

```

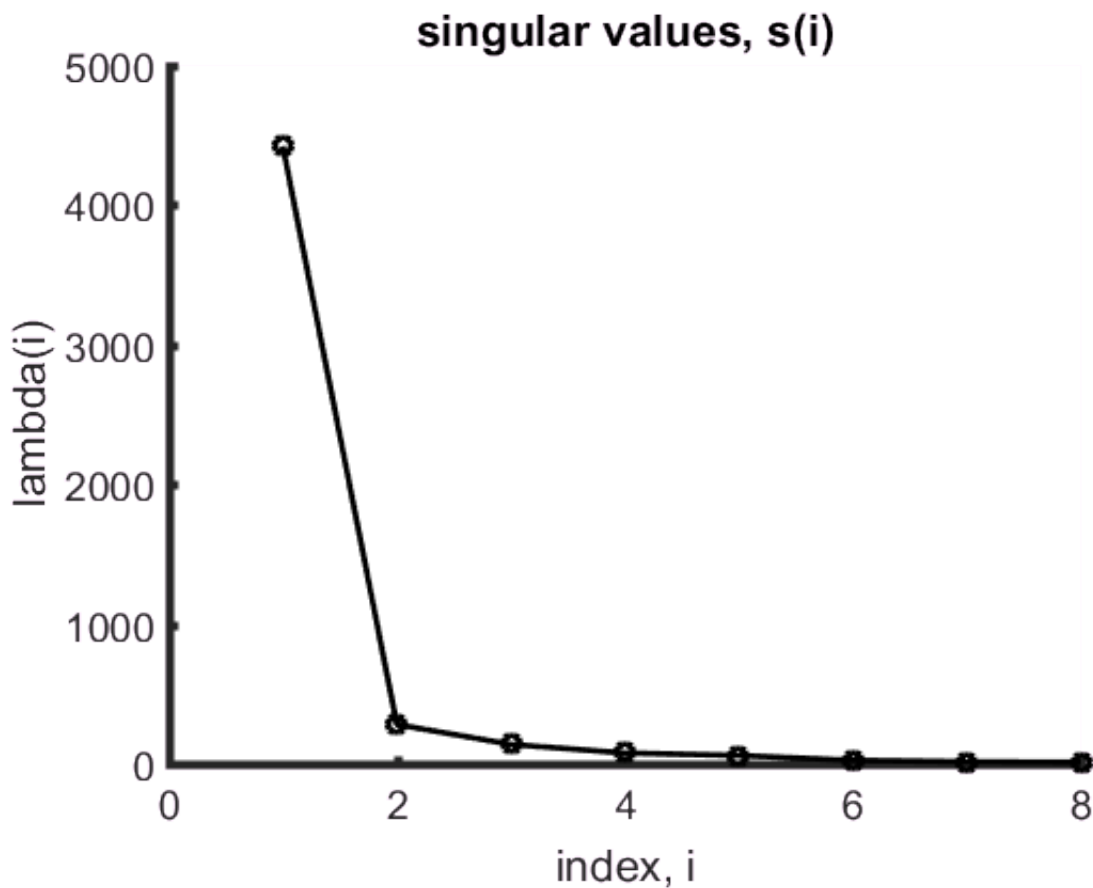
% gda10_04
% factor analysis on Atlantic Rocks dataset
% using singular value decomposition
% Supports Figures 10.5 and 10.6

% load data
D = load(' ../data/rocks.txt');
sio2 = D(:,1); % SiO2
tio2 = D(:,2); % TiO2
als03 = D(:,3); % Al2O3
feot = D(:,4); % FeO-total
mgo = D(:,5); % MgO
cao = D(:,6); % CaO
na20 = D(:,7); % Na2O
k20 = D(:,8); % K2O
Ns = size(D);
N = Ns(1);
M = Ns(2);

% compute factors and factor loadings using singular value decomposition
S=D;
[U, LAMBDA, V] = svd(S,0);
lambda = diag(LAMBDA);
Ns = length(lambda);
F = V';
C = U*LAMBDA;

% plot singular values
figure(1);
clf;
set(gca, 'LineWidth', 3);
set(gca, 'FontSize', 14);
hold on;
plot( [1:Ns], lambda, 'k-', 'LineWidth', 2 );
plot( [1:Ns], lambda, 'ko', 'LineWidth', 2 );
title('singular values, s(i)');
xlabel('index, i');
ylabel('lambda(i)');

```



% Figure 10.5 Singular values λ_i of the Atlantic Ocean Rock dataset. MatLab script gda10_04.

```
% display first five factors
for j = [1:5]
f1=F(j,:);
disp(sprintf('factor %d', j));
disp(sprintf('SiO2 %f', f1(1)));
disp(sprintf('TiO2 %f', f1(2)));
disp(sprintf('Al2O3 %f', f1(3)));
disp(sprintf('FeO-total %f', f1(4)));
disp(sprintf('MgO %f', f1(5)));
disp(sprintf('CaO %f', f1(6)));
disp(sprintf('Na2O %f', f1(7)));
disp(sprintf('K2O %f', f1(8)));
disp(sprintf(' '));
end
```

```
factor 1
SiO2 -0.908829
TiO2 -0.024638
Al2O3 -0.275168
FeO-total -0.177851
MgO -0.141341
CaO -0.209989
Na2O -0.044611
K2O -0.003430
```

```
factor 2
```

```
SiO2 0.007684
TiO2 -0.037474
Al2O3 -0.301583
FeO-total -0.018421
MgO 0.923193
CaO -0.226917
Na2O -0.058457
K2O -0.007204
```

```
factor 3
SiO2 -0.161689
TiO2 -0.126343
Al2O3 0.567828
FeO-total -0.659205
MgO 0.255748
CaO 0.365682
Na2O -0.041738
K2O -0.006464
```

```
factor 4
SiO2 0.209819
TiO2 0.151367
Al2O3 0.176021
FeO-total -0.427461
MgO -0.118643
CaO -0.780043
Na2O 0.302367
K2O 0.073403
```

```
factor 5
SiO2 0.309495
TiO2 -0.100476
Al2O3 -0.670083
FeO-total -0.585155
MgO -0.195193
CaO 0.207980
Na2O -0.145318
K2O 0.015035
```

```
% plot loadings of factors (f2,f3,f4) in 3D (c2,c3,c4) space
cmin=(-50);
cmax=50;
figure(2);
clf;
set(gca, 'LineWidth', 3);
set(gca, 'FontSize', 14);
hold on;
axis( [cmin, cmax, cmin, cmax, cmin, cmax] );
plot3( C(:,2), C(:,3), C(:,4), 'k.', 'LineWidth', 2 );
plot3( [cmin,cmin], [cmin,cmin], [cmin,cmax], 'k-', 'LineWidth', 2 );
plot3( [cmin,cmin], [cmin,cmax], [cmin,cmin], 'k-', 'LineWidth', 2 );
plot3( [cmin,cmax], [cmin,cmin], [cmin,cmin], 'k-', 'LineWidth', 2 );
```

```

plot3( [cmax,cmax], [cmax,cmax], [cmax,cmin], 'k-', 'LineWidth', 2 );
plot3( [cmax,cmax], [cmax,cmin], [cmax,cmax], 'k-', 'LineWidth', 2 );
plot3( [cmax,cmin], [cmax,cmax], [cmax,cmax], 'k-', 'LineWidth', 2 );

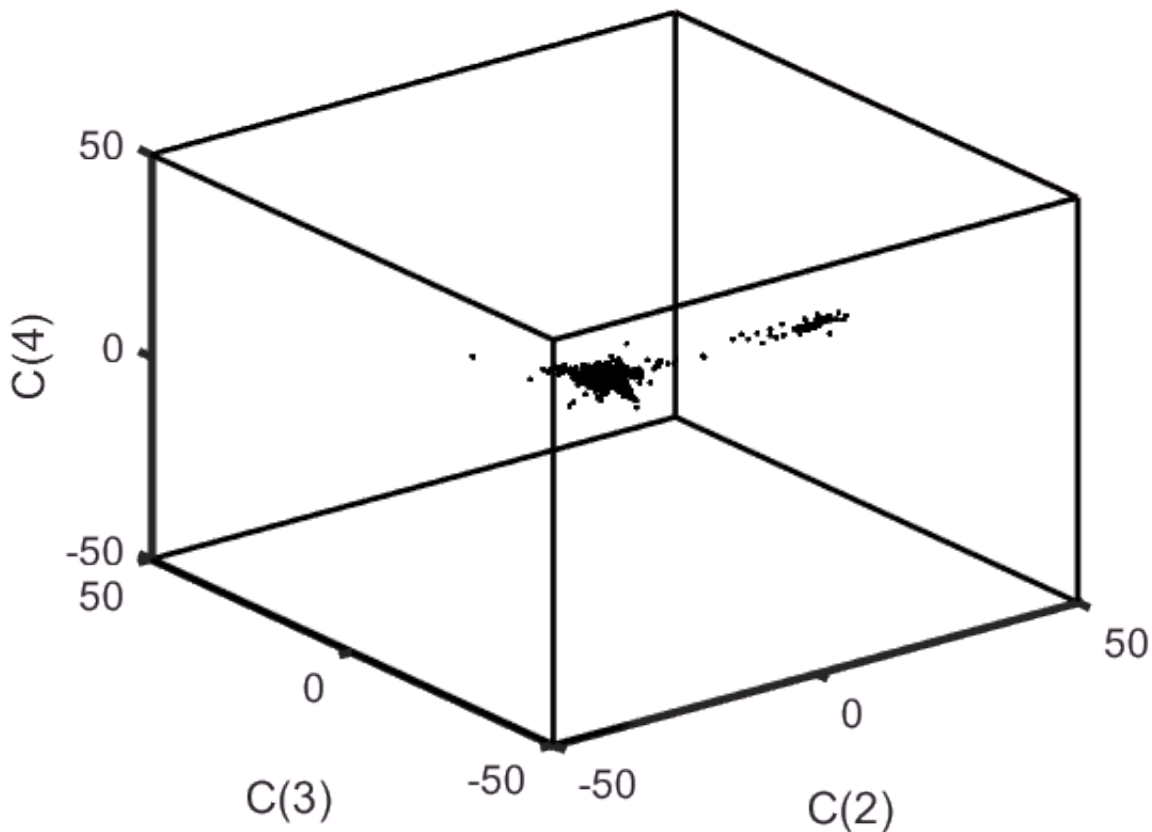
plot3( [cmax,cmin], [cmin,cmin], [cmax,cmax], 'k-', 'LineWidth', 2 );
plot3( [cmax,cmax], [cmin,cmin], [cmax,cmin], 'k-', 'LineWidth', 2 );

plot3( [cmin,cmin], [cmax,cmin], [cmax,cmax], 'k-', 'LineWidth', 2 );
plot3( [cmin,cmin], [cmax,cmax], [cmax,cmin], 'k-', 'LineWidth', 2 );

plot3( [cmax,cmax], [cmax,cmin], [cmin,cmin], 'k-', 'LineWidth', 2 );
plot3( [cmax,cmin], [cmax,cmax], [cmin,cmin], 'k-', 'LineWidth', 2 );

xlabel('C(2)');
ylabel('C(3)');
zlabel('C(4)');
view(3);

```



% Figure 10.6 Three-dimensional perspective view of the coefficients C_i of factors 2, 3, and 4 in each of the rock samples (dots) of the Atlantic Ocean Rock data set. MatLab script go