

EE 146: Computer Vision

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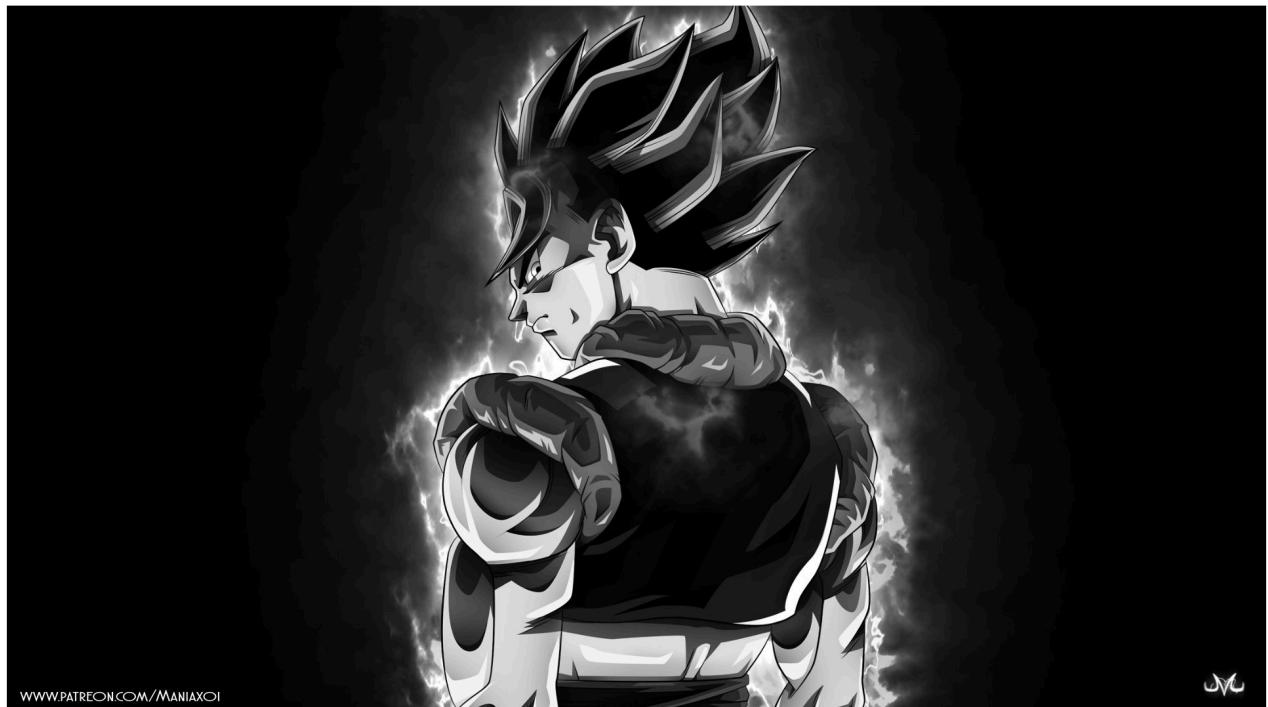
Lab 8: Scale Invariant Feature Transform (SIFT) and Matching

Date: 02/23/2022

Problem 1: Scale Invariant Feature Transform (SIFT)

- (a) Select some interesting image

```
ultra_instinct = imread("Ultra_Instinct.jpeg");
ultra_instinct = rgb2gray(ultra_instinct);
imshow(ultra_instinct)
```



```
[kpd_1, kploc_1] = SIFT(ultra_instinct);
```

Time taken for Pyramid level generation is :27.938105

Time taken for finding the key points is :20.129121

Image with key points mapped onto it

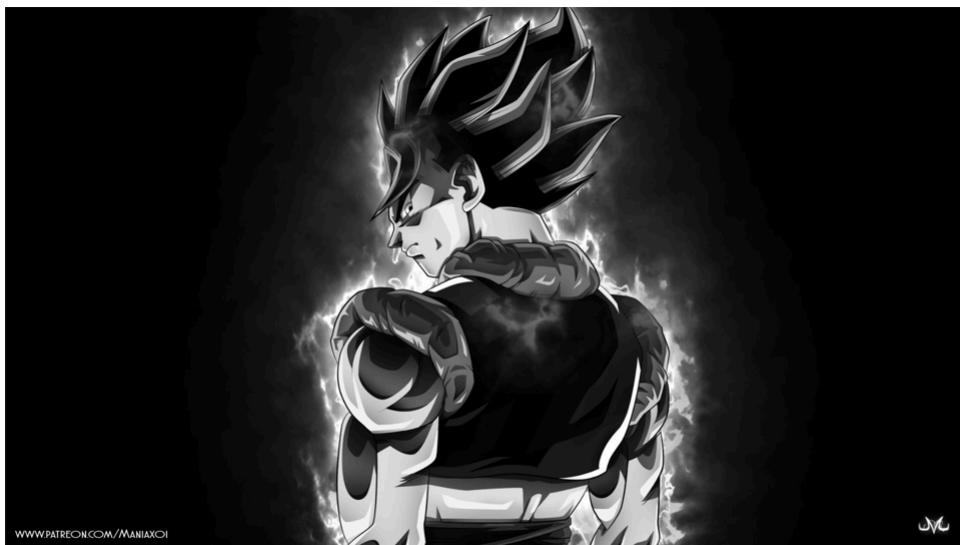


Time taken for magnitude and orientation assignment is :22.584010

Time taken for finding key point descriptors is :25.021966

Generate additional images from the give image

```
% Change the scale of the image  
ultra_size = imresize(ultra_instinct, 0.5);  
imshow(ultra_size)
```



```
[kpd_2, kploc_2] = SIFT(ultra_size);
```

Time taken for Pyramid level generation is :6.964242

Time taken for finding the key points is :4.319676

Image with key points mapped onto it



Time taken for magnitude and orientation assignment is :5.141922

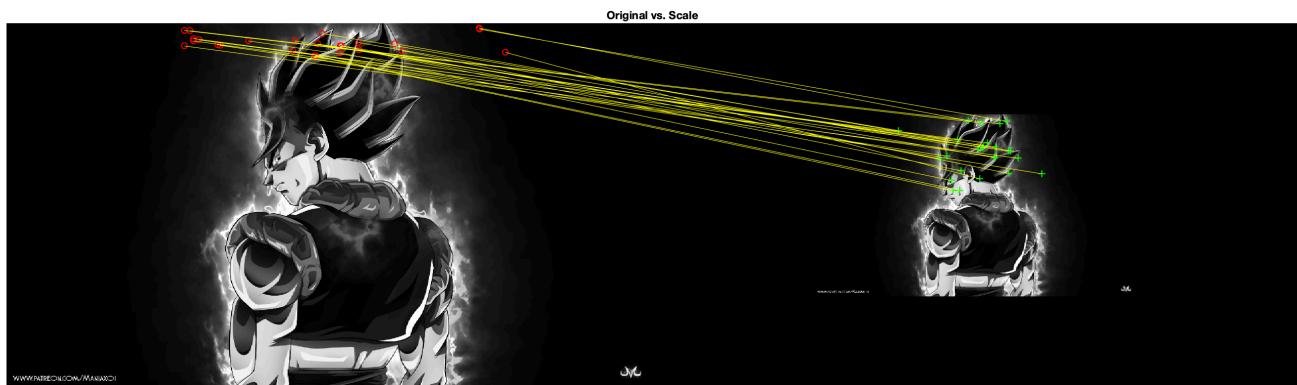
Time taken for finding key point descriptors is :5.483547

% Match features

```
indexpairs1 = matchFeatures(kpd_1, kpd_2);
matchpoints1 = kploc_1(indexpairs1(1:25,1),:);
matchpoints2 = kploc_2(indexpairs1(1:25,1),:);
showMatchedFeatures(ultra_instinct, ultra_size, matchpoints1, matchpoints2, 'montage')
```

Warning: Image is too big to fit on screen; displaying at 67%

```
title('Original vs. Scale')
```



The quality of these results is poor. In some instances, we see matched points (at the top of the hair). For the most part, many of the points from the scaled image do not correlate with the original image. Compared to the original image, the scaled image requires one order of magnitude less computation time than the scaled image. The algorithm seems to fail when around the image. Points in the background of the original image match with points in the foreground in the scaled image, which is incorrect.

```
% Rotate the image  
ultra_rotate = imrotate(ultra_instinct, 90);  
imshow(ultra_rotate)
```



```
[kpd_3, kploc_3] = SIFT(ultra_rotate);
```

Time taken for Pyramid level generation is :29.388299

Time taken for finding the key points is :17.749494

Image with key points mapped onto it



Warning: Image is too big to fit on screen; displaying at 67%

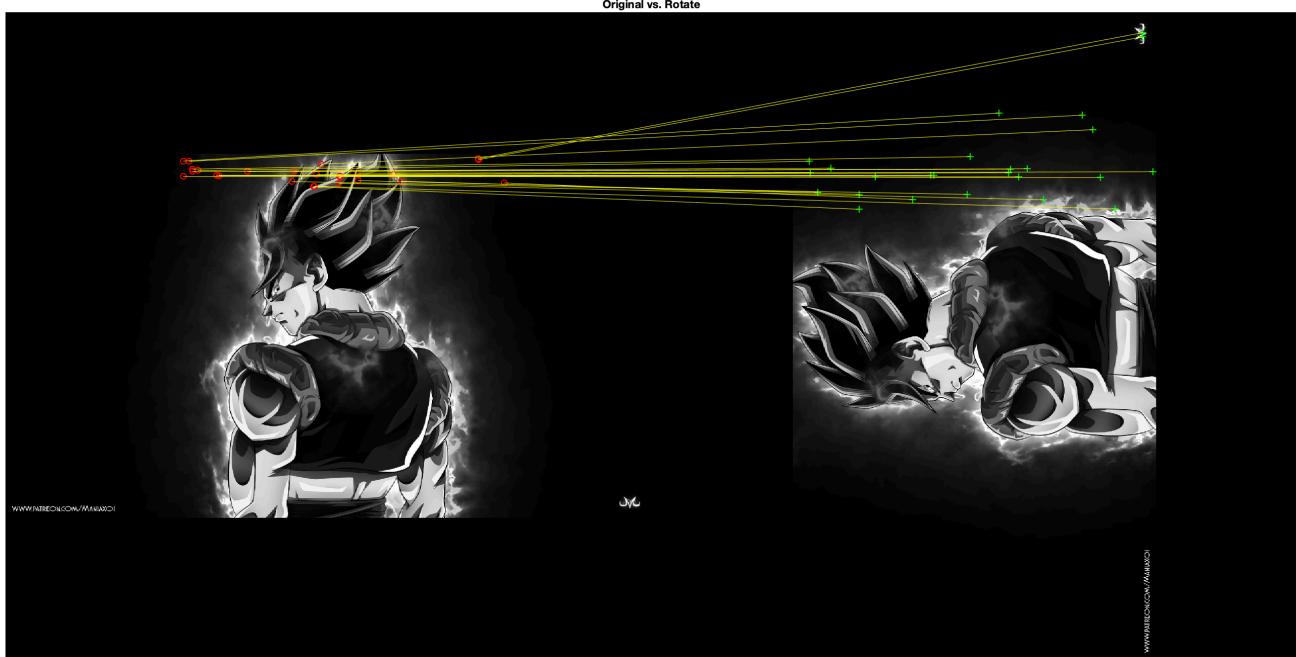
Time taken for magnitude and orientation assignment is :21.130367

Time taken for finding key point descriptors is :23.457556

```
% Match features
indexpairs2 = matchFeatures(kpd_1, kpd_3);
matchpoints3 = kploc_3(indexpairs1(1:25,1),:);
showMatchedFeatures(ultra_instinct, ultra_rotate, matchpoints1, matchpoints3, 'montage')
```

Warning: Image is too big to fit on screen; displaying at 67%

```
title('Original vs. Rotate')
```



The quality of these results is worse than when the scale of the image changes. We see no matched points. Compared to the original image, the rotated image requires less computation time than the original image; however, this difference is not as significant as when the scale of the image changes. The algorithm fails and does not appear to be rotationally invariant.

```
% Change illumination  
ultra_ill = ultra_instinct+50;  
imshow(ultra_ill)
```



```
[kpd_4, kploc_4] = SIFT(ultra_ill);
```

Time taken for Pyramid level generation is :28.810649

Time taken for finding the key points is :17.798178

Image with key points mapped onto it



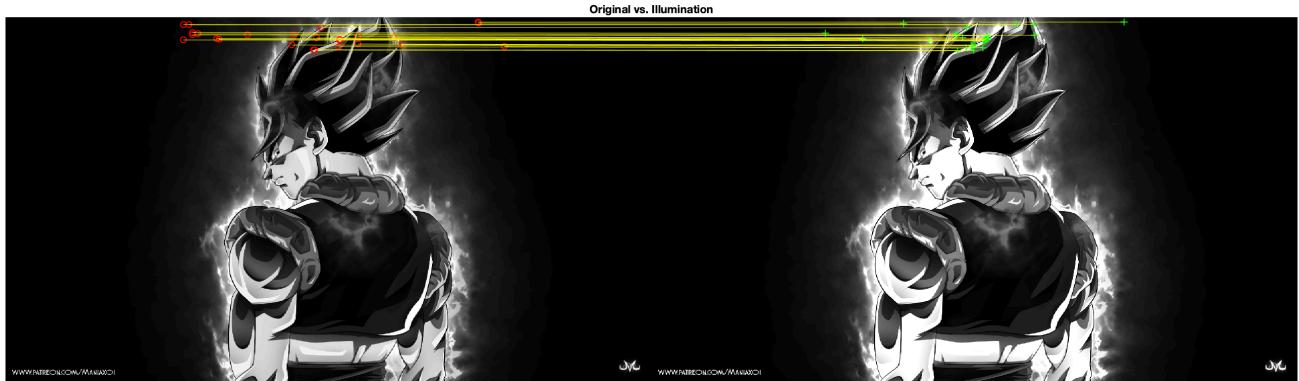
Time taken for magnitude and orientation assignment is :19.921567

Time taken for finding key point descriptors is :21.554165

```
% Match features
indexpairs3 = matchFeatures(kpd_1, kpd_4);
matchpoints4 = kploc_4(indexpairs1(1:25,1),:);
showMatchedFeatures(ultra_instinct, ultra_ill, matchpoints1, matchpoints4, 'montage')
```

Warning: Image is too big to fit on screen; displaying at 67%

```
title('Original vs. Illumination')
```



The quality of these results is excellent compared to the scaled and rotation image changes. We see several matched points. Compared to the original image, the illuminated image requires less computation time than the original image; however, this difference is not as significant as when the scale of the image changes. The algorithm appears to be illumination invariant.

```
% Partially occlude the image
imshow(ultra_instinctCopy)
```



```
[kpd_5, kploc_5] = SIFT(ultra_instinctCopy);
```

Time taken for Pyramid level generation is :29.504877

Time taken for finding the key points is :20.114914

Image with key points mapped onto it



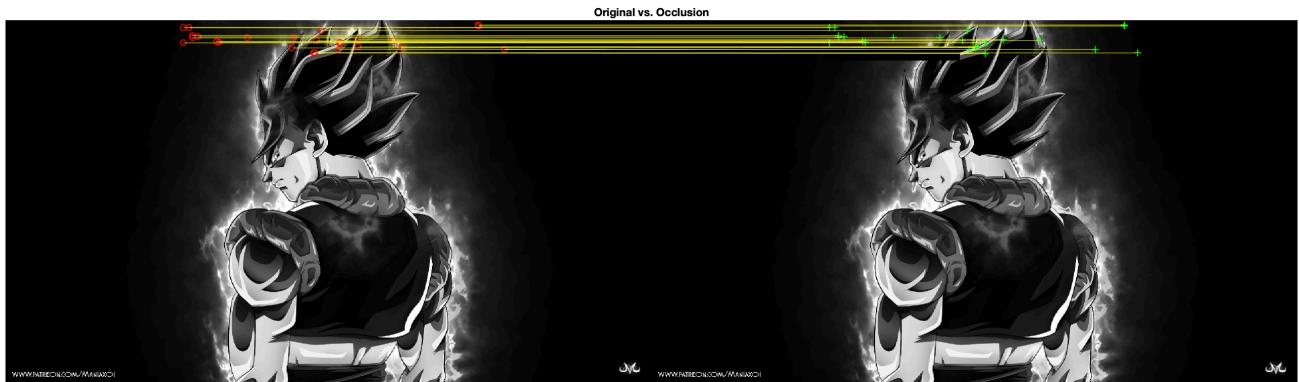
Time taken for magnitude and orientation assignment is :23.125053

Time taken for finding key point descriptors is :25.533218

```
% Match features
indexpairs4 = matchFeatures(kpd_1, kpd_5);
matchpoints5 = kploc_5(indexpairs1(1:25,1),:);
showMatchedFeatures(ultra_instinct, ultra_instinctCopy, matchpoints1, matchpoints5, 'm'
```

Warning: Image is too big to fit on screen; displaying at 67%

```
title('Original vs. Occlusion')
```



The quality of these results is excellent compared to the scaled and rotation image changes. We see several matched points. Compared to the original image, the occluded image requires less computation time than

the original image; however, this difference is not as significant as when the scale of the image changes. The algorithm appears to be occlusion invariant.