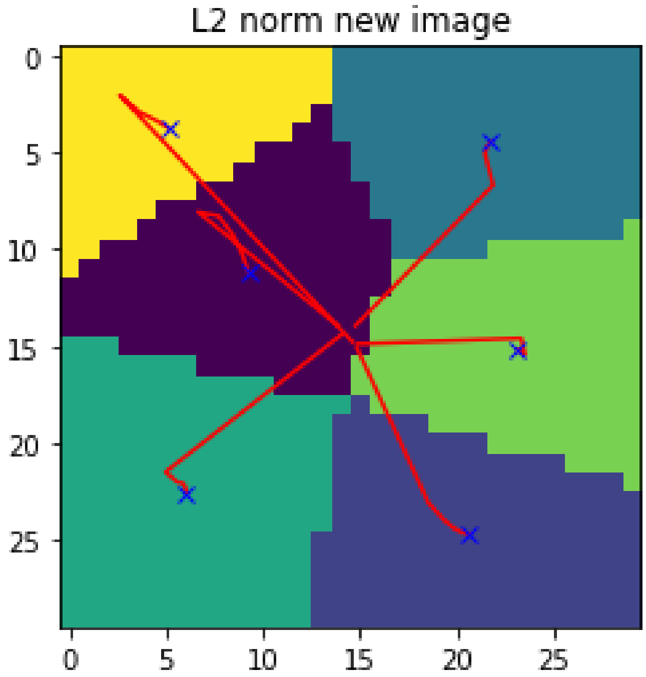
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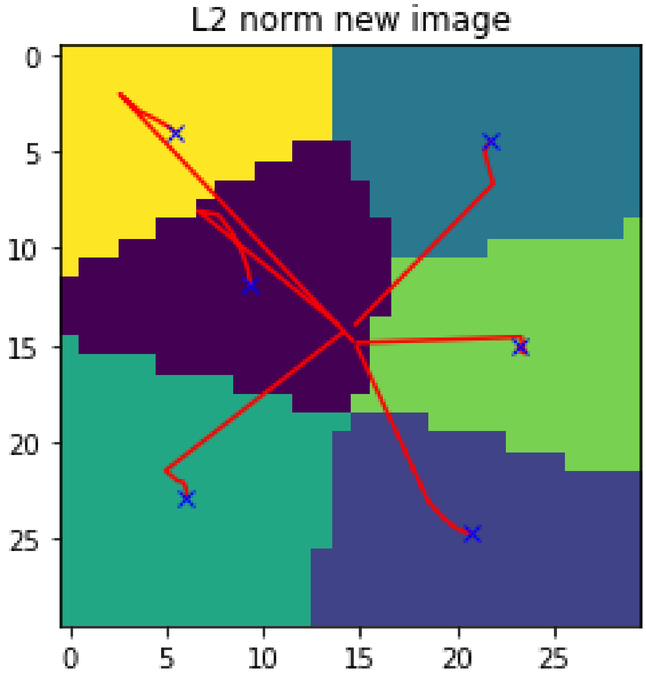
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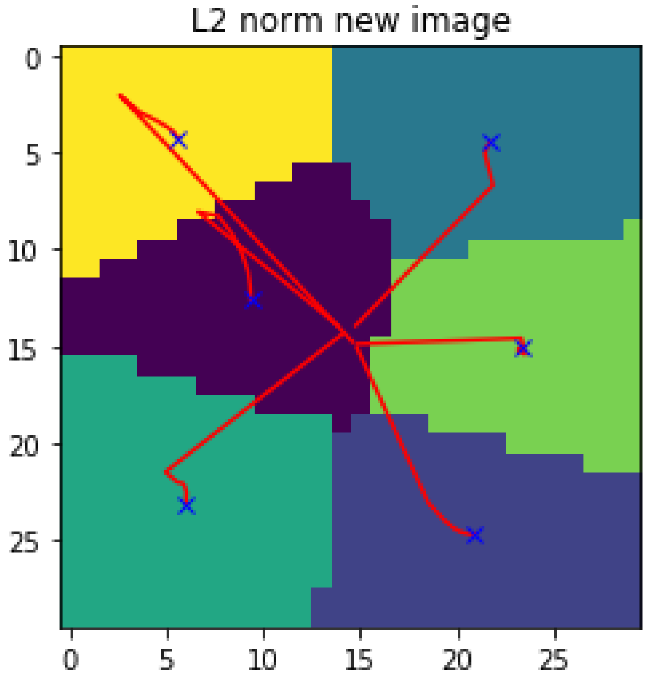
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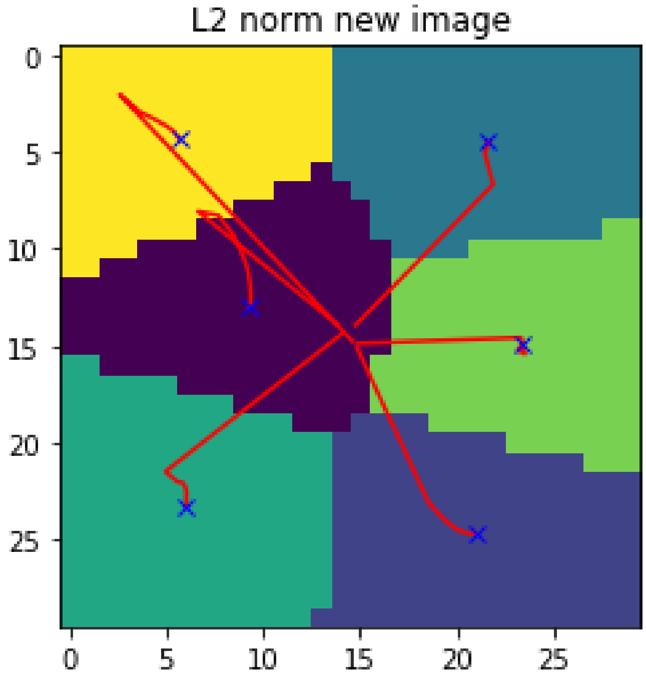
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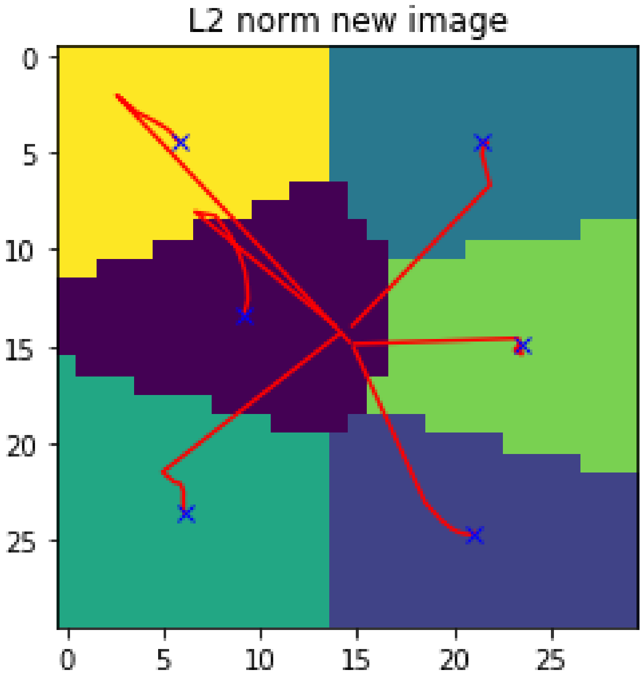
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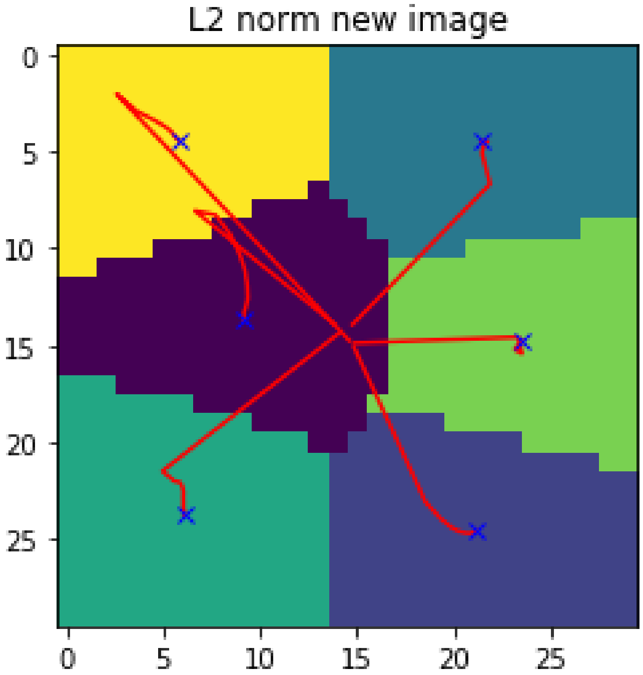
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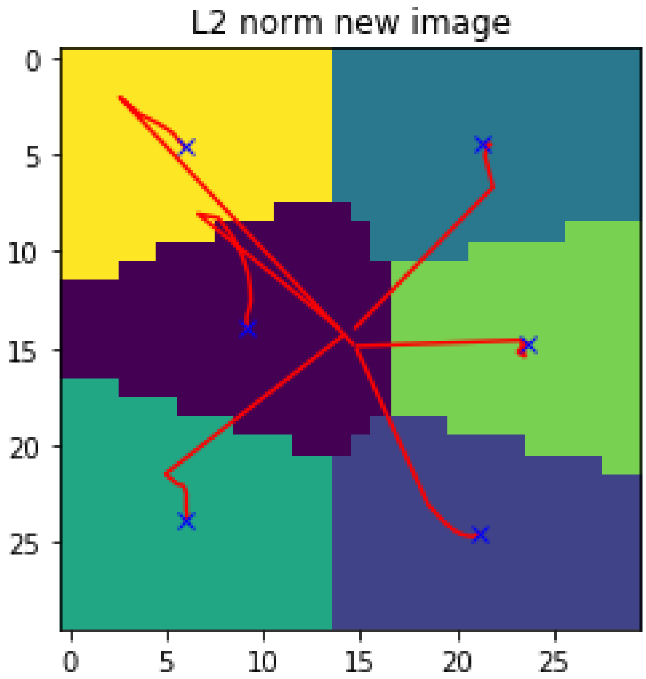
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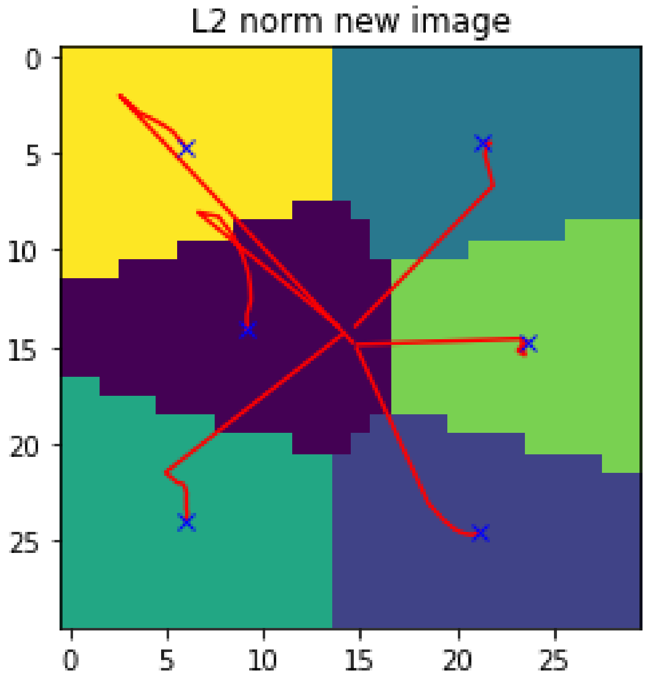
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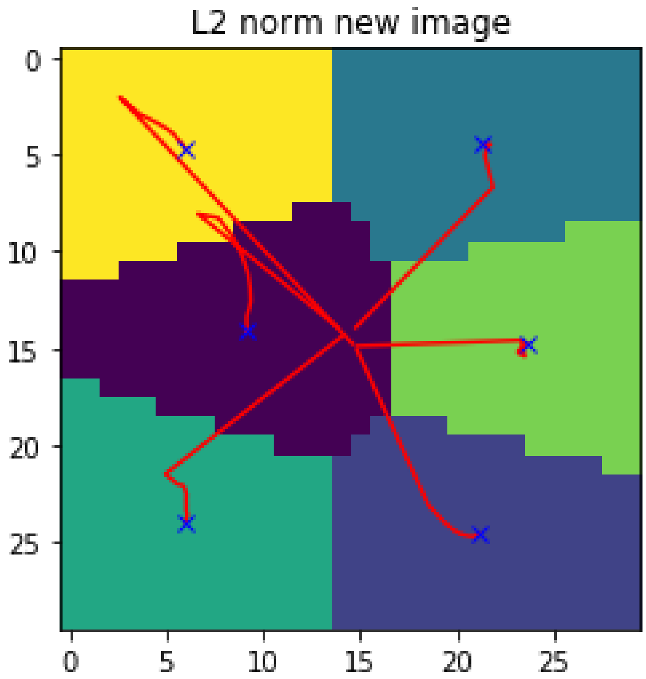
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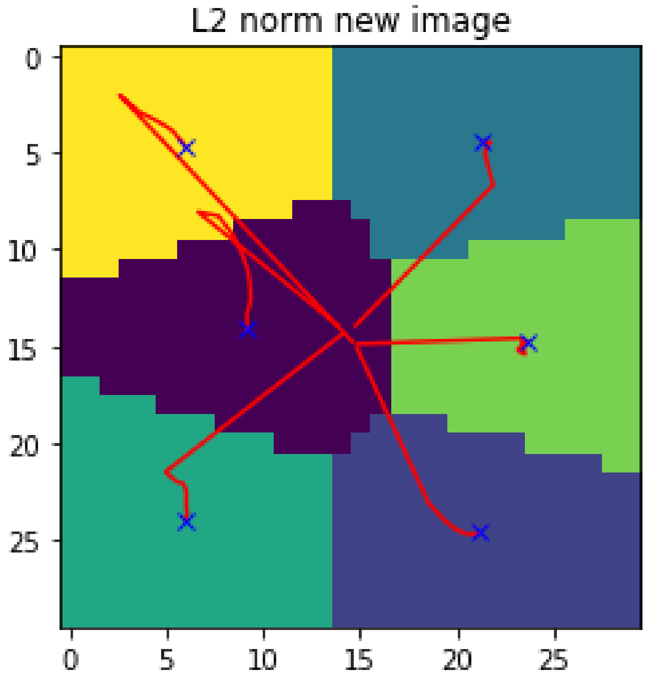
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In [13]: initialize_label(9, 'l1')
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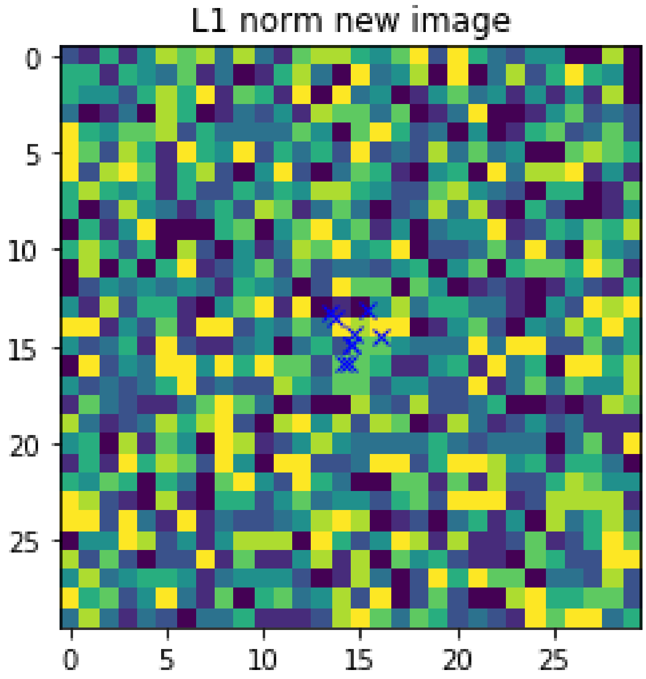

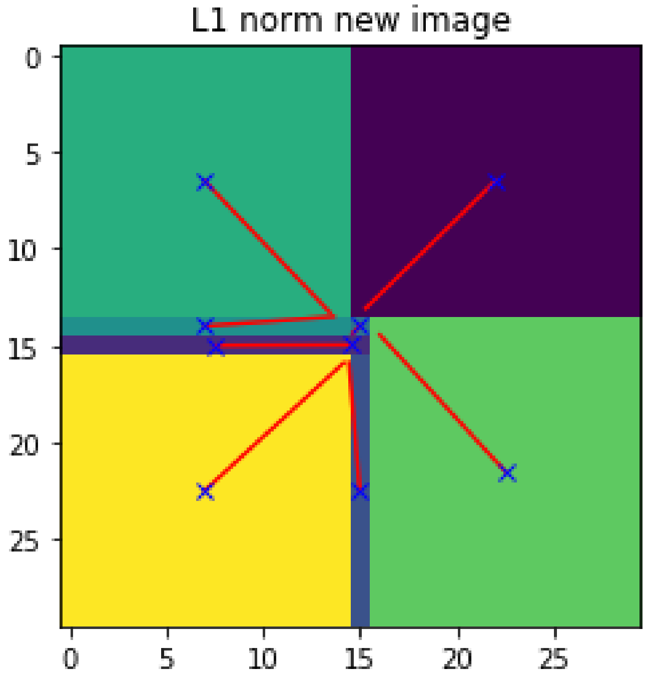

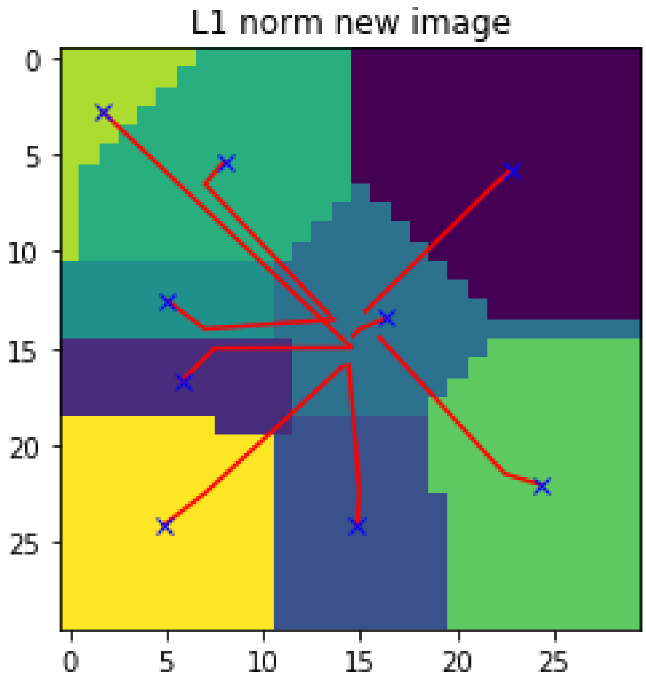
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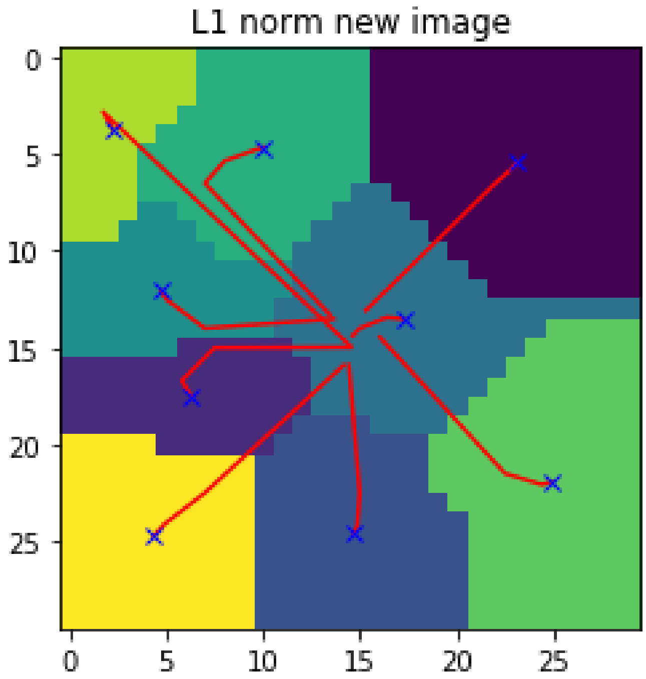
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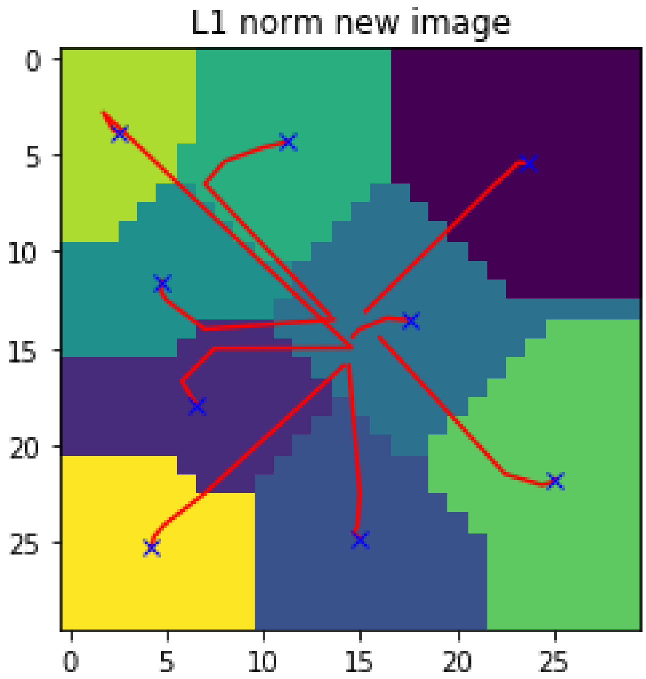
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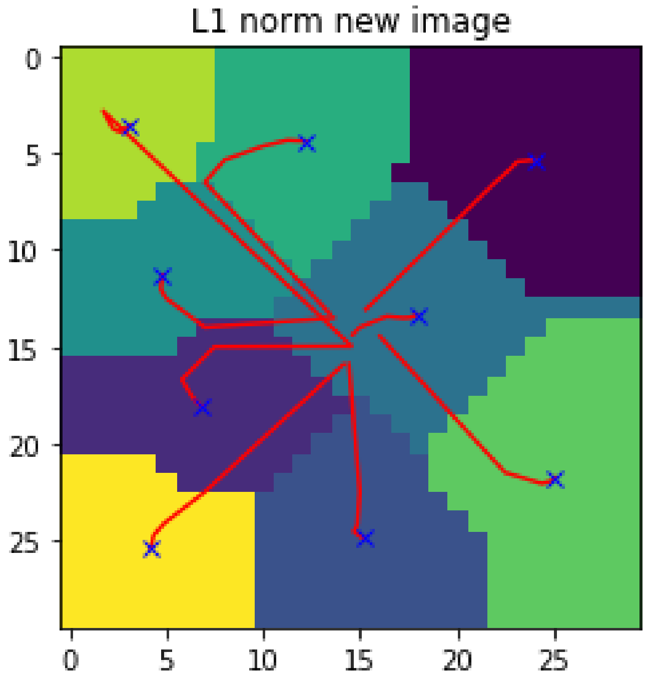
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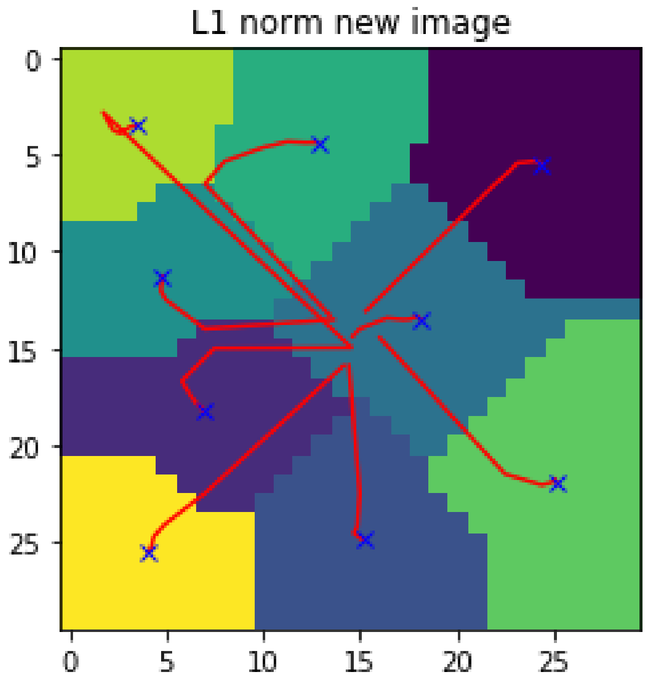
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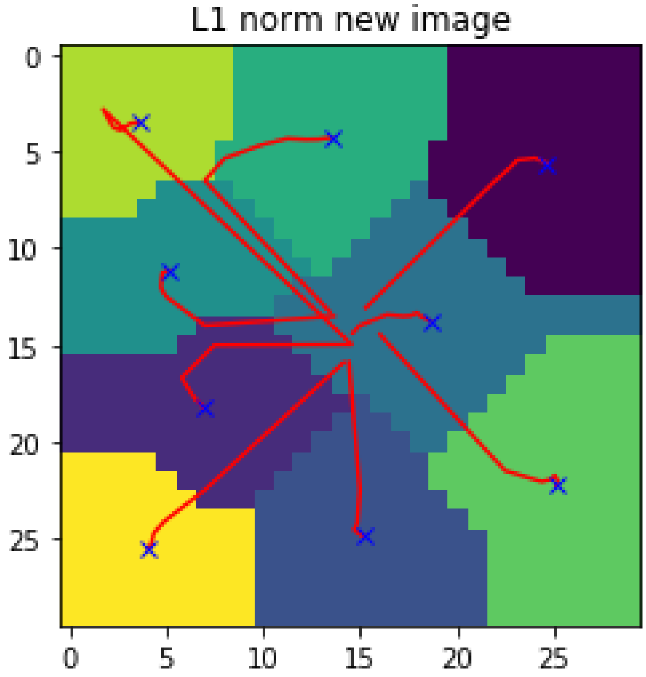
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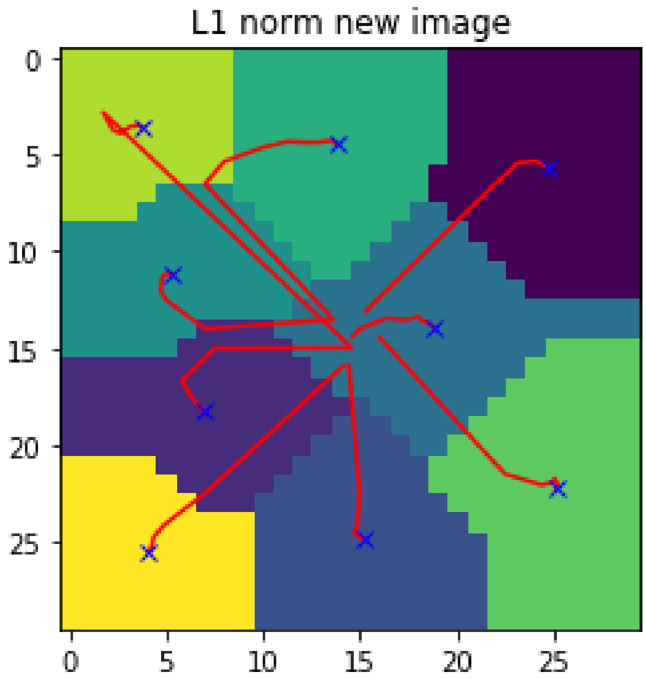
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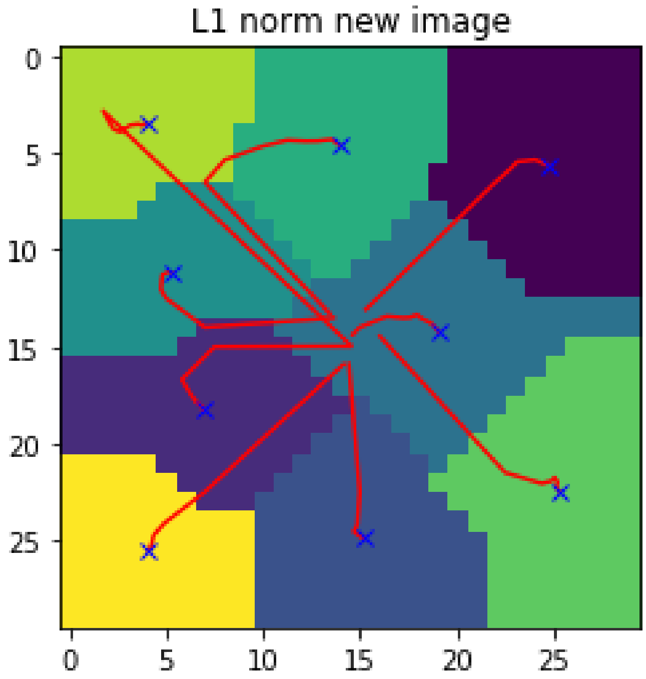
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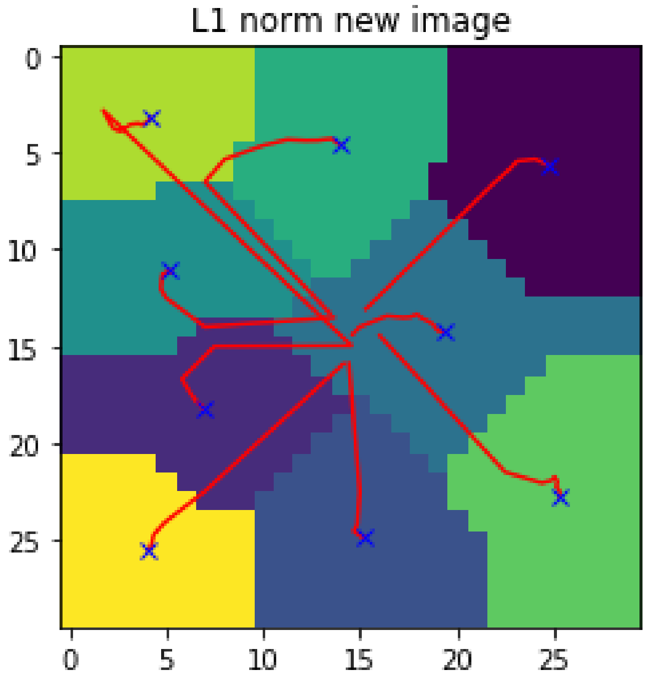
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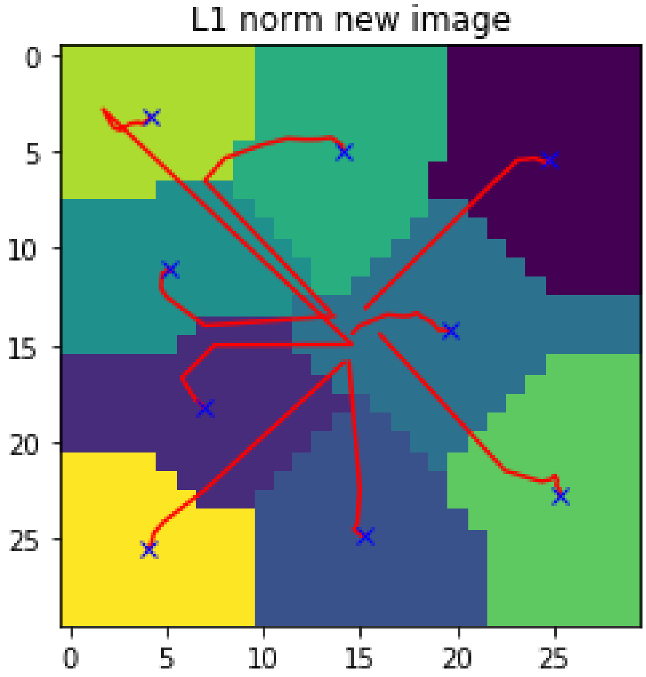
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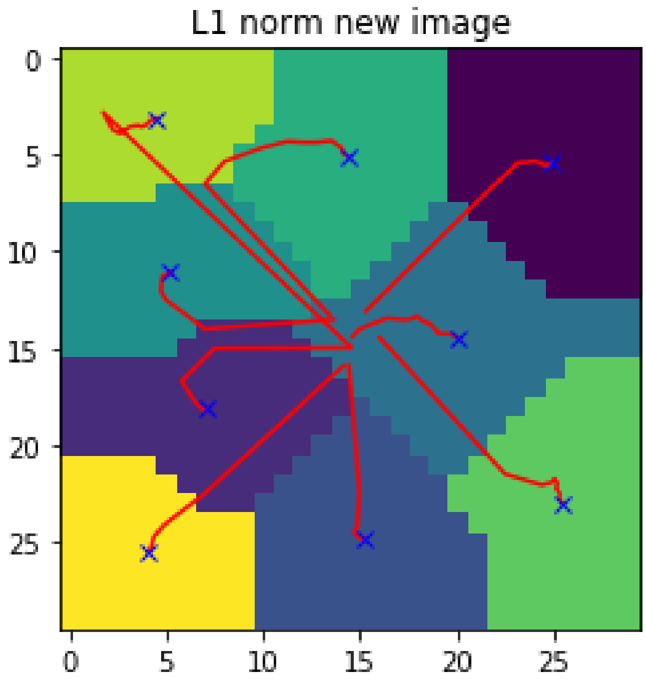
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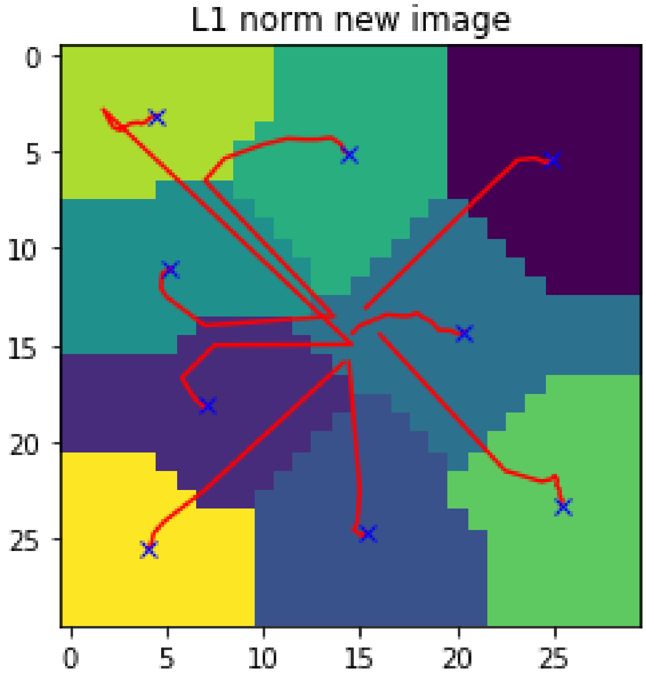
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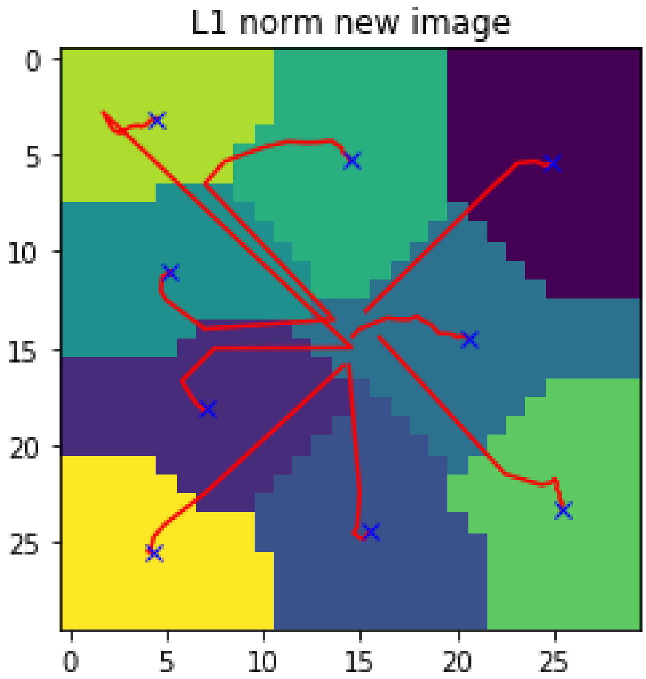
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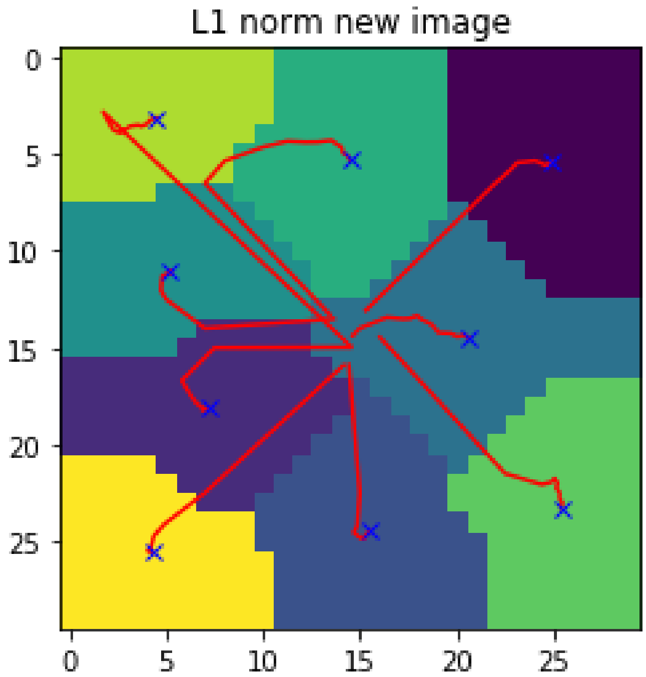
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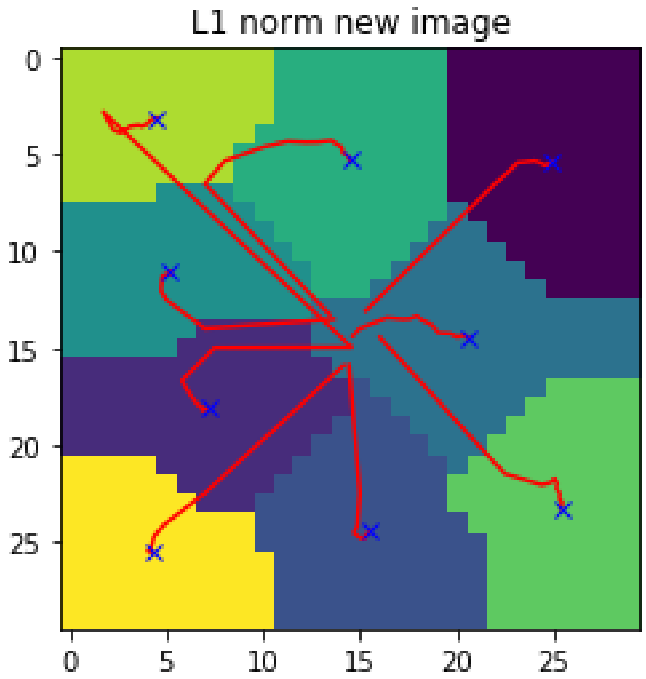

```
In [14]: initialize_label(9, '12')
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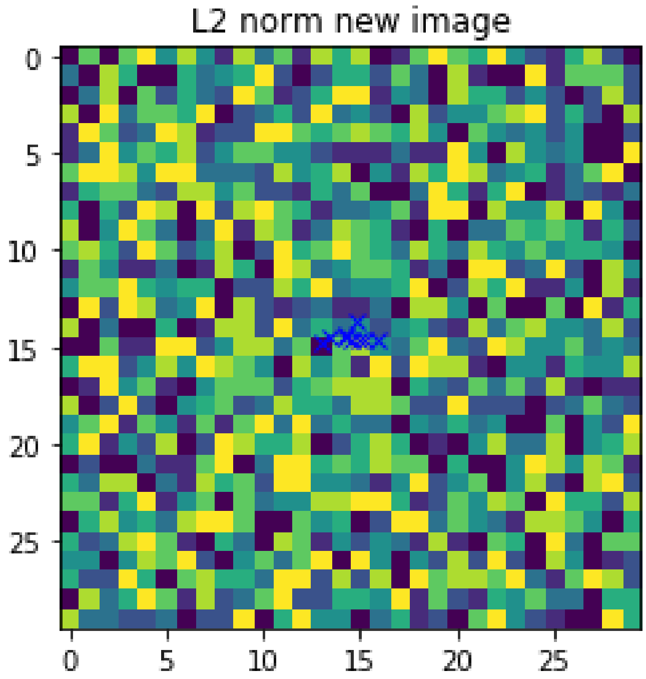

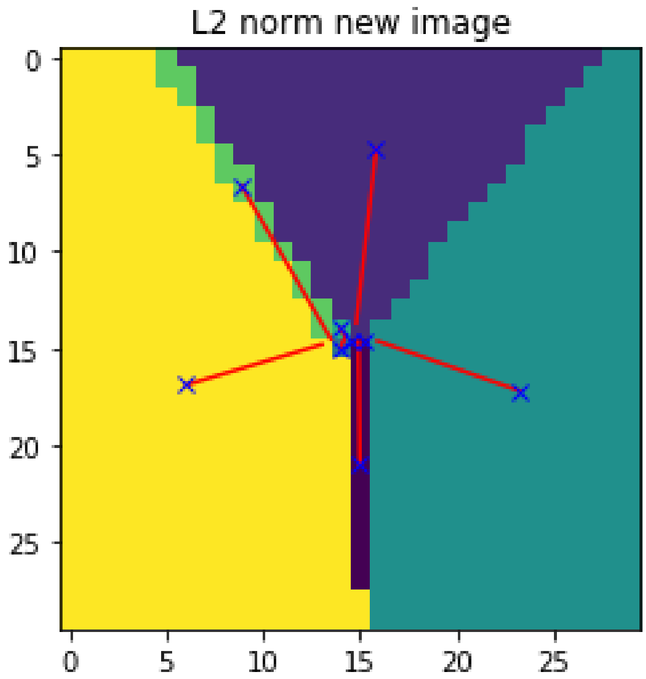
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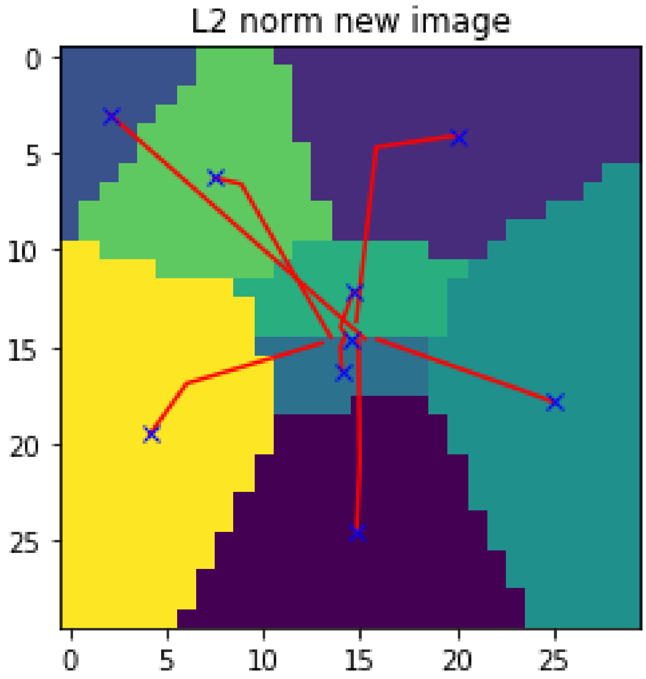
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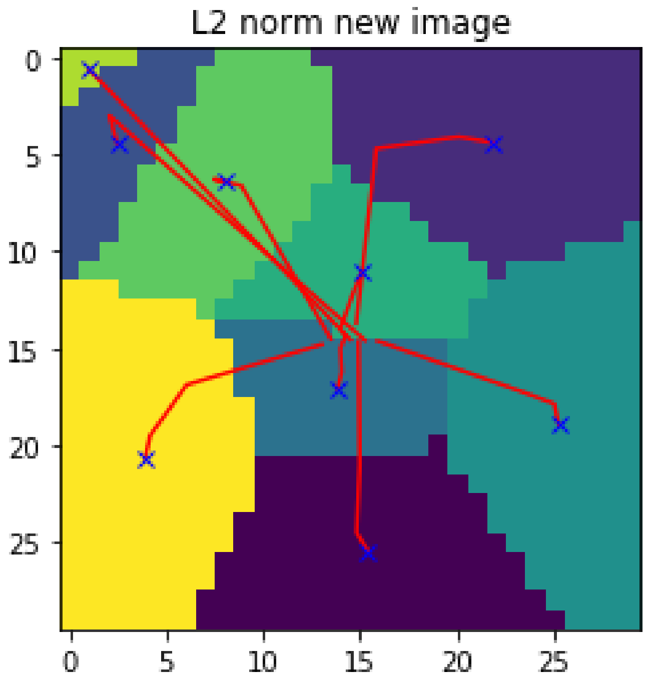
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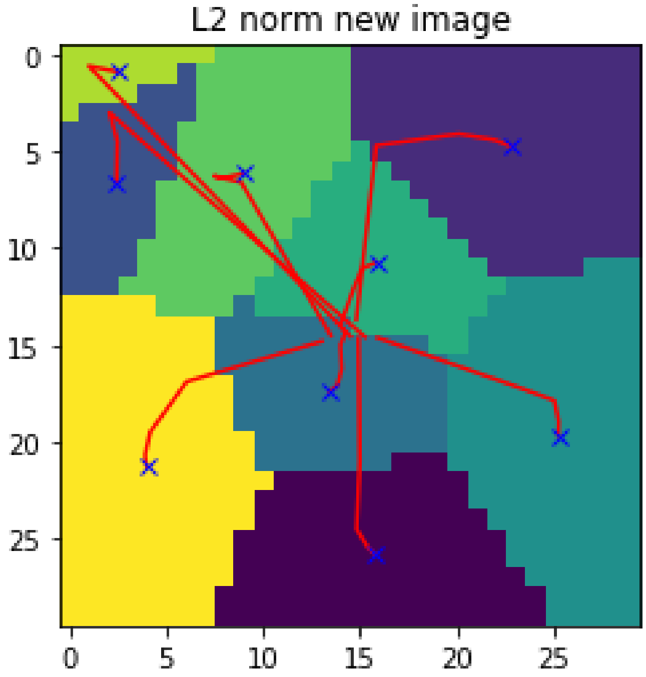
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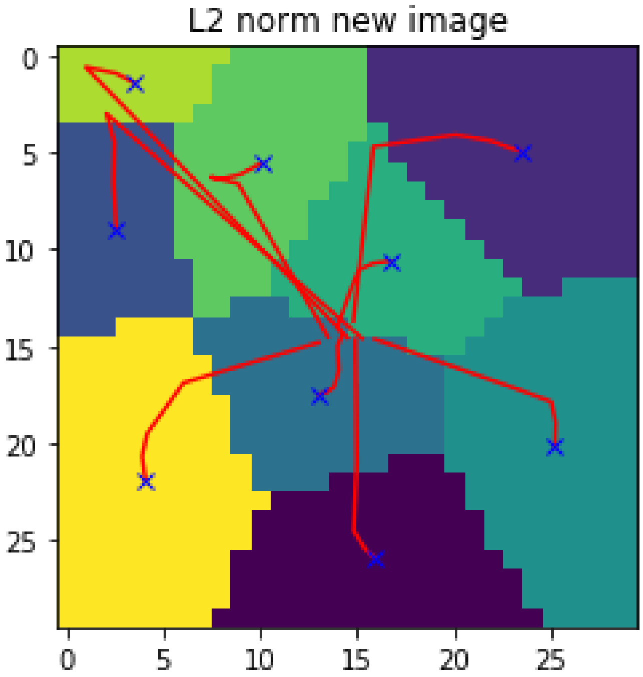
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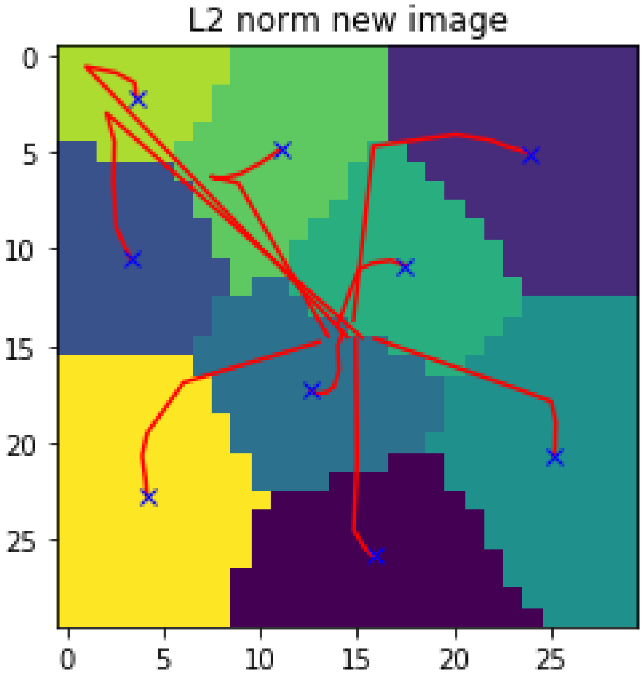
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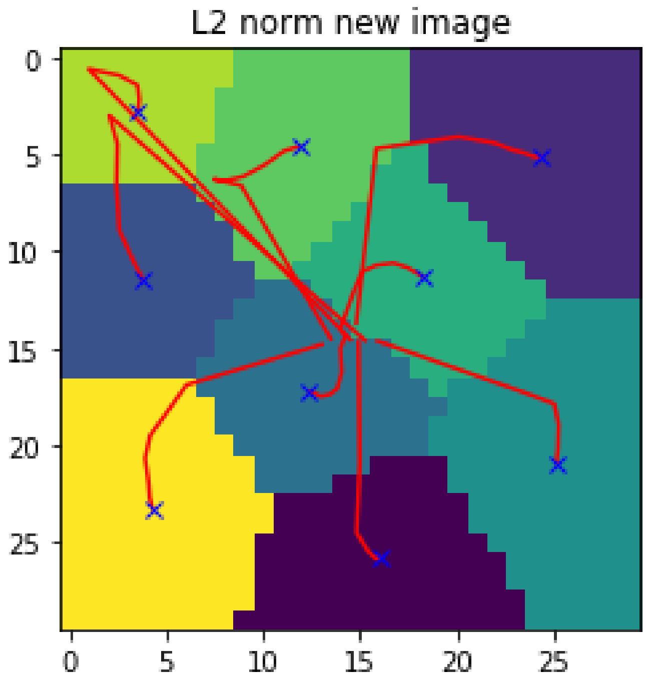
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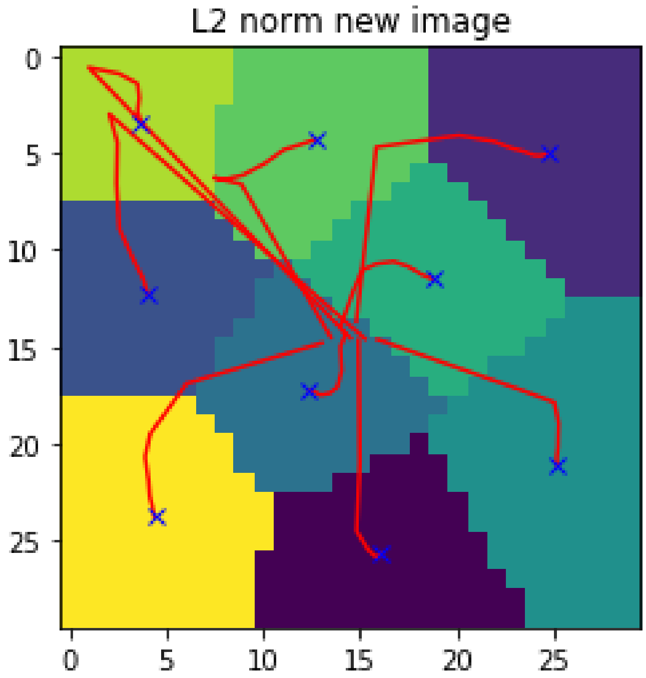
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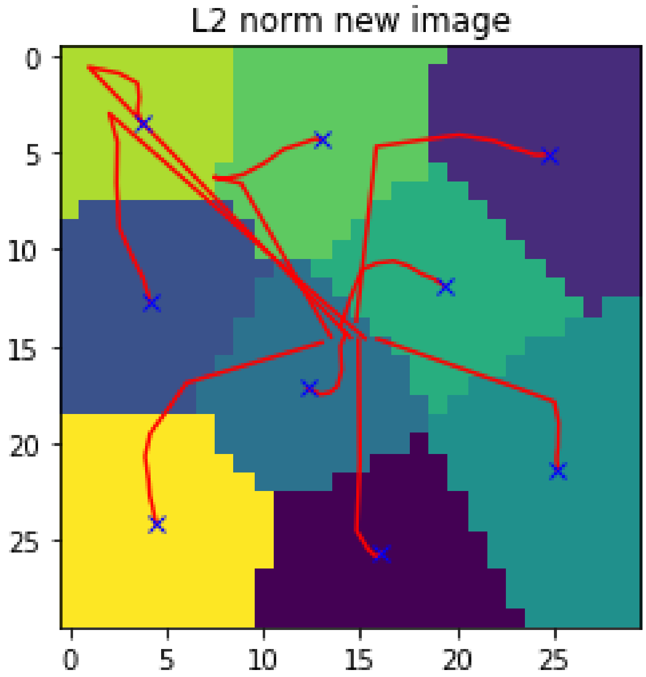
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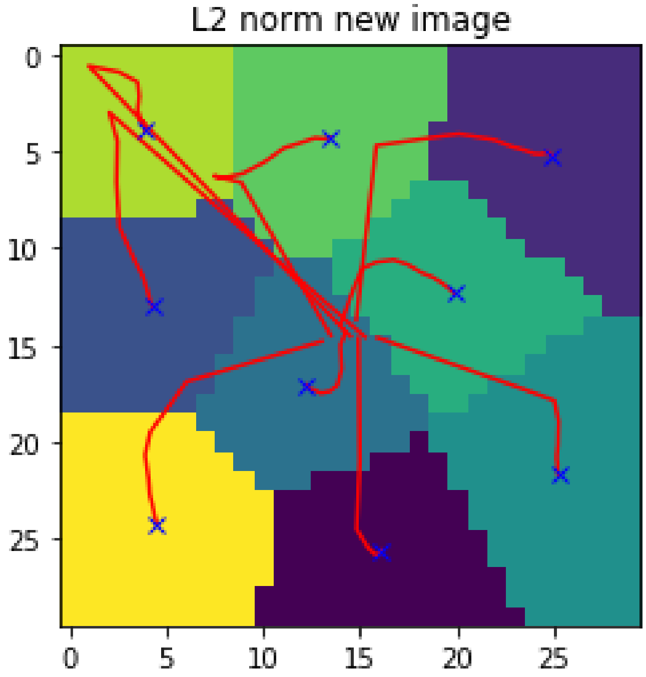
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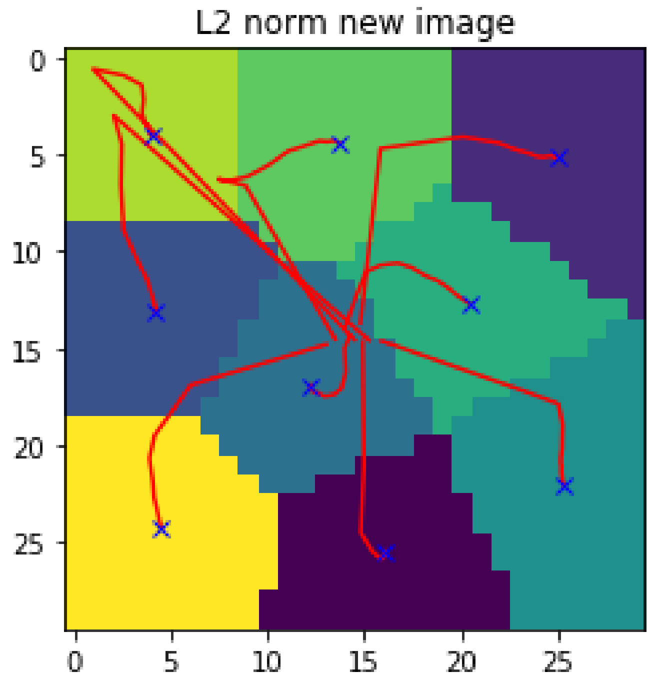
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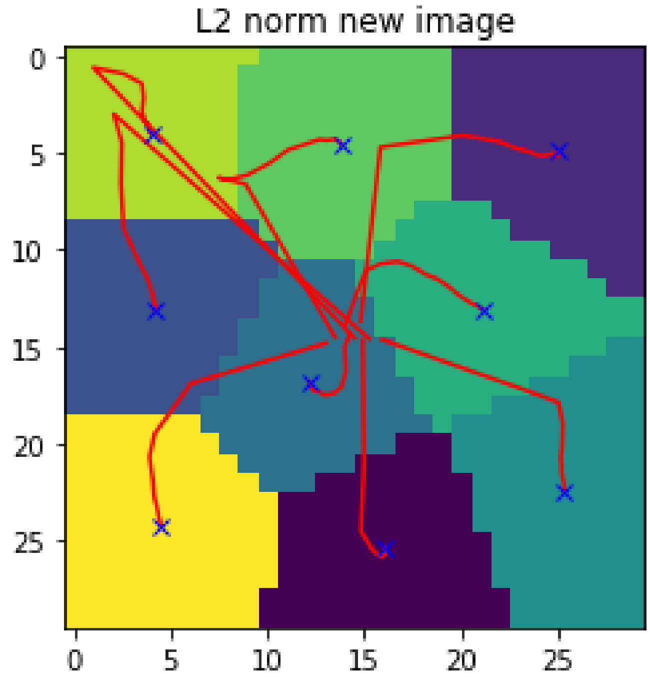
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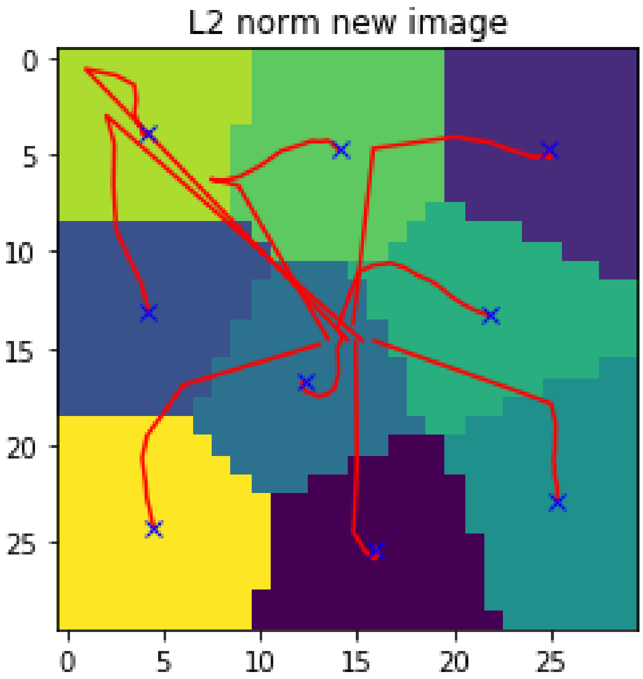
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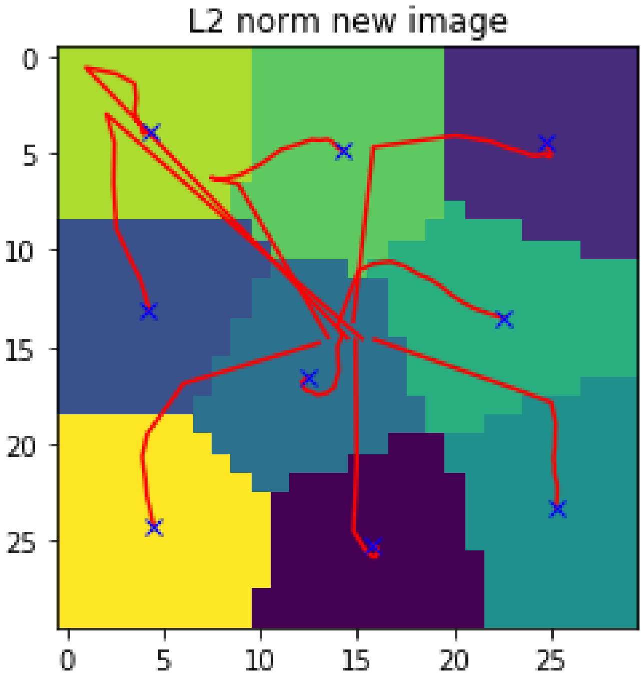
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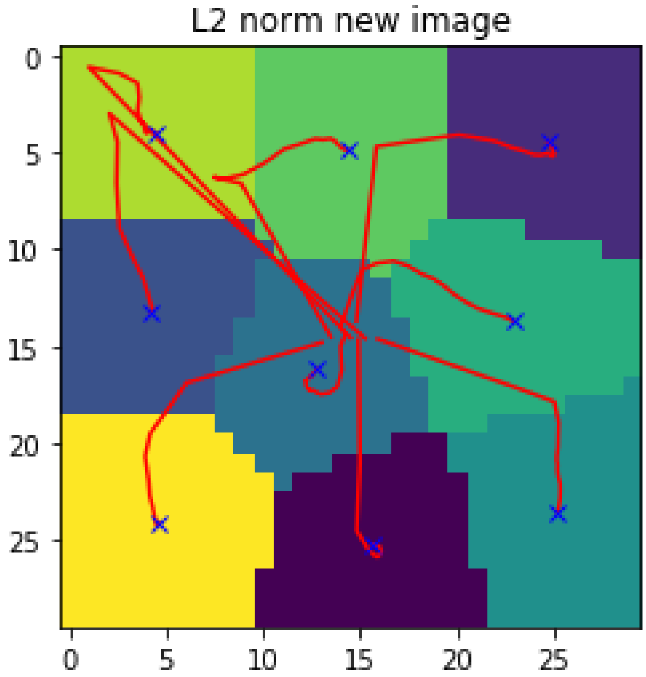
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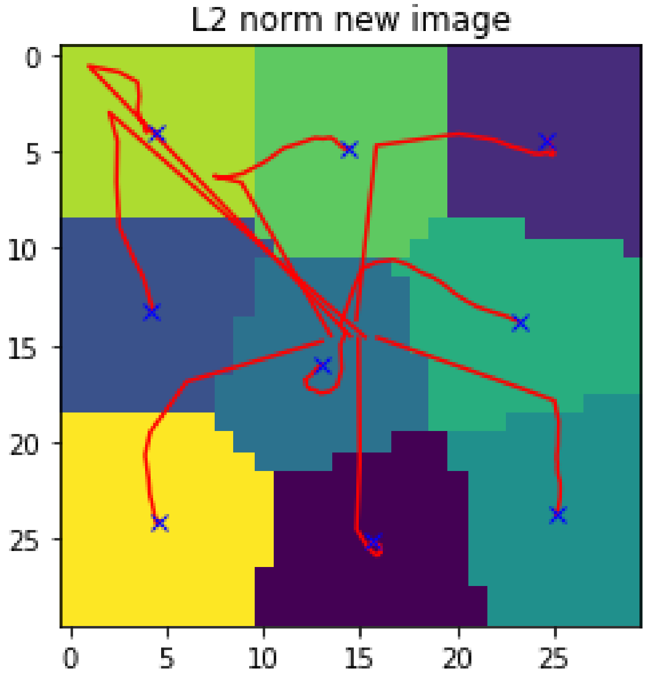
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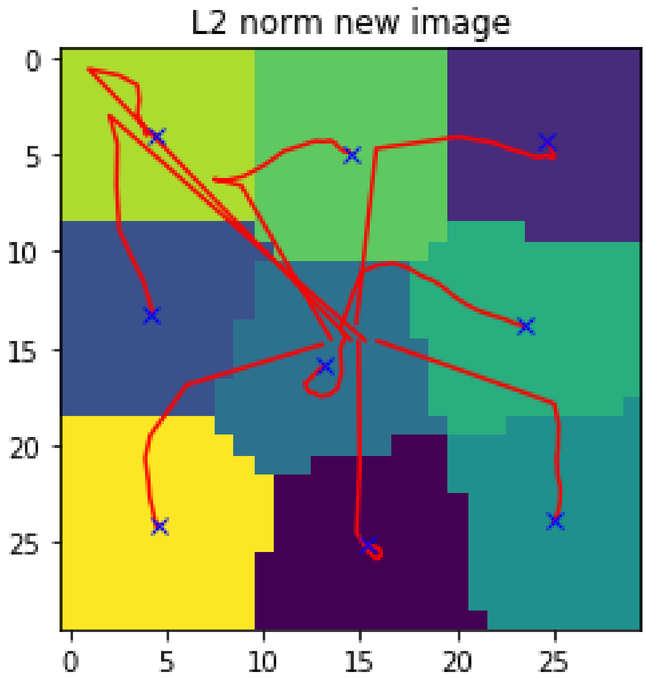
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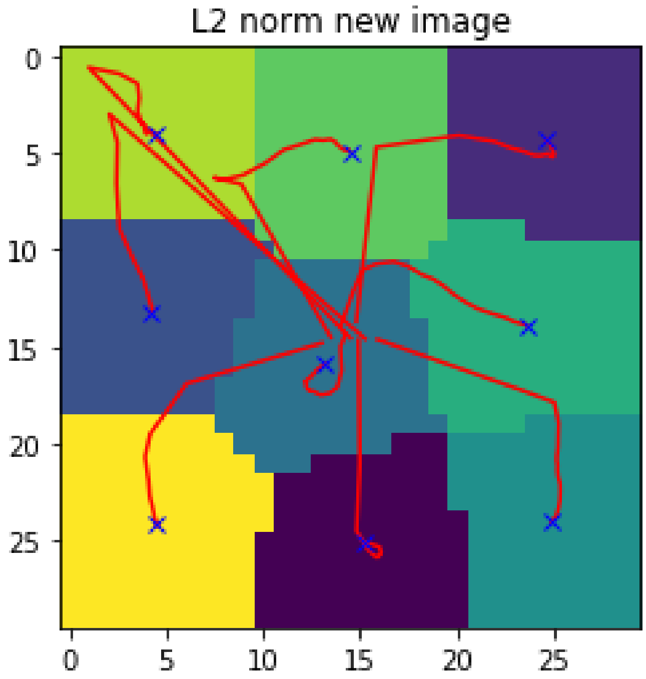
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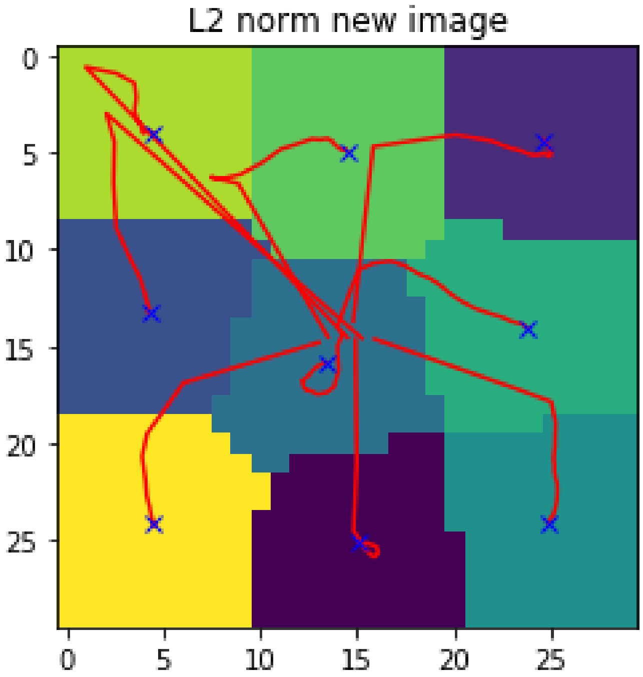
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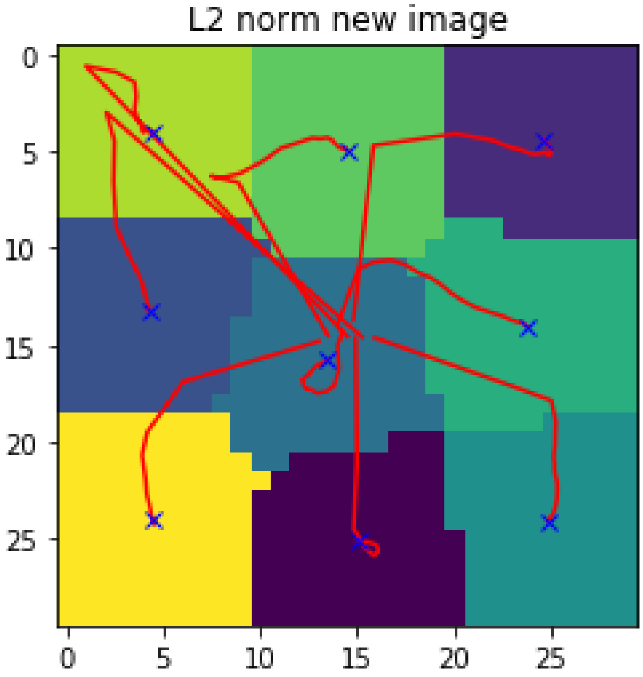
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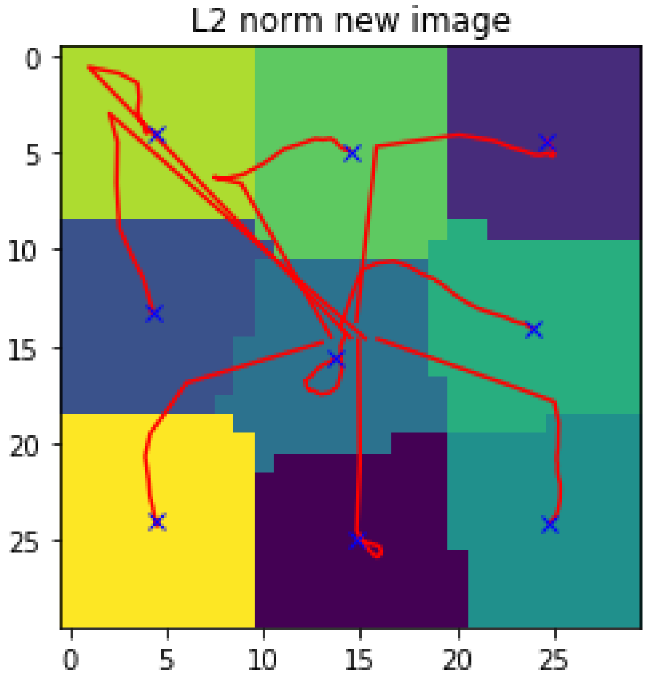
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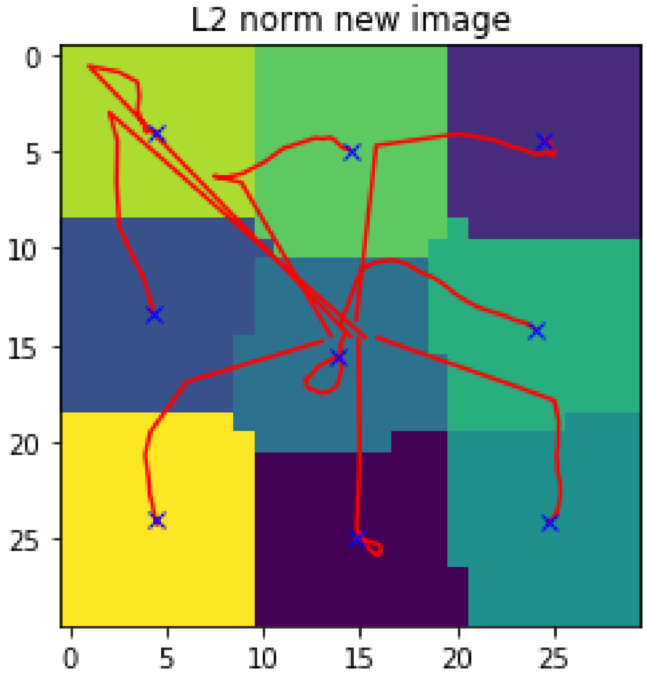
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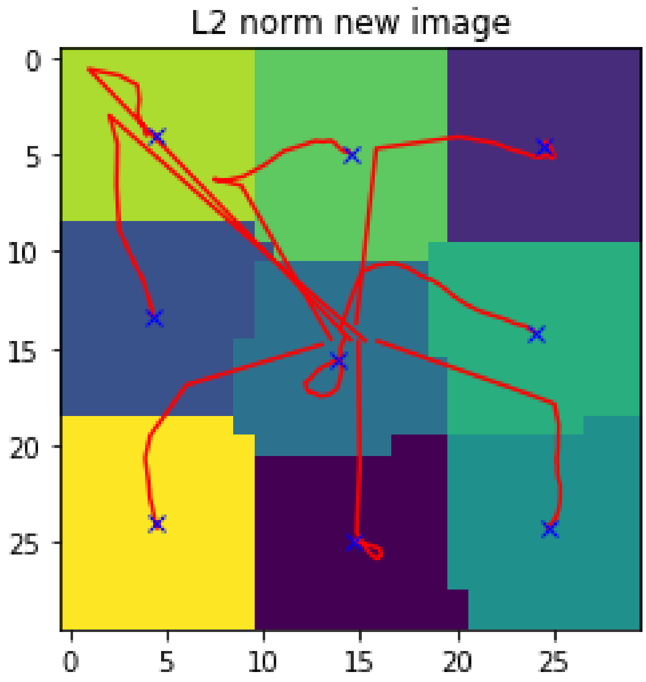
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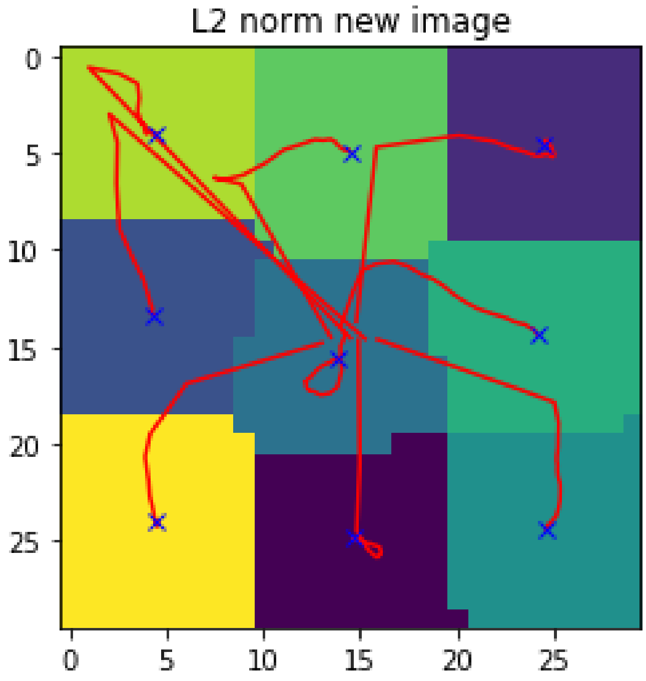
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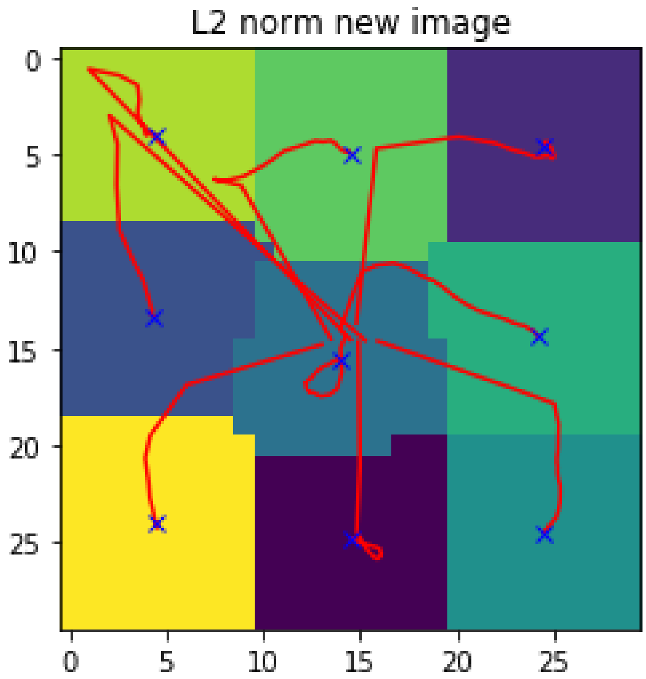
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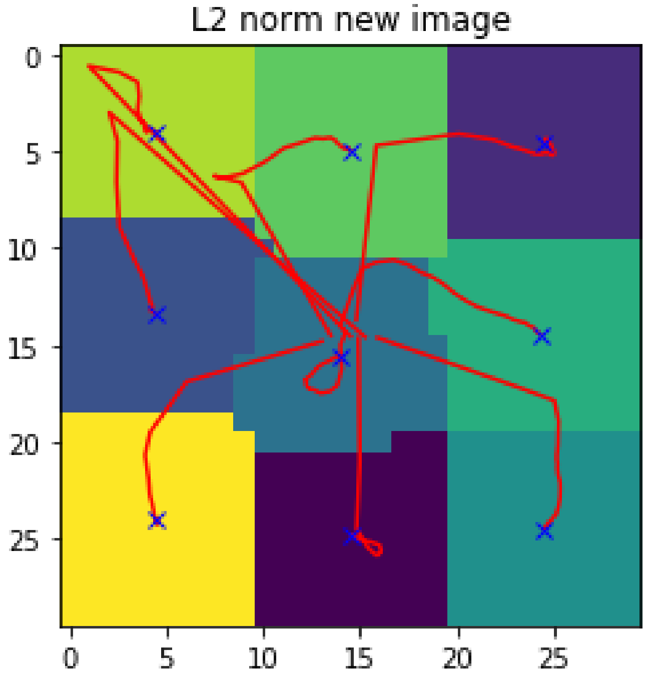
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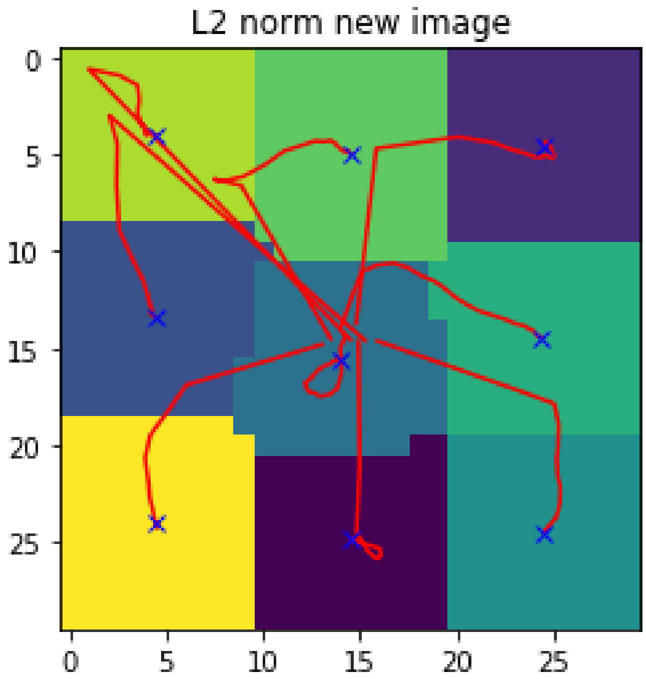
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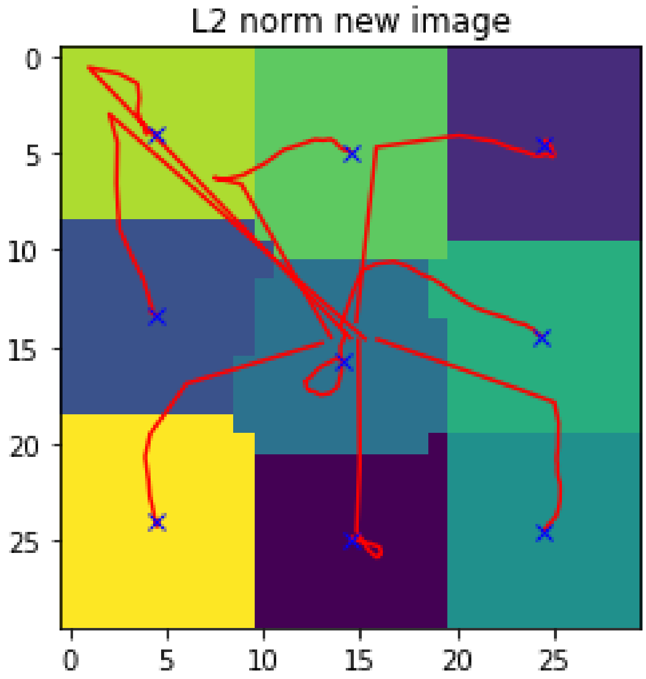
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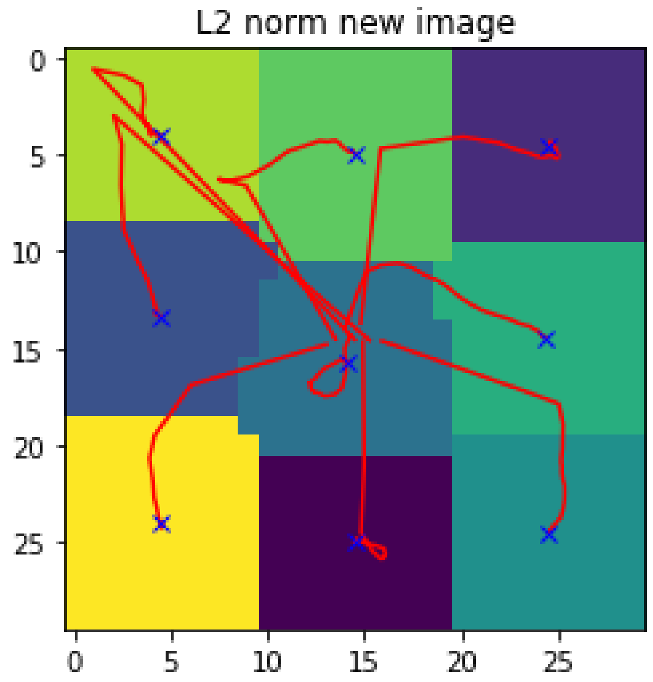
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end
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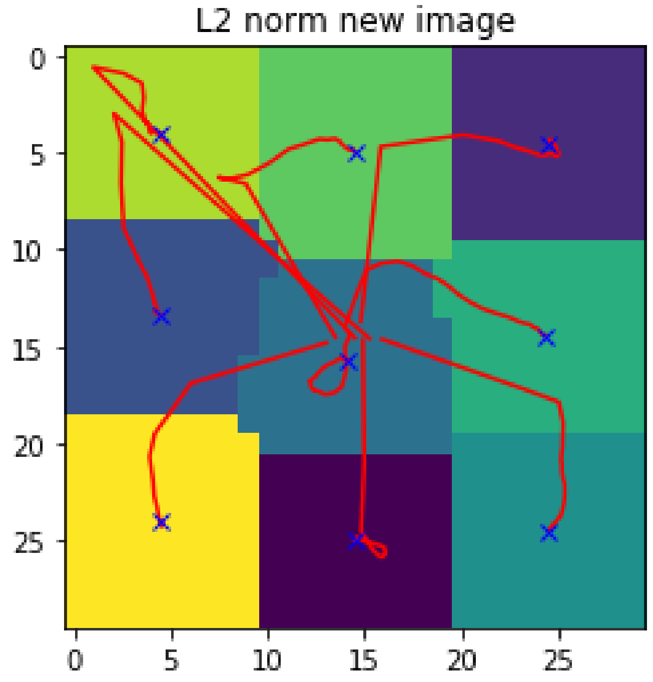
L2 norm new image
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In [15]: initialize_label(12, 'l1')
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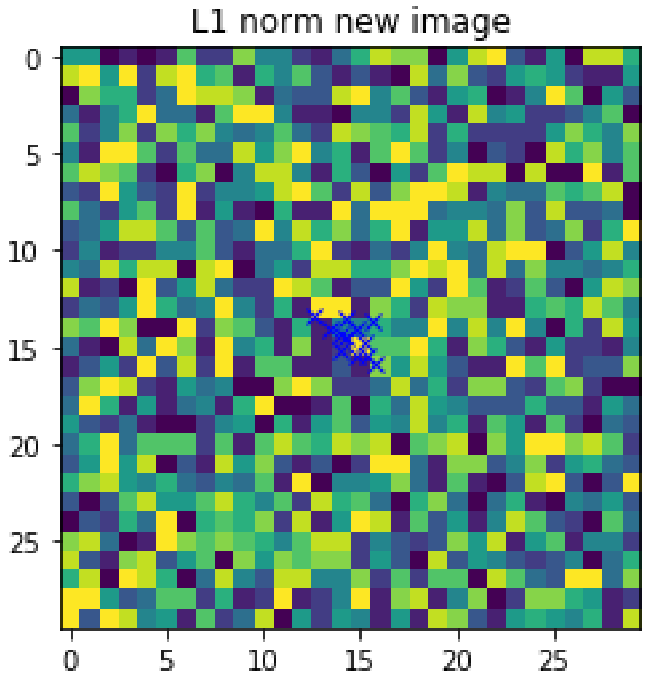

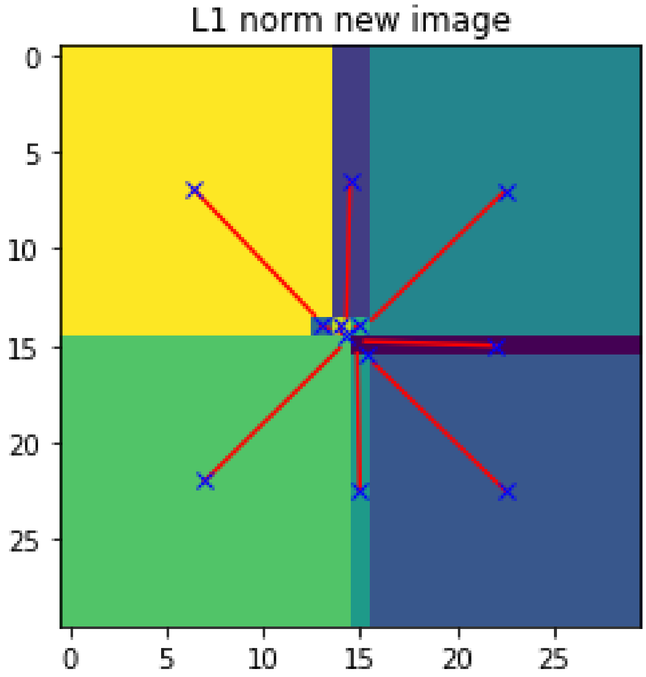

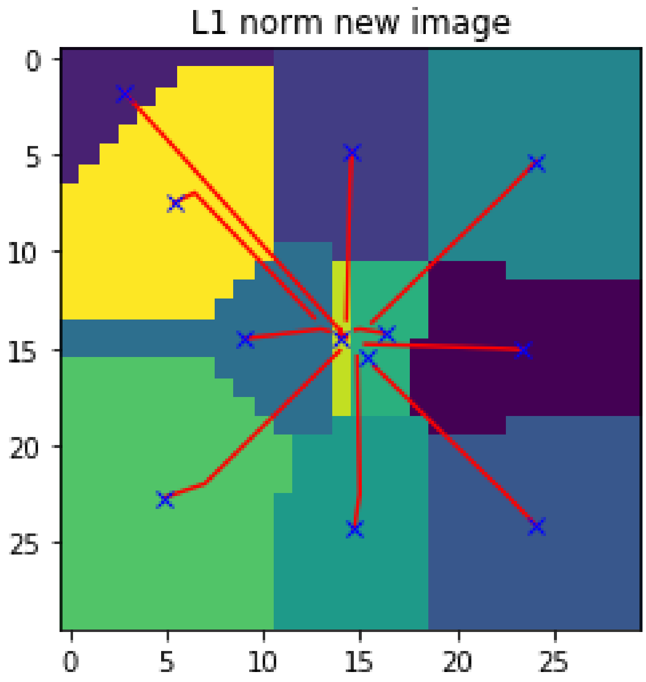
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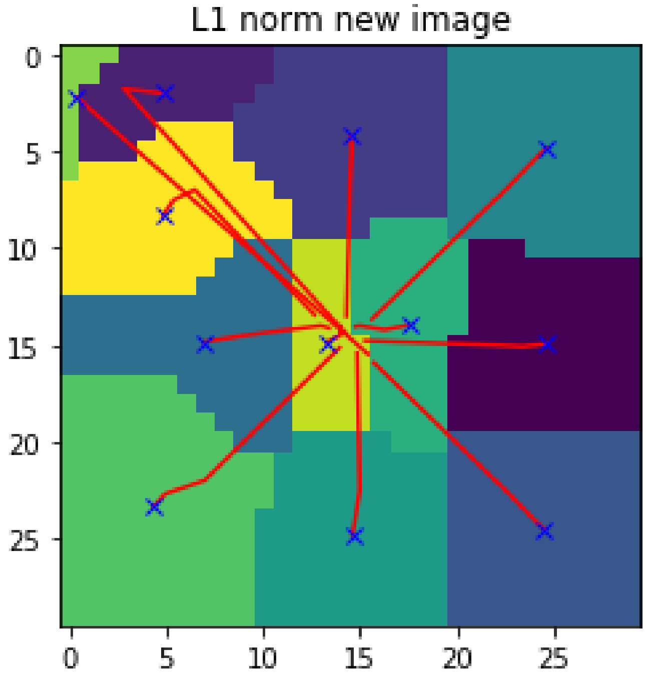
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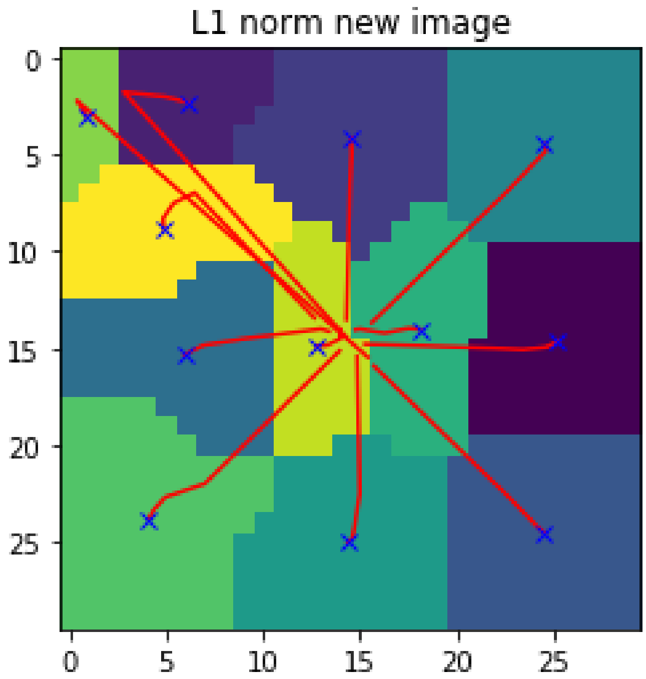
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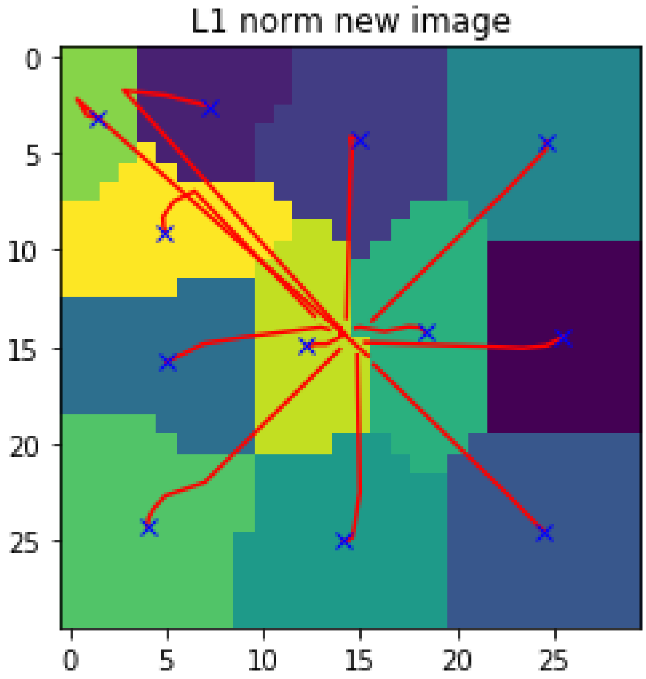
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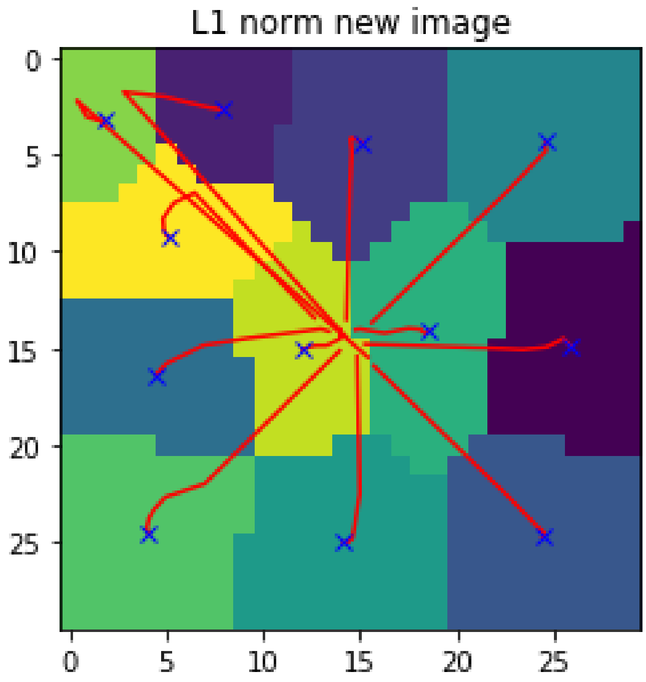
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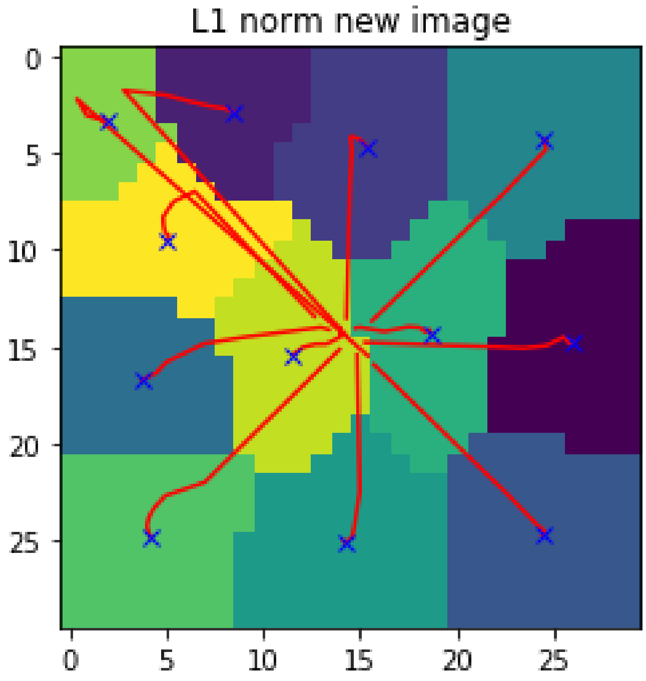
L1 norm new image
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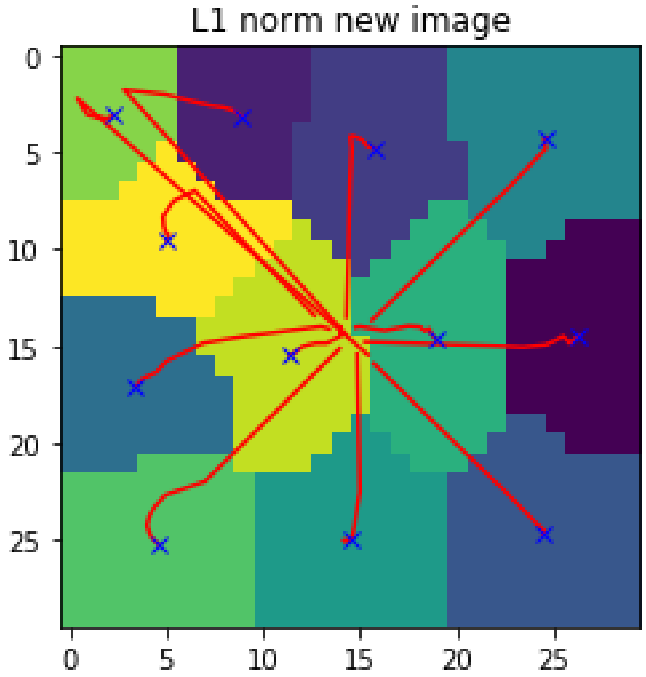
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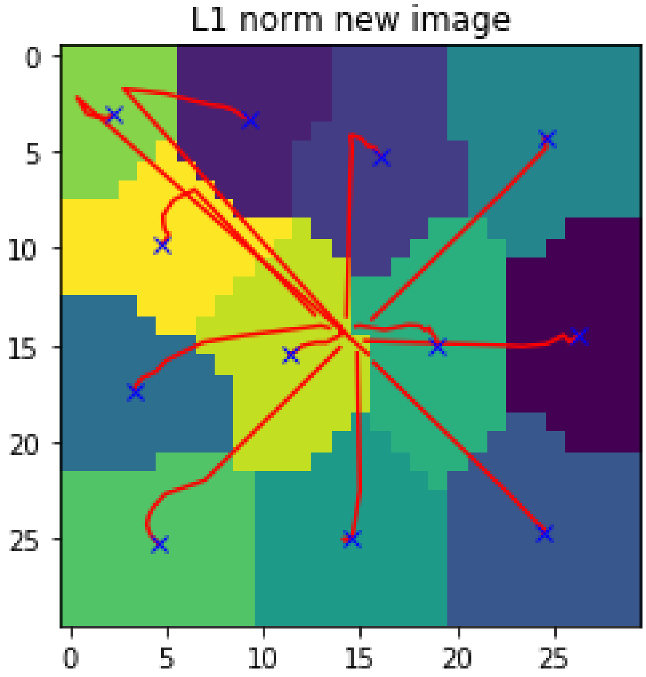
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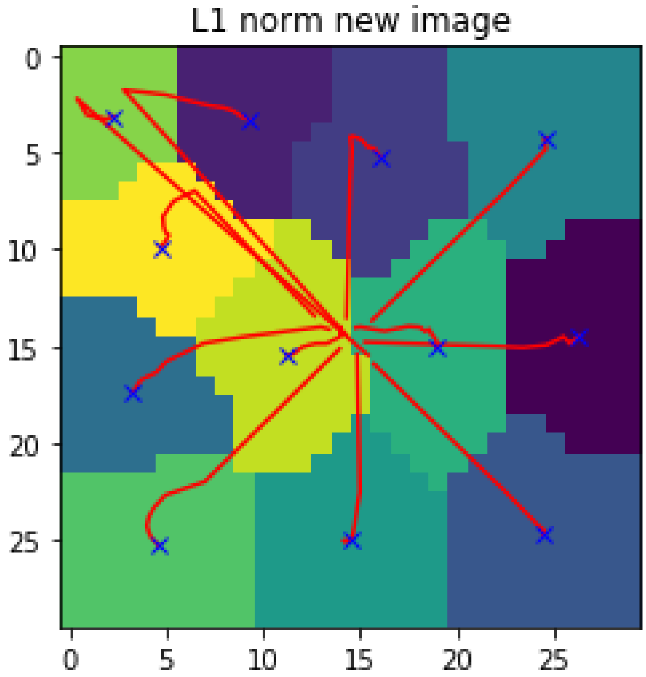
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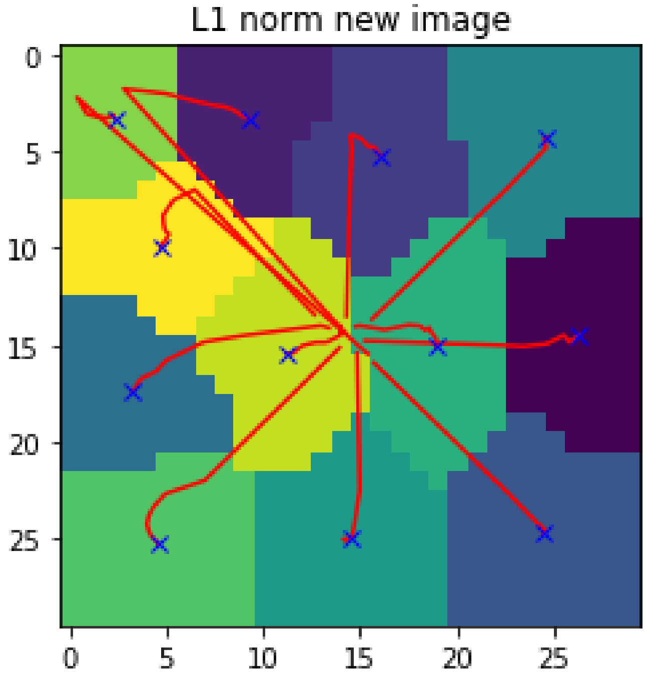
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end
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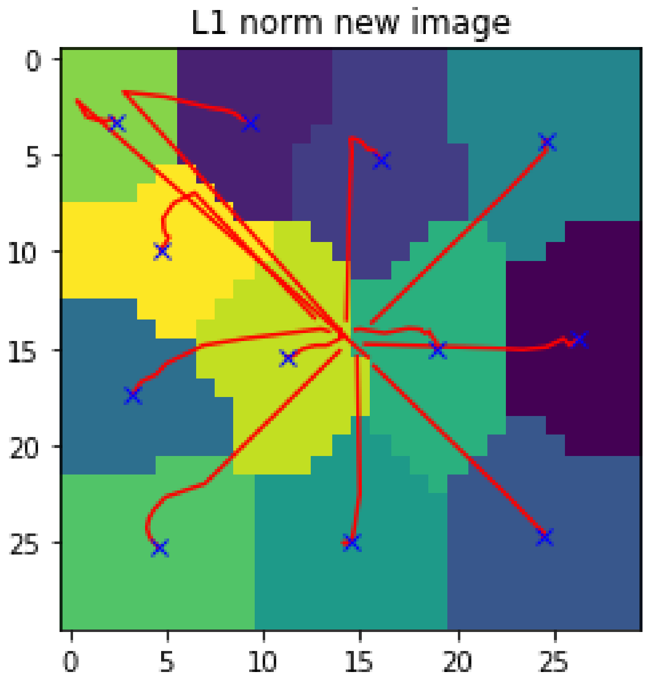

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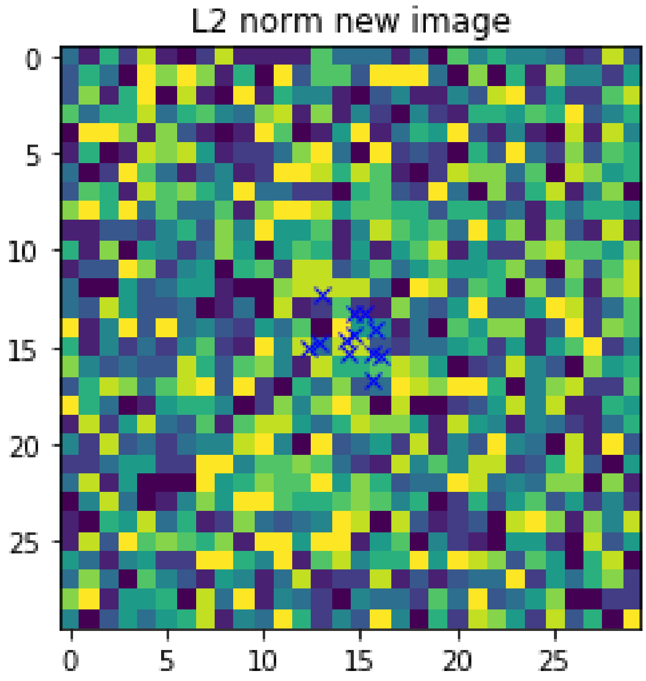

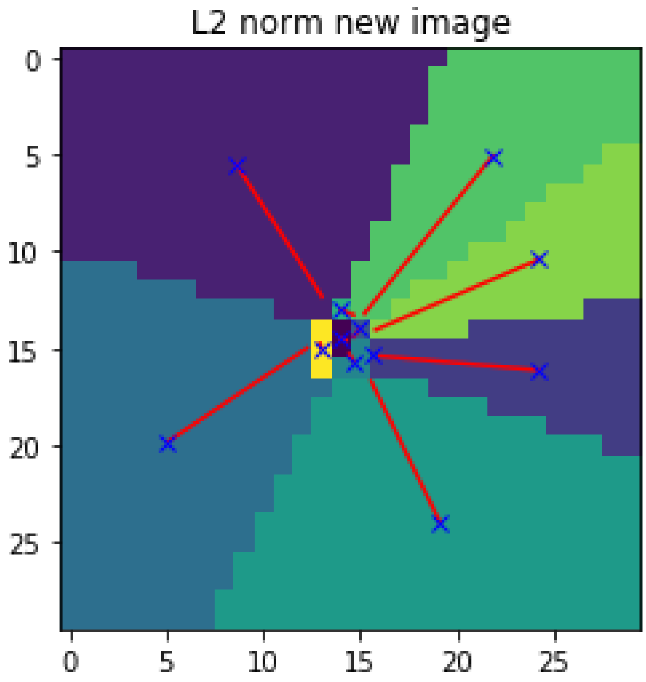
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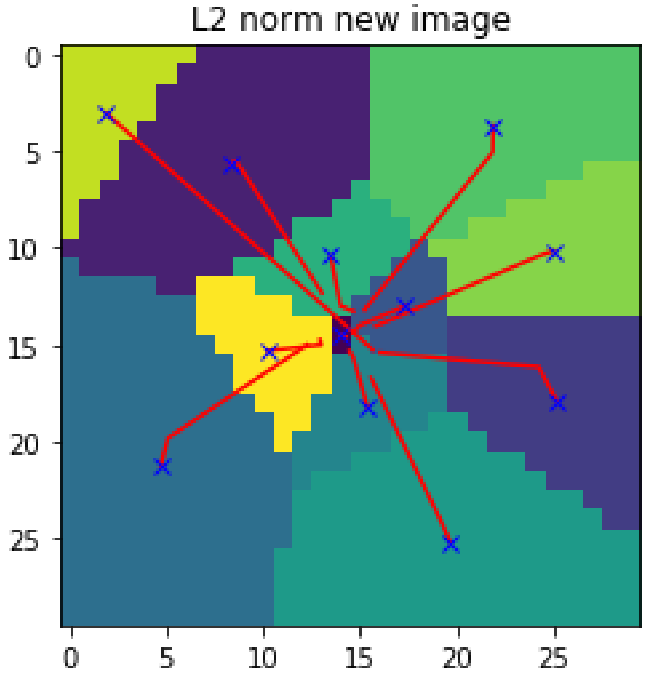
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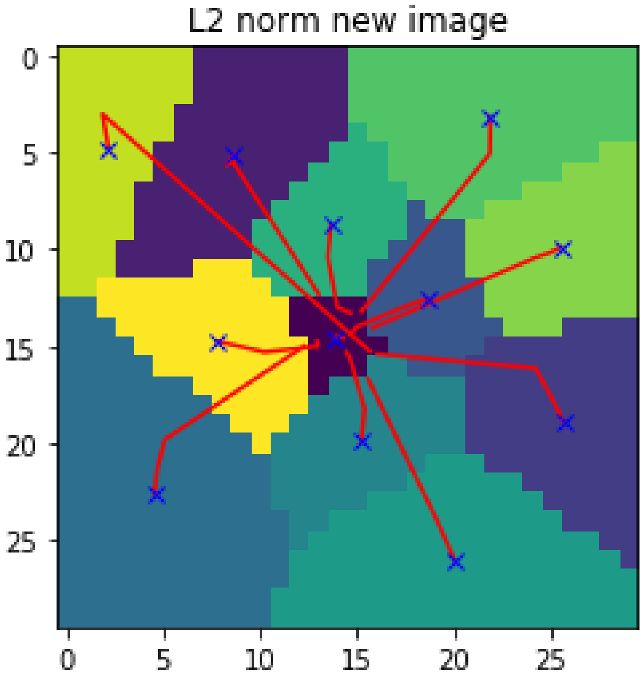
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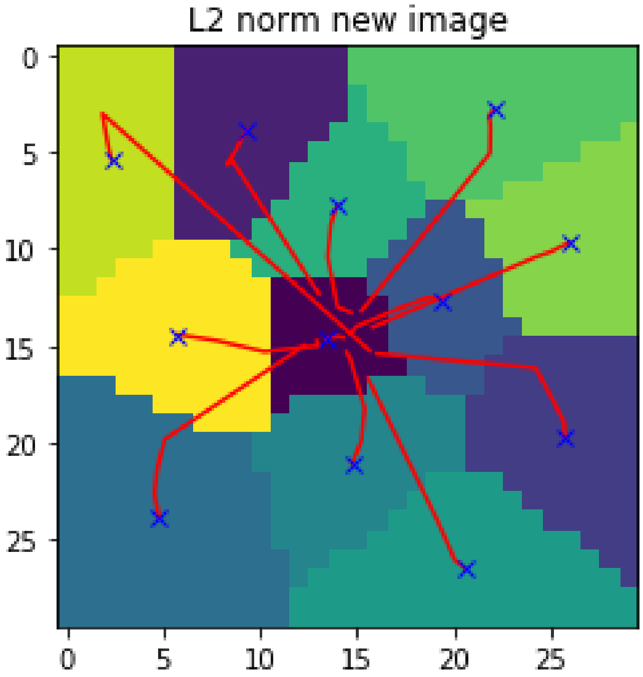
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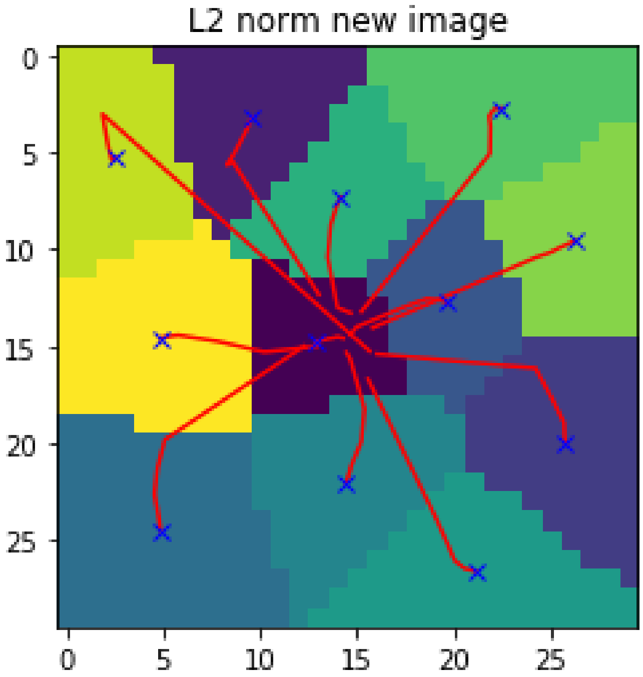
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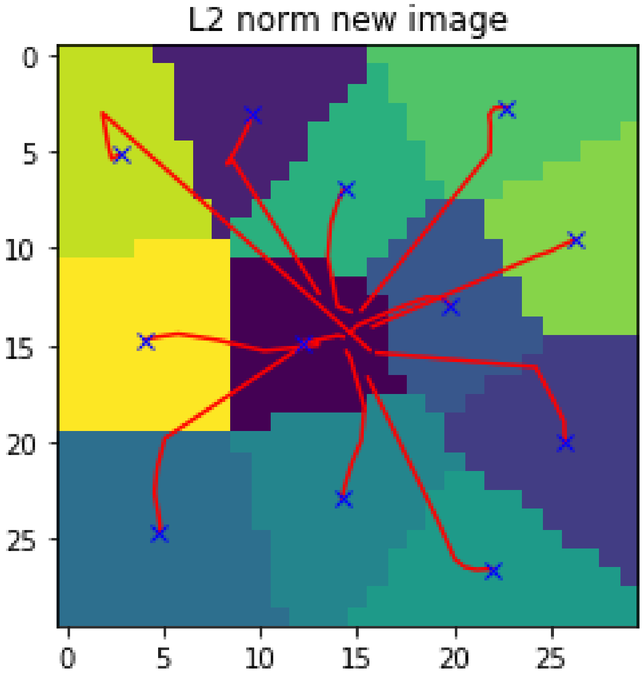
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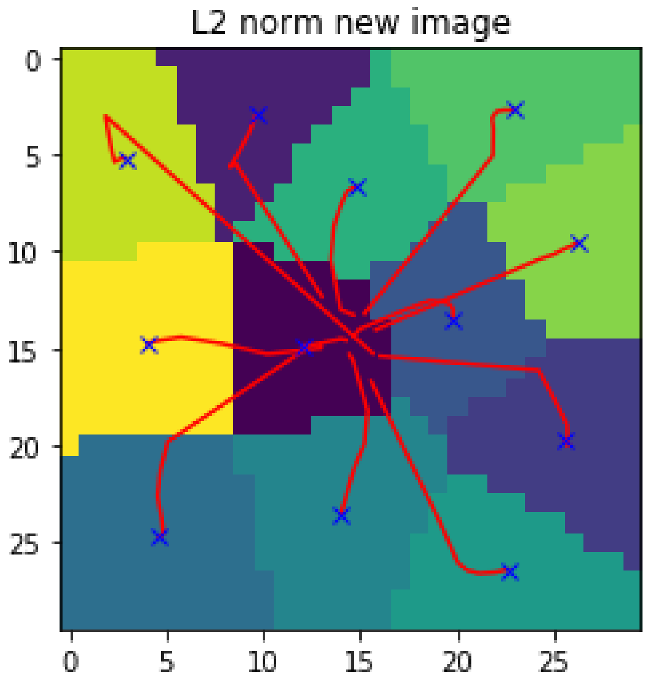
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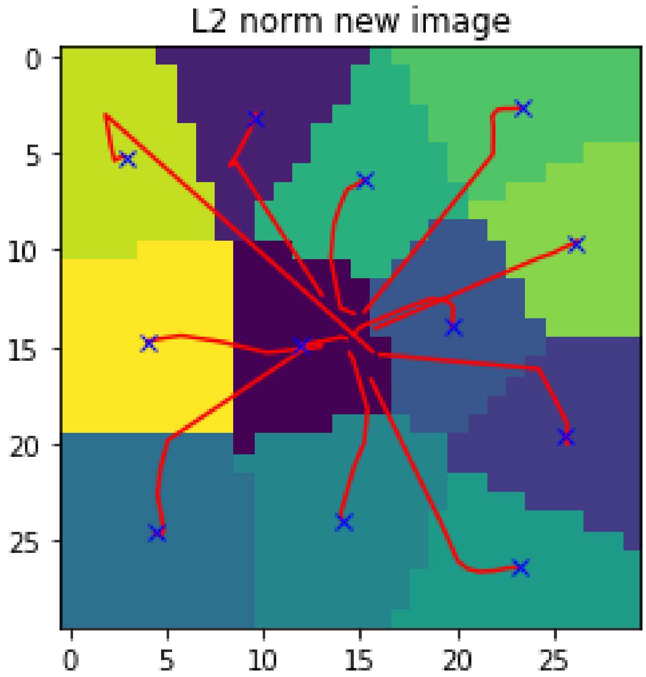
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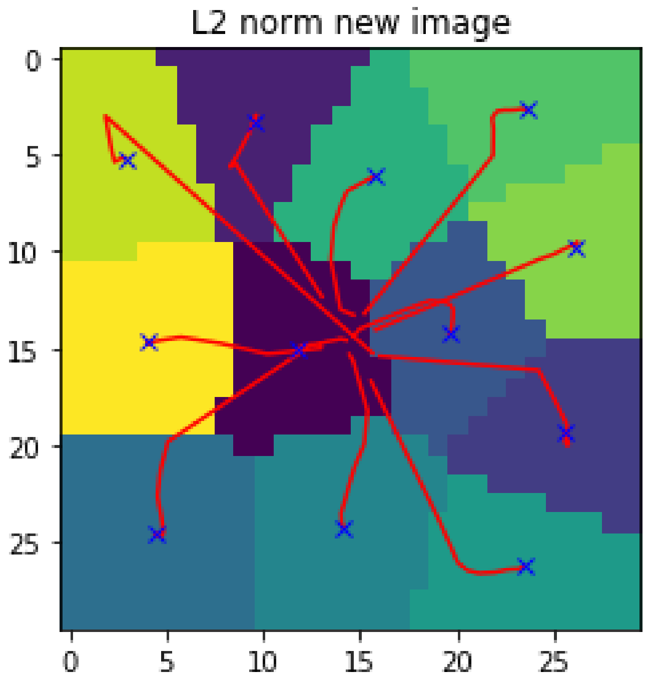
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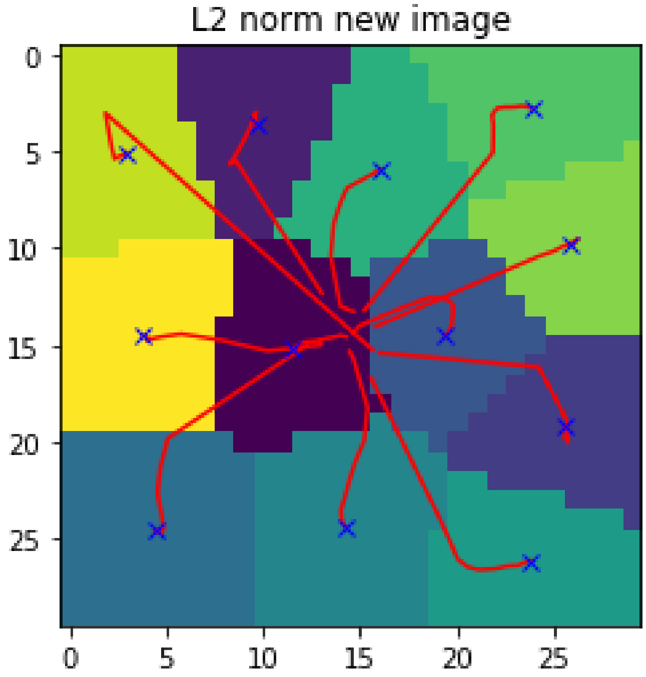
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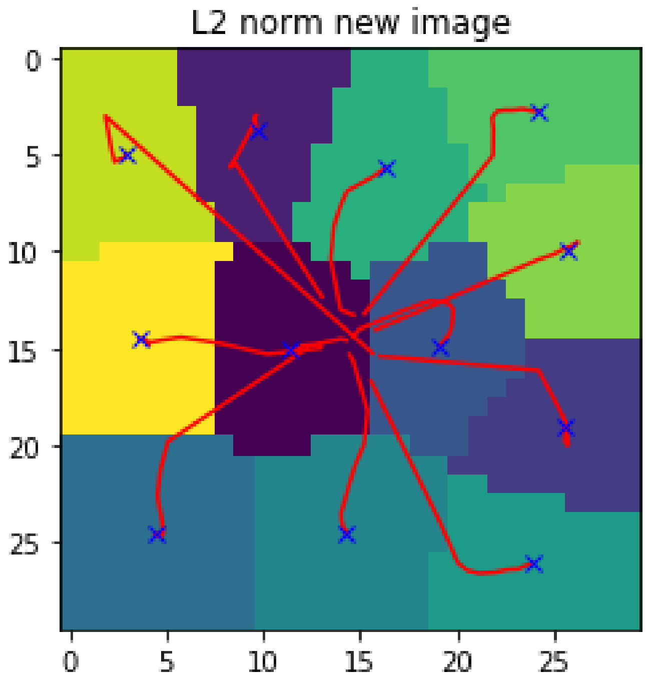
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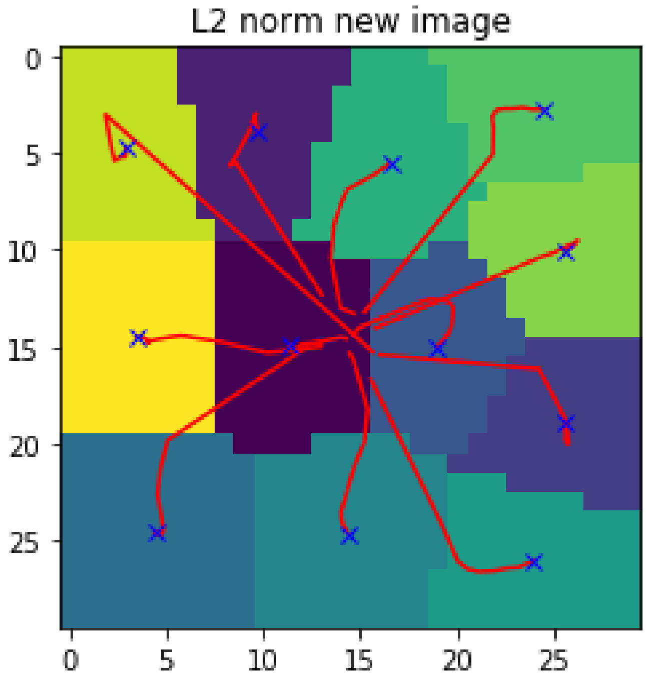
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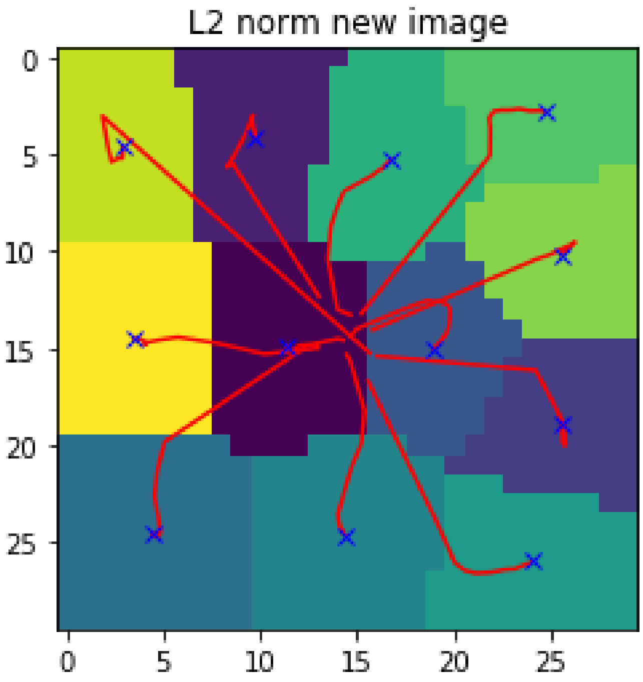
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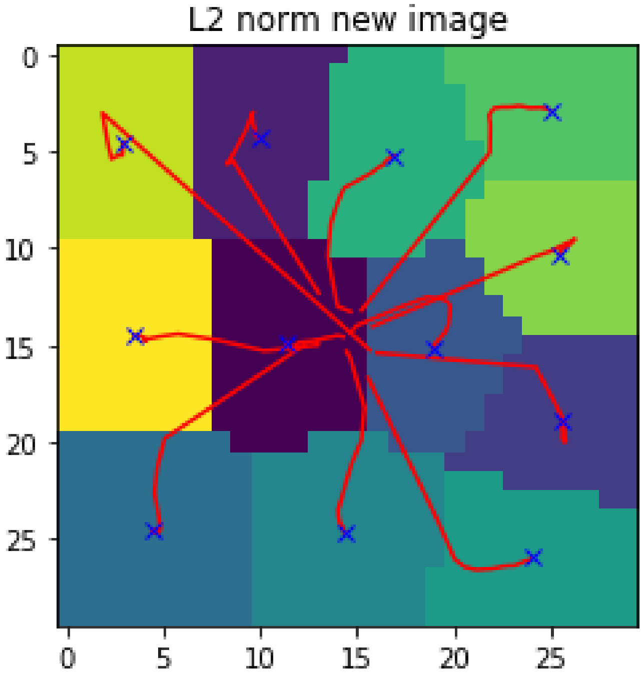
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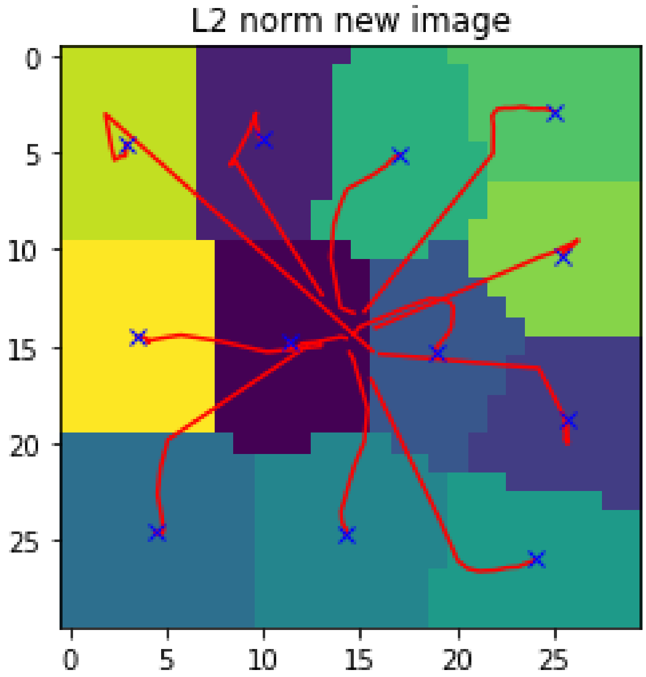
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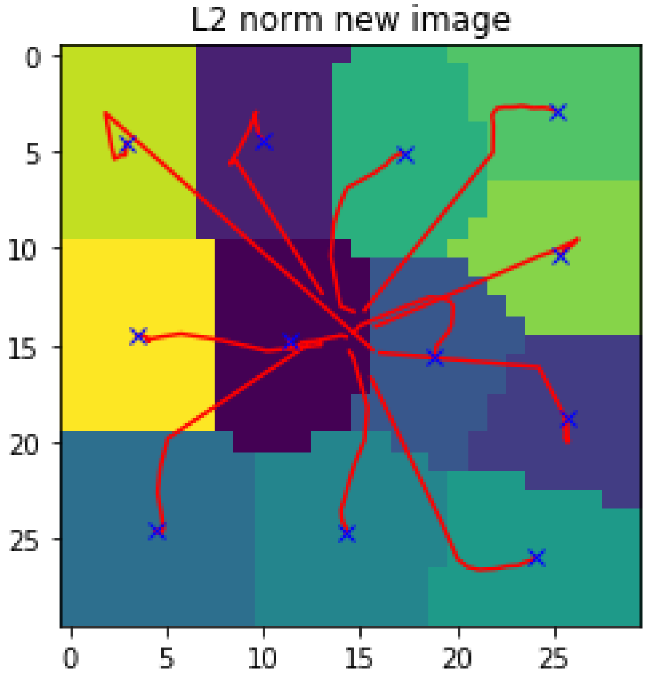
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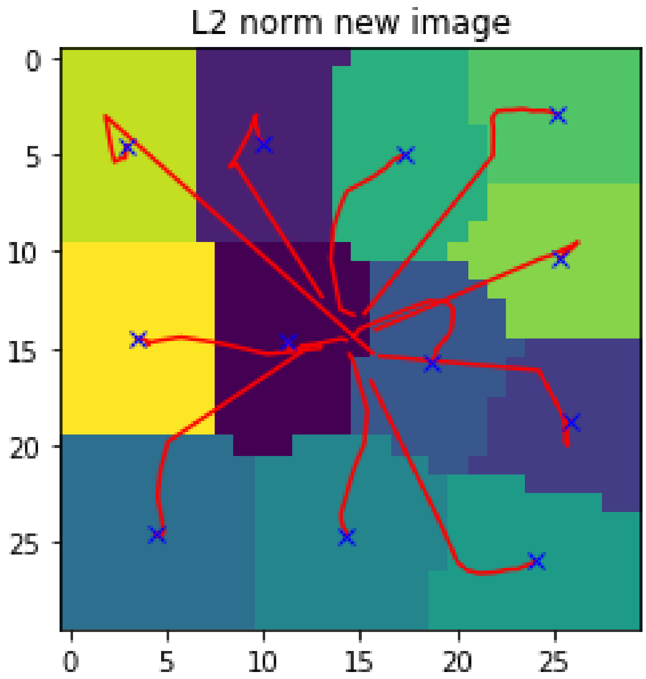
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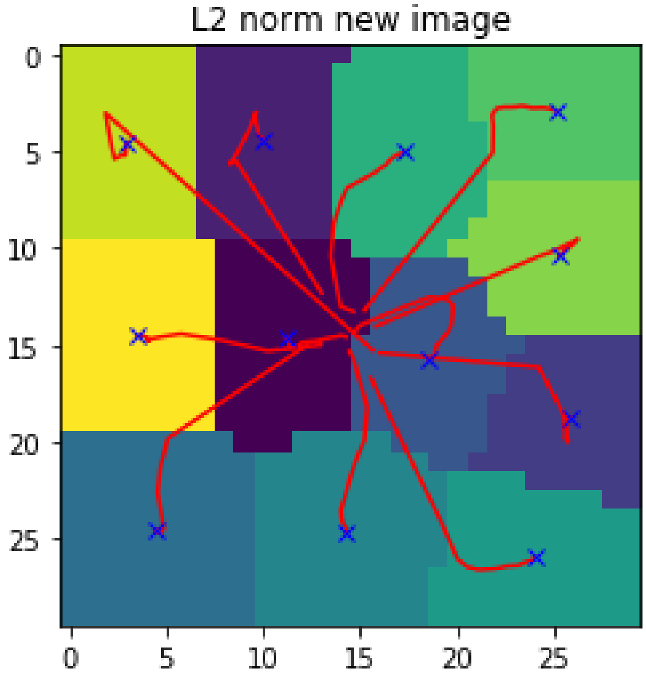
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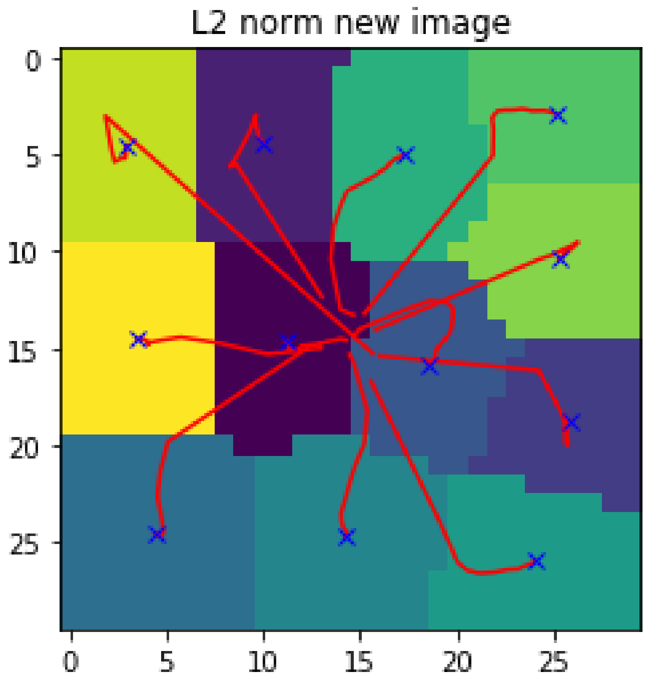
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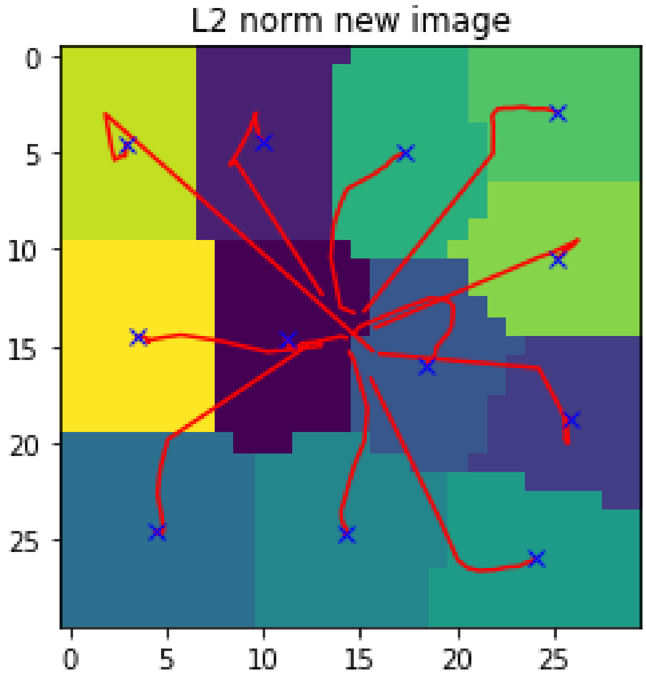
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end
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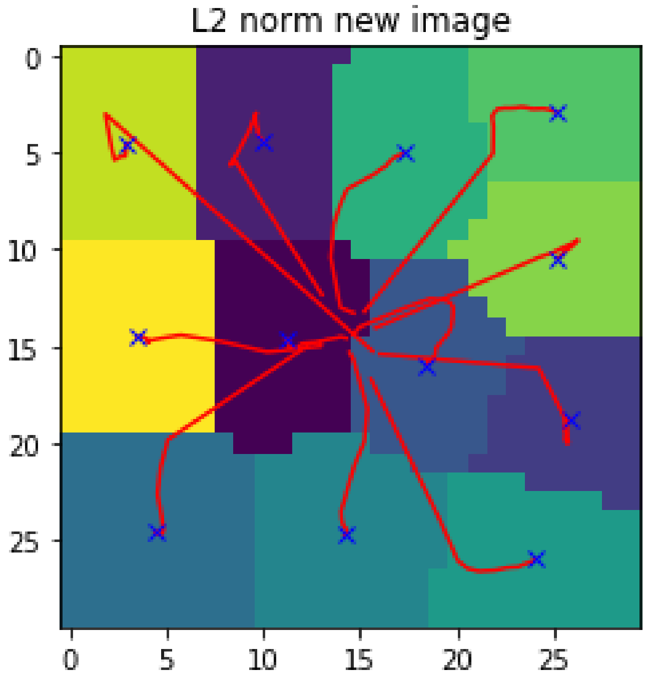
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