Lab 12: SVD

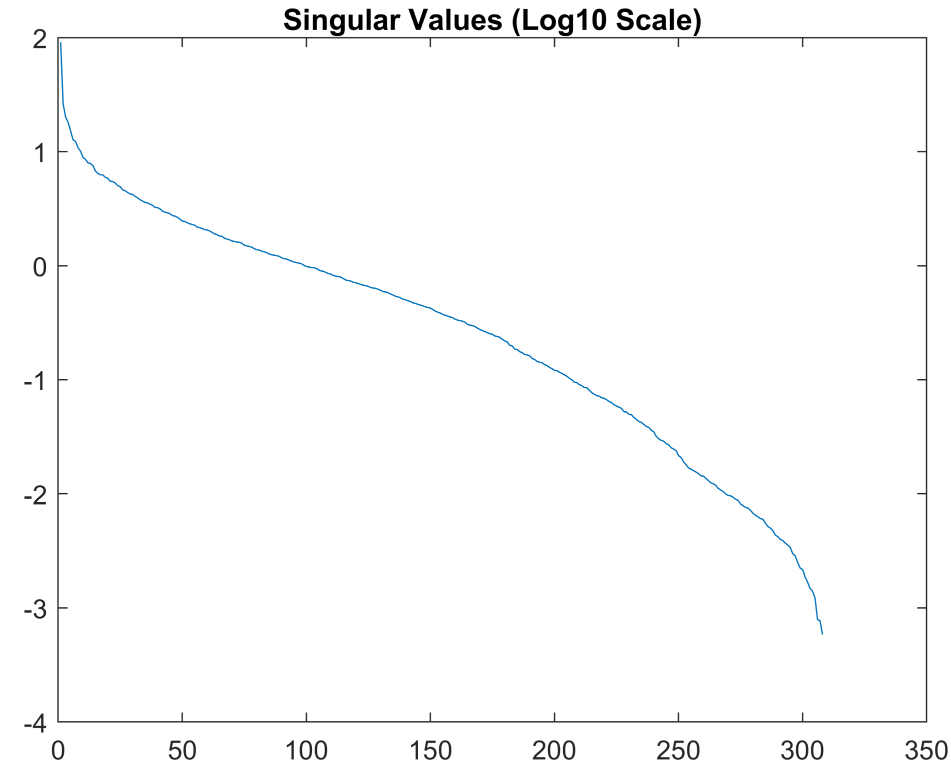
Image compressing - Gorodetskii and Cell

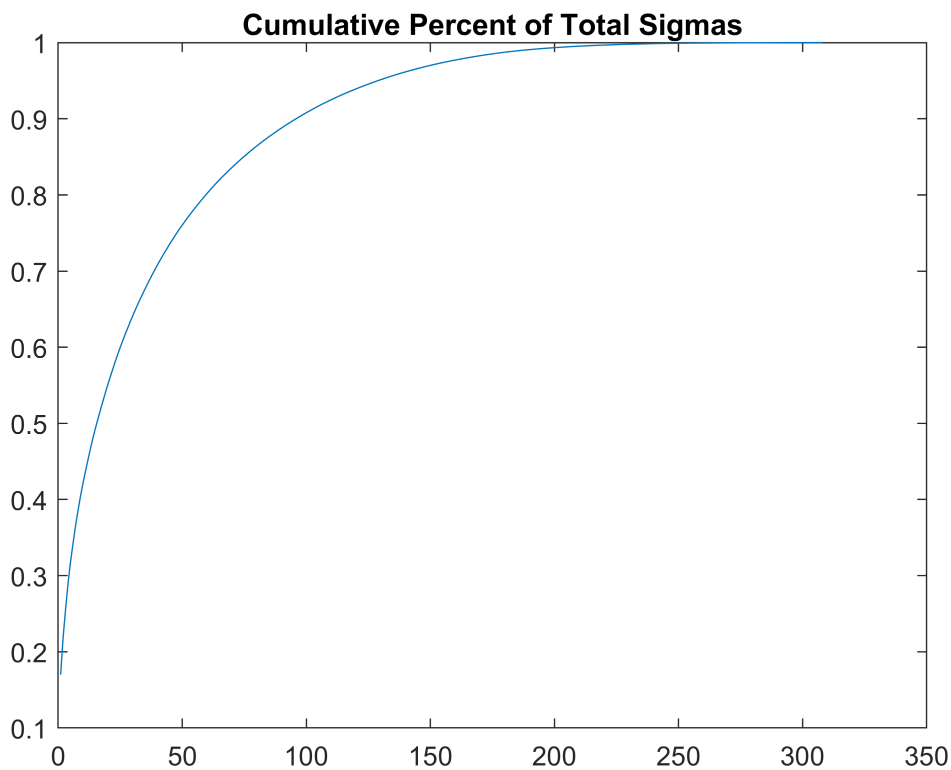
Cell is needed for understanding what does information means

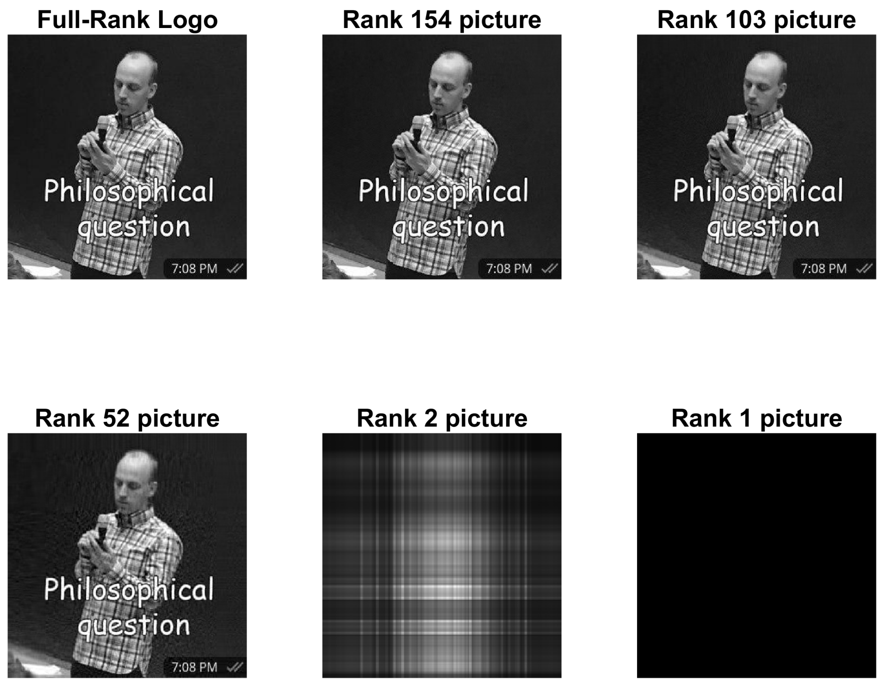
```
pic_name = ['tsar.jpg';'cell.jpg']
```

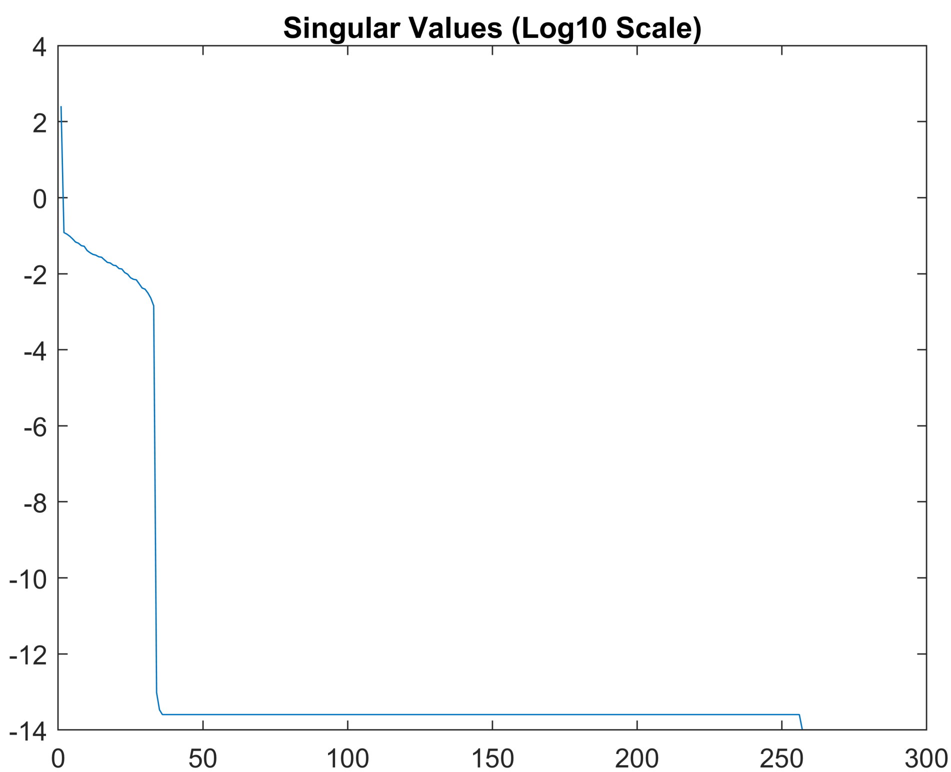
```
pic_name = 2×8 char array
    'tsar.jpg'
    'cell.jpg'
```

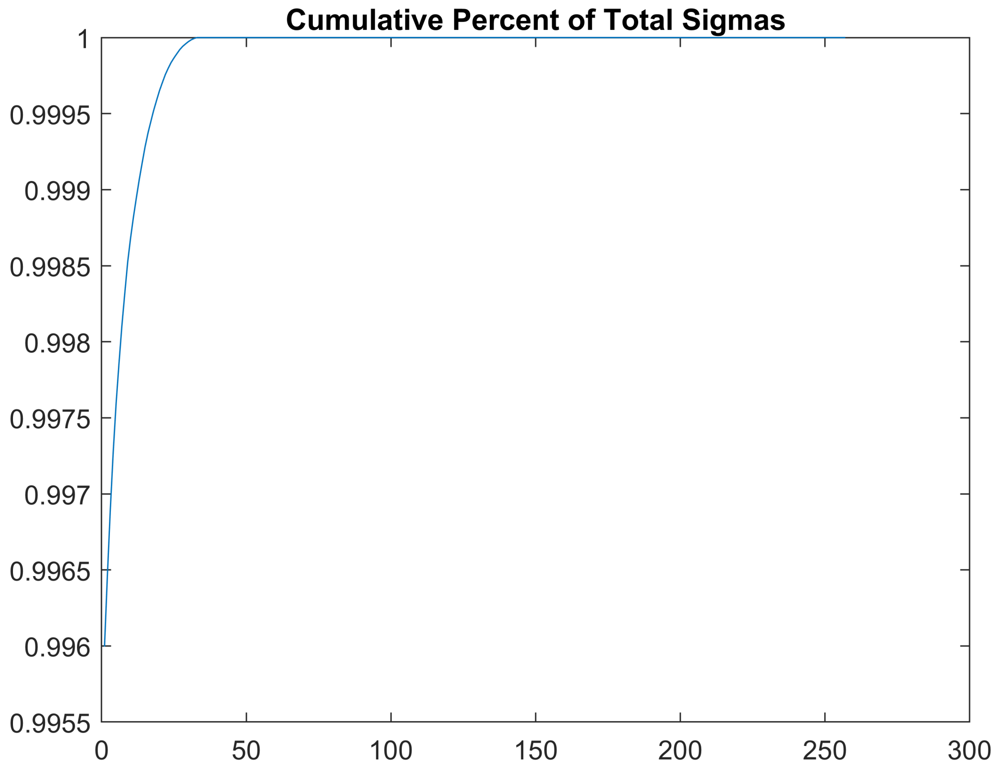
```
for pic_num=1:size(pic_name,1)
    logo_num = im2double(rgb2gray(imread(pic_name(pic_num,:))));
    [U, S, V] = svd(logo_num);
    % Compute SVD of this picture
    [U, S, V] = svd(logo_num);
    S_myau = S;
    % Plot the magnitude of the singular values (log scale)
    sigmas = diag(S);
    figure; plot(log10(sigmas)); title('Singular Values (Log10 Scale)');
    % It shows how much information will be after redusing matrix rank
    figure; plot(cumsum(sigmas) / sum(sigmas)); title('Cumulative Percent of Total Sigmas');

    % Show full-rank picture
    figure; subplot(2, 3, 1), imshow(logo_num), title('Full-Rank Logo');

    % Compute low-rank approximations of the picture, and show them
    ranks = [ceil(rank(S)/2), ceil(rank(S)/3), ceil(rank(S)/6), 2, 1];
    for i = 1:length(ranks)
        % Keep largest singular values, and nullify others.
        approx_sigmas = sigmas; approx_sigmas(ranks(i):end) = 0;

        % Form the singular value matrix, padded as necessary
        ns = length(sigmas);
        approx_S = S; approx_S(1:ns, 1:ns) = diag(approx_sigmas);

        % Compute low-rank approximation by multiplying out component matrices.
        approx_logo = U * approx_S * V';

        % Plot approximation
        subplot(2, 3, i + 1), imshow(approx_logo), title(sprintf('Rank %d picture', ranks(i)));
    end
end
```

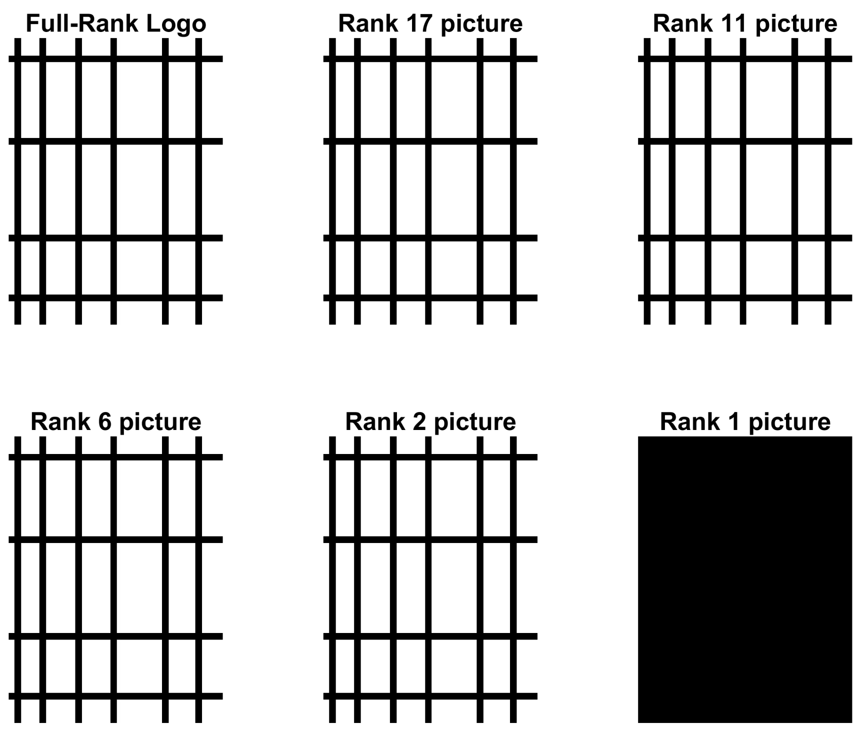

Singular Values (Log10 Scale)
2
1
0
-1
-2
-3
-4
0
50
100
150
200
250
300
350


Cumulative Percent of Total Sigmas
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300
350


Full-Rank Logo
Rank 154 picture
Rank 103 picture
Rank 52 picture
Rank 2 picture
Rank 1 picture
Philosophical
question
7:08 PM


Singular Values (Log10 Scale)
4
2
0
-2
-4
-6
-8
-10
-12
-14
0
50
100
150
200
250
300


Cumulative Percent of Total Sigmas
1
0.9995
0.999
0.9985
0.998
0.9975
0.997
0.9965
0.996
0.9955
0
50
100
150
200
250
300


Full-Rank Logo
Rank 17 picture
Rank 11 picture
Rank 6 picture
Rank 2 picture
Rank 1 picture