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B9TB1710

CAPS11_B9TB1710.m

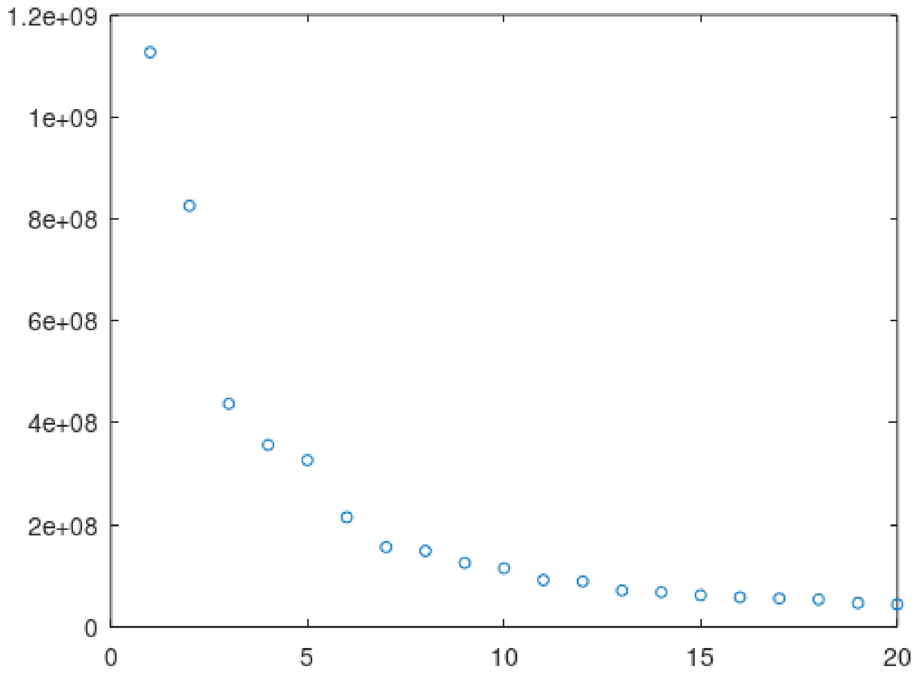
```
load_faces #400 faces, 10304 information
CX=X-ones(400,1)*mean(X);
[U,W,V]=svds(CX,20);
w=0;
for i=1:20
  w(i)=W(i,i);
endfor

plot(w.^2,"o"); #plotting eigenvalues
set(gca,"fontsize",14);
figure

#eigenvectors
for j=1:20
  svec=V(:,j);
  imshow(reshape(svec,[112,92]),[min(svec),max(svec)]);
  if j<20
    figure
   endif
endfor
```

I load data from file load_faces. It is a matrix X of size 400×10304 which contains 10304 information about each of 400 faces.

I create matrix CX from matrix X, by subtracting from each element of X, the mean of the column that the element resides in. CX has size 400×10304.

I use function **svds** on the matrix CX with a condition that output matrix W will contain only 20 largest singular values. I also get a matrix V of size 10304×20 in which every column i corresponds to the eigenvector with eigenvalue $W(i,i)^2$.

I plot eigenvalues w_i , $1 \leq i \leq 20$, $w_i = W(i,i)^2$.



From the graph I can see that first few eigenvalues are much greater that the rest.

Next, I display eigenvectors corresponding to plotted eigenvalues (from the highest eigenvalue to the lowest). Every eigenvector is of size 10304×1, where the number of rows correspond to the resolution 92×112 of the image. Thus, I display every eigenvector in the form of image. I use the function **imshow**. I give the function two inputs – first is the data of image and second is a display range. For the first input I want to use eigenvector. They are stored as column vectors and in order to make them compatible with function **imshow**, I change them into 112×92 matrices which **imshow** can interpret as images. I use function **reshape** to do that.

As for the display range, specified in the second input, I use the minimum and maximum coordinates from the eigenvector I want to display. Thus, the display range is adjusted for every eigenvector. The output is as below

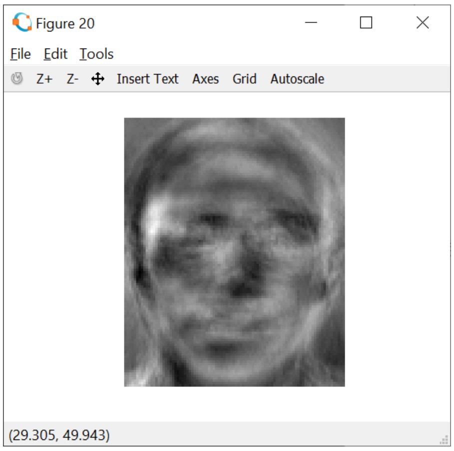


Figure 20
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(29.305, 49.943)

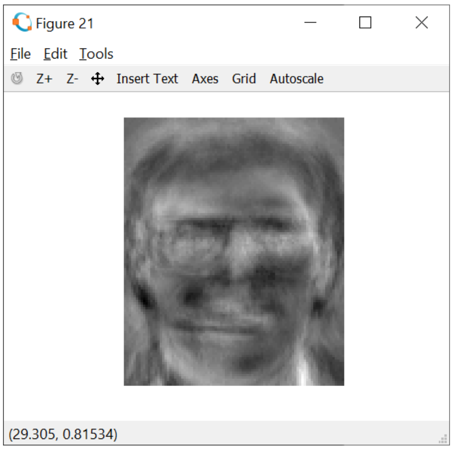


Figure 21
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(29.305, 0.81534)

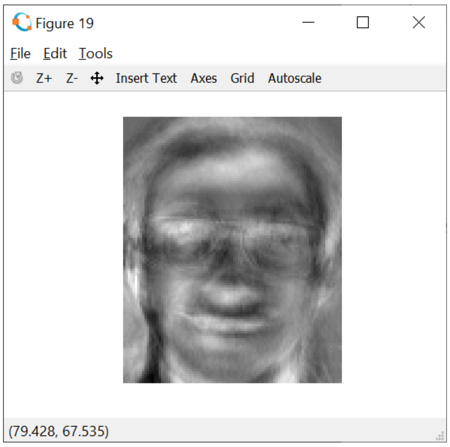


Figure 19
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(79.428, 67.535)

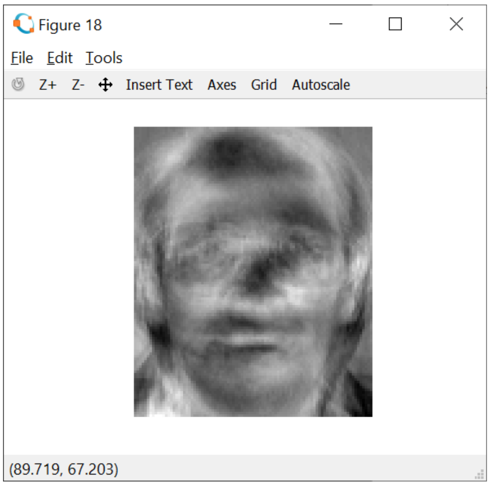


Figure 18
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(89.719, 67.203)

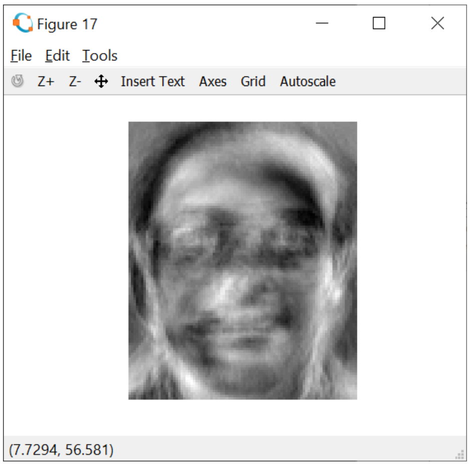


Figure 17
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(7.7294, 56.581)

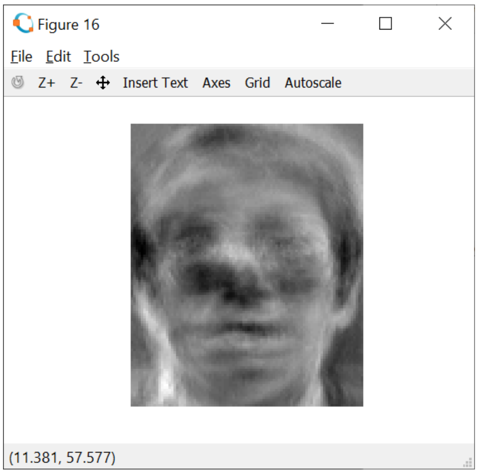


Figure 16
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(11.381, 57.577)

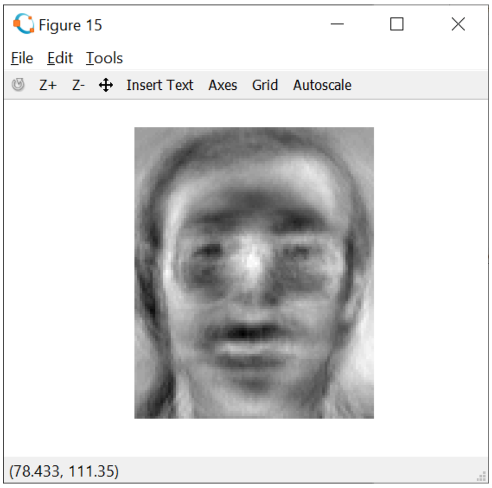


Figure 15
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(78.433, 111.35)


Figure 14
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(52.209, 102.06)

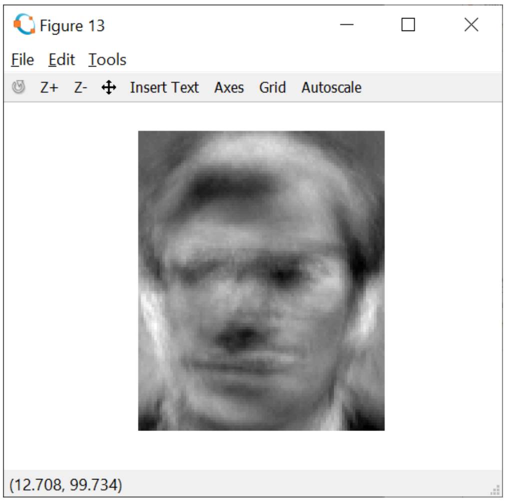


Figure 13
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(12.708, 99.734)

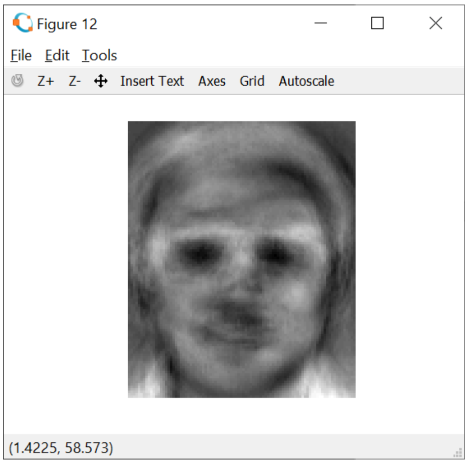


Figure 12
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(1.4225, 58.573)

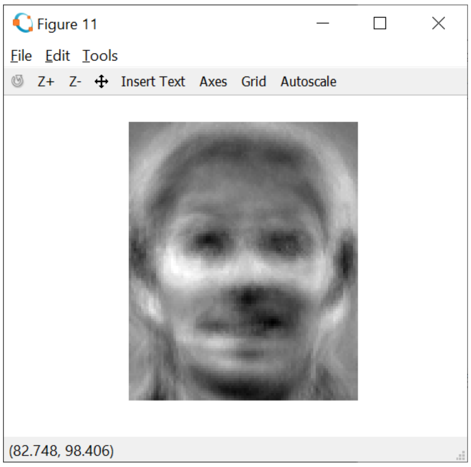


Figure 11
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(82.748, 98.406)

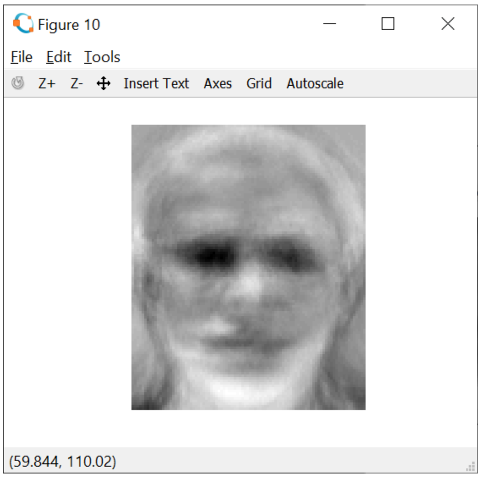


Figure 10
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(59.844, 110.02)

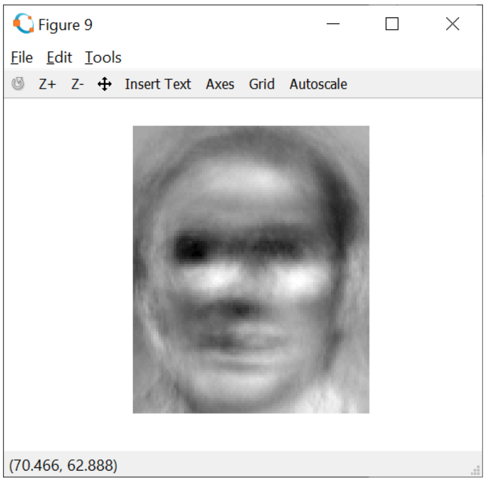


Figure 9
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(70.466, 62.888)

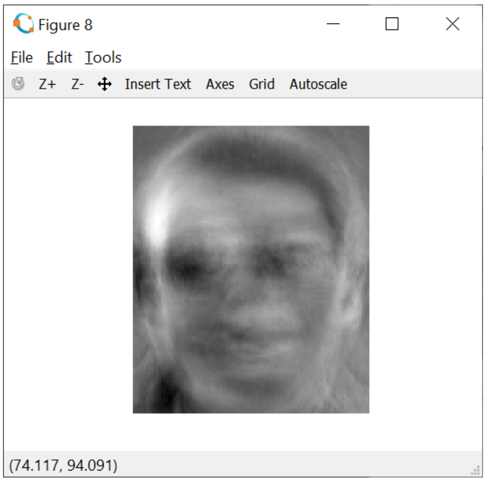


Figure 8
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(74.117, 94.091)

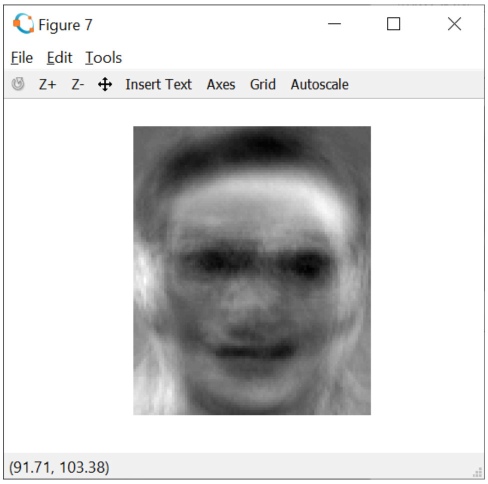


Figure 7
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(91.71, 103.38)

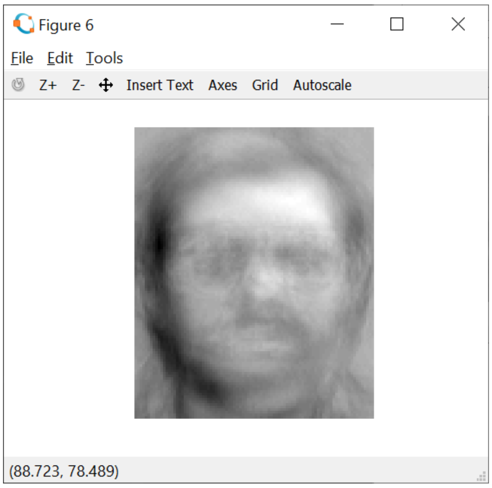


Figure 6
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(88.723, 78.489)

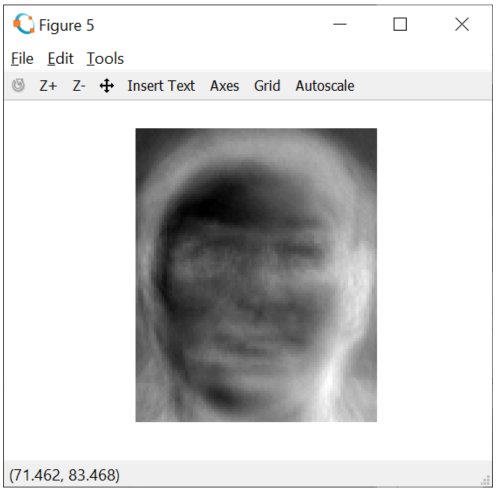


Figure 5
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(71.462, 83.468)

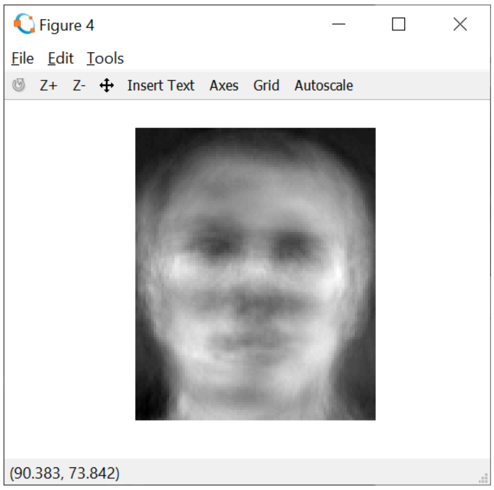
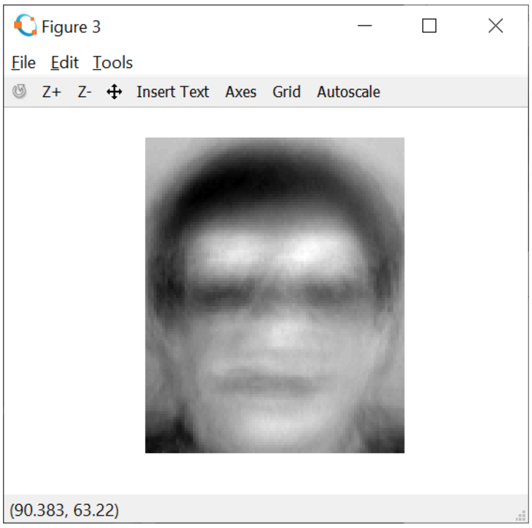
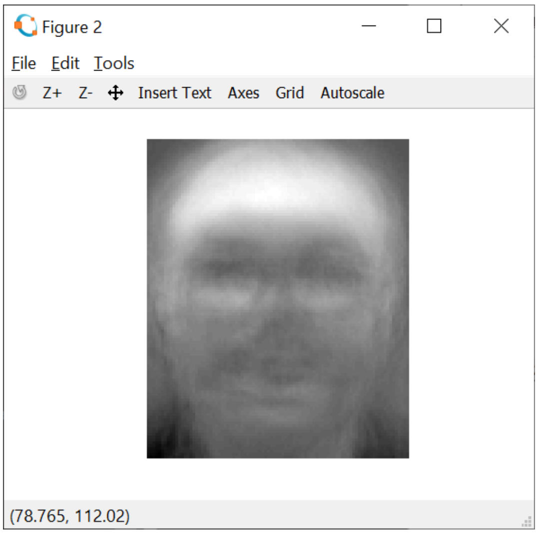


Figure 4
File Edit Tools
Z+ Z- Insert Text Axes Grid Autoscale
(90.383, 73.842)





Images are blurred, but the shape of the face can be clearly seen. The eigenvectors which corresponding eigenvalues are smaller, appear clearer. First 5 images (figure 2-6), are especially blurred and that would match with the number of biggest eigenvalues.