MATH456 HW9

LGEEL

Plot an image for each person in the database

```
   load ../DATA/allFaces.mat
allPersons = zeros(n*6,m*6);
count = 1;
for i=1:6
   for j=1:6
      allPersons(1+(i-1)*n:i*n,1+(j-1)*m:j*m) ...
         = reshape(faces(:,1+sum(nfaces(1:count-1))),n,m);
      count = count + 1;
end
end
figure(1), axes('position',[0 0 1 1]), axis off
imagesc(allPersons), colormap gray
```

Plot each image for a specific person in the database

```
   for person = 1:length(nfaces)
   subset = faces(:,1+sum(nfaces(1:person-1)):sum(nfaces(1:person)) );
   allFaces = zeros(n*8,m*8);
   count = 1;
   for i=1:8
      for j=1:8
         if(count¡=nfaces(person))
            allFaces(1+(i-1)*n:i*n,1+(j-1)*m:j*m) ...
               = reshape(subset(:,count),n,m);
            count = count + 1;
            end
         end
      end
   imagesc(allFaces), colormap gray
end
```

Date: May 2022.

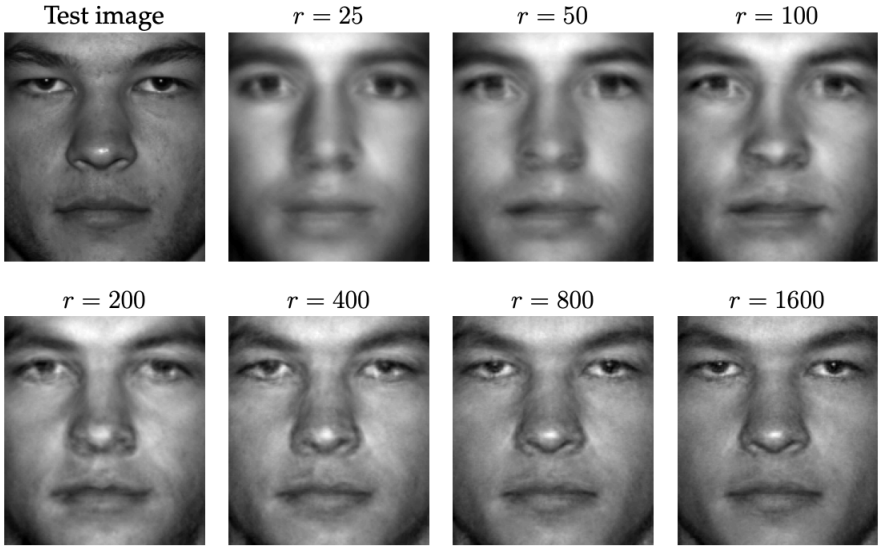
Compute eigenfaces on mean-subtracted data

```
   %We use the first 36 people for training data
trainingFaces = faces(:,1:sum(nfaces(1:36)));
avgFace = mean(trainingFaces,2); % compute eigenfaces on mean-subtracted
training data
X = trainingFaces-avgFace*ones(1,size(trainingFaces,2));
[U,S,V] = svd(X,'econ');
figure, axes('position',[0 0 1 1]), axis off
imagesc(reshape(avgFace,n,m)), colormap gray
for i=1:50 % plot the first 50 eigenfaces
   pause(0.1); % wait for 0.1 seconds
   imagesc(reshape(U(:,i),n,m)); colormap gray;
end
```

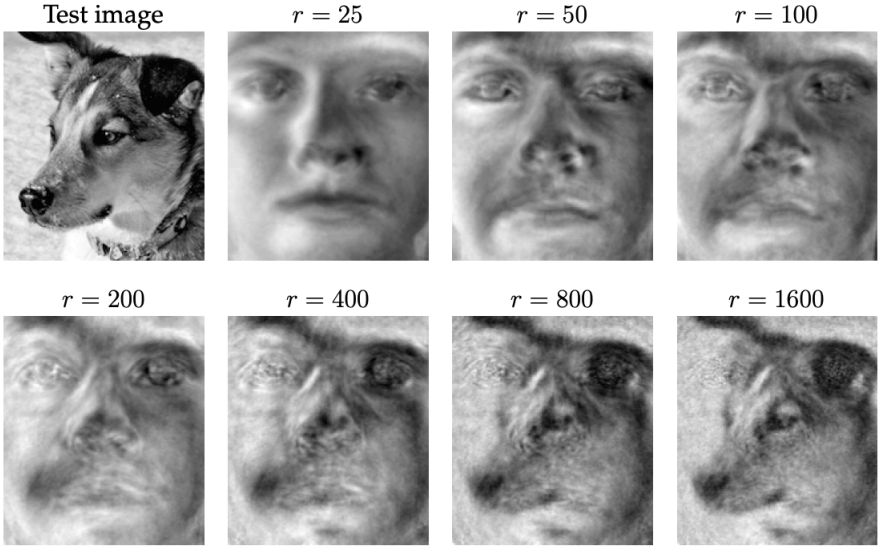
We will see how a rank-r SVD basis will approximate an image of a face using this projection: $\tilde{x}_{test} = U_r {U_r}^T x_{test}$

Approximate test-image recreation using eigenfaces

```
   testFace = faces(:,1+sum(nfaces(1:36)));
% face of person 37 axes('position',[0 0 1 1]), axis off
imagesc(reshape(testFace,n,m)), colormap gray
testFaceMS = testFace - avgFace;
for r=25:25:2275
   reconFace = avgFace + (U(:,1:r)*(U(:,1:r)'*testFaceMS));
   imagesc(reshape(reconFace,n,m)), colormap gray
   title(['r=',num2str(r,'%d')]);
   pause(0.1)
end
```



Approximate representation of test image of human face using eigenfaces basis of various levels of r



Approximate representation of test image of dog using eigenfaces basis of various levels of r