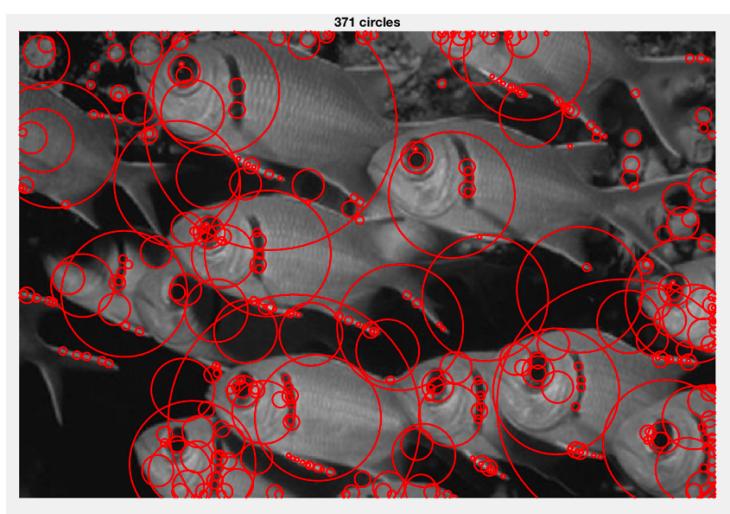
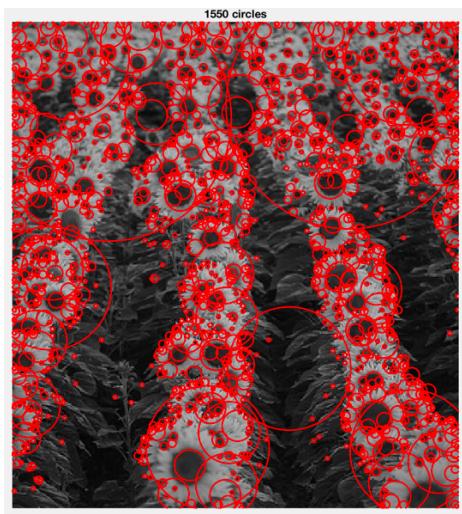
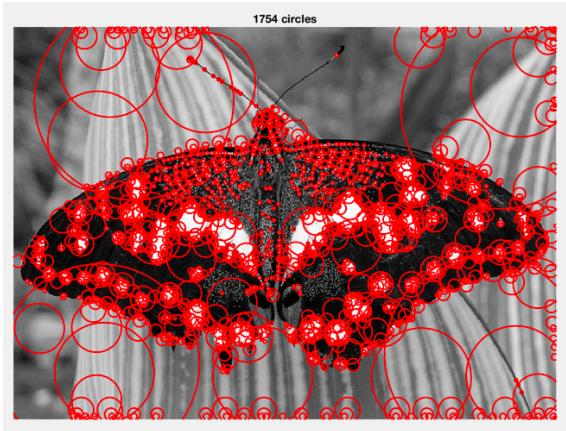


HomeWork 2
Computer Vision and Image Processing
Scale-space blob detection
CSE-573 - Fall 2017

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Analysis & Results

1. Output for Inefficient Implementation: Following are the outputs of blob detection by increasing the kernel size.



2. Output for efficient implementation after down sampling the image and then applying the LOG filter.

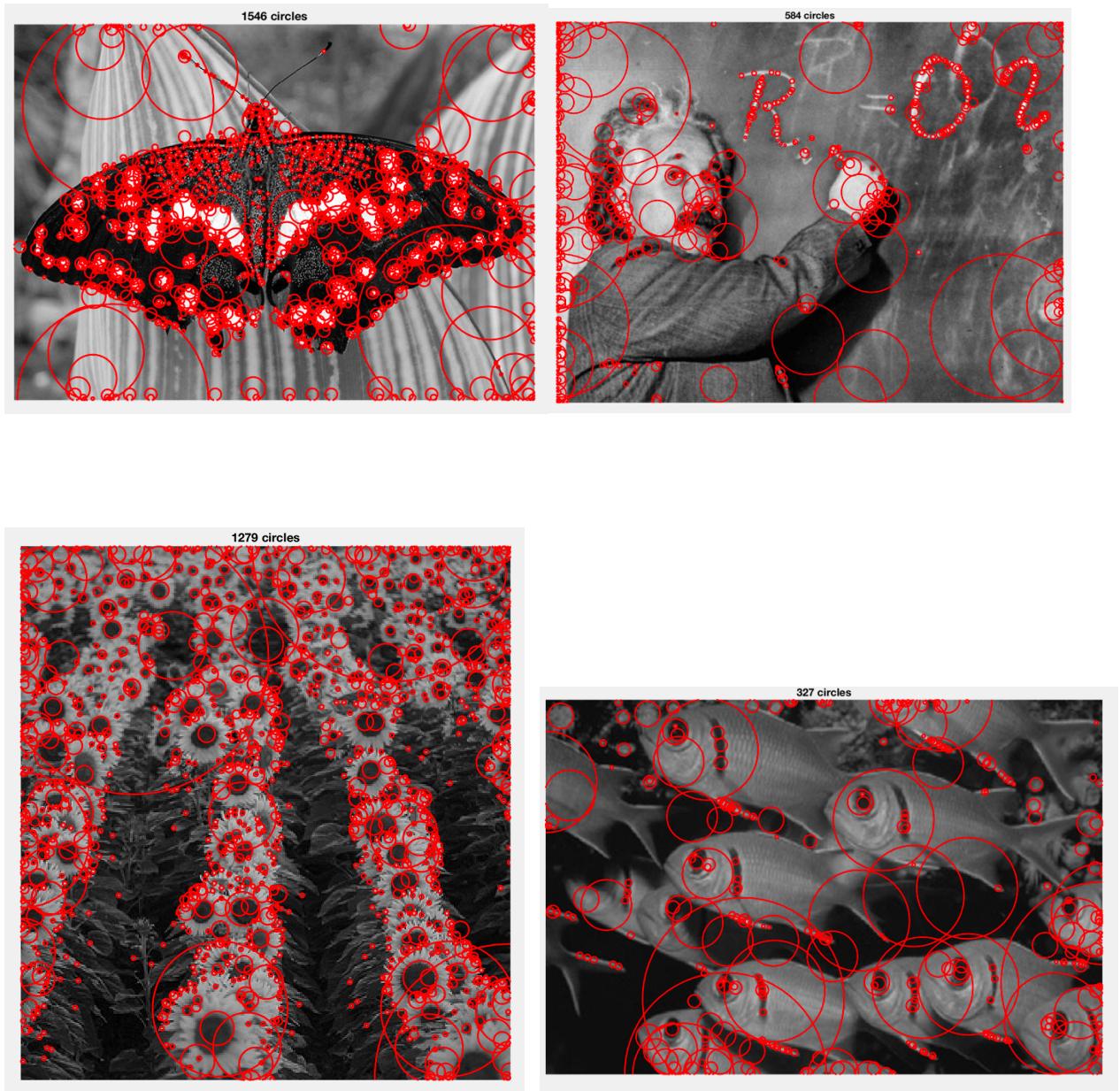
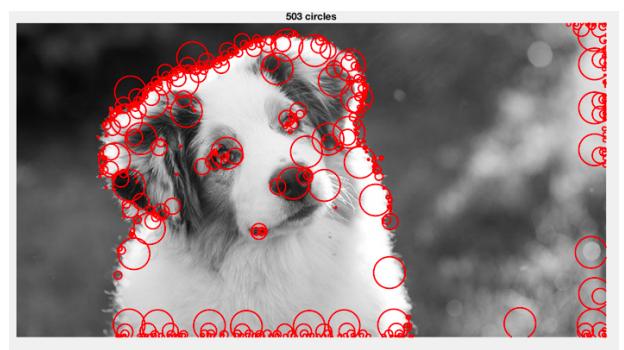
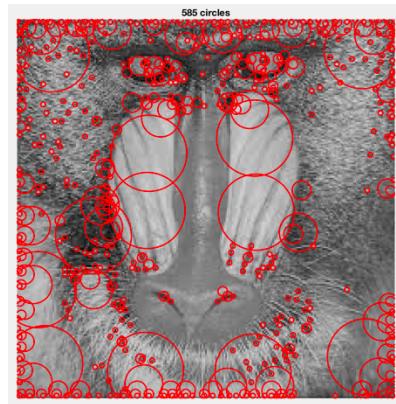


Image	Inefficient approach(filter increase by factor k) (secs)	Efficient approach(downsampling) (secs)
Butterfly	4.148217	2.609951
Einstien	5.658137	1.897001
Sunflowers	3.068512	2.141346
Fishes	3.051703	0.958651

Clearly from the table above down sampling the images by factor k is more efficient than increasing the kernel size by factor k. down sampling the image doesn't affect the scale of the filter that is why it is considered as scale invariant detection of features.

More Outputs:

1. Inefficient



2. Efficient





Implementation choices

1. In order to perform non maximum suppression ordfilt2 was used as it is much faster than colfilter and nfilter. According to its definition When working with large domain matrices that do not contain any zero-valued elements, ordfilt2 can achieve higher performance. Moreover, it is easier to find the maximum value in the neighborhood and replacing the neighborhood with that value.
2. The filter width used was odd in order to avoid shifting.
3. Bicubic interpolation was used for image resizing in order to maintain the spatial resolution of an image.
4. No scale normalization was done on down sampling the image as the scale of the filter was not varied resulting in its scale invariant nature.

Parameters:

1. The threshold was set to be around 0.01 which was found to be optimal for almost all the images.
2. The factor by which the filter size was increased or by which the image was down sampled was set to be 2.
3. The number of iteration was taken to be 10 as for this value larger blobs were generated of radius around 512 pixels which itself was larger than the size of the image. So for k=2 max scale space generated should be max 10.

References:

1. http://www.cse.psu.edu/~rtc12/CSE586/lectures/featureExtractionPart2_6pp.pdf
2. http://www.cs.unc.edu/~lazebnik/spring11/lec08_blob.pdf
3. <http://www.cs.ubc.ca/~lowe/papers/ijcv04.pdf>