CS663
Assignment 4 - Q4

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The function `mySVD()` accepts any matrix input. If $A = U\Sigma V^T$, and A has dimensions (m, n), the function will output U, V and a vector S of size $(m, 1)$ which contains the singular values of A sorted in descending order. Some values of S might be zero, which correspond to the remaining eigenvalues of AA^T.
In order to align the eigenvectors correctly, we've equated Av_i and $\sigma_i u_i$ (which are expected to be equal). If $||Av_i - \sigma_i u_i||_2 < t$, (t is the tolerance set to 10^{-8}), we've reversed the sign of v_i.

In the main script, the vector S has been converted into the suitable (m, n) format for comparison with A. **MATLAB report attached with this PDF**.

MyMainScript

```
tic;
m = 5;
n = 7;
A = reshape(randperm(m * n), m, n);
% Generating SVD
[U, V, S] = mySVD(A);

% Converting the vector into m*n form
diag_S = diag(S);
if n > m
    diag_S = cat(2, diag_S, zeros(m, n-m));
elseif m > n
    diag_S = diag_S(:, 1:n);
end
% Comparing values of A with U*S*V^T
A
U * diag_S * V'
toc
```

```
A =

    31    12    20    29    17    33     8
     9    14    32    16    19    11     3
    18    30    15     7     4    27     2
    23    21     5    10     1    26    25
    28    22    13    35    34     6    24


ans =

   31.0000   12.0000   20.0000   29.0000   17.0000   33.0000    8.0000
    9.0000   14.0000   32.0000   16.0000   19.0000   11.0000    3.0000
   18.0000   30.0000   15.0000    7.0000    4.0000   27.0000    2.0000
   23.0000   21.0000    5.0000   10.0000    1.0000   26.0000   25.0000
   28.0000   22.0000   13.0000   35.0000   34.0000    6.0000   24.0000

Elapsed time is 0.683073 seconds.
```