PCA LAB

VISUAL DATA LABORATORY

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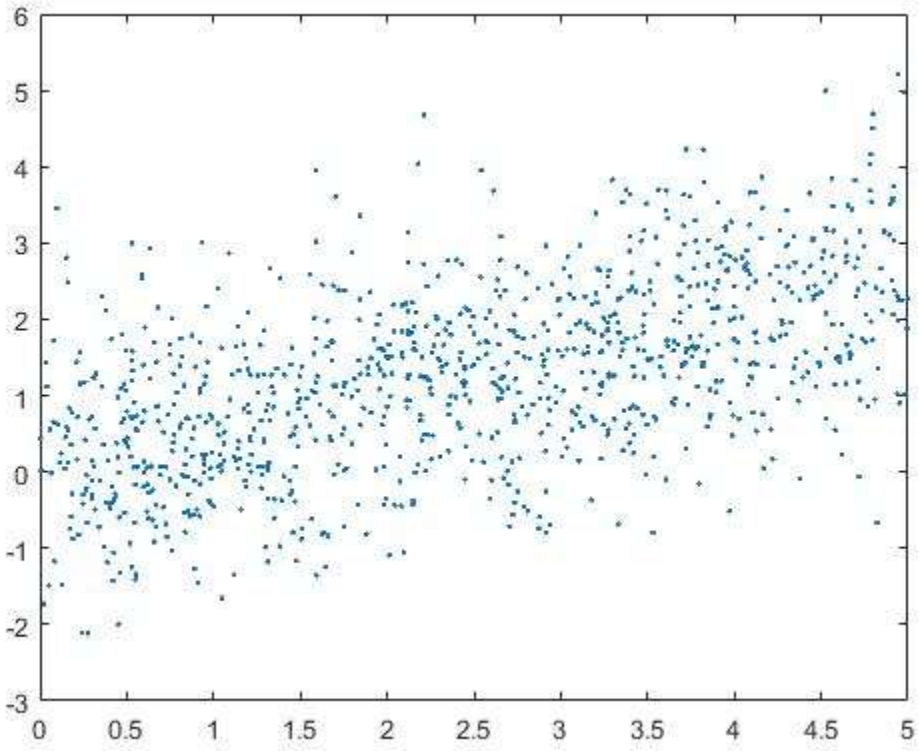
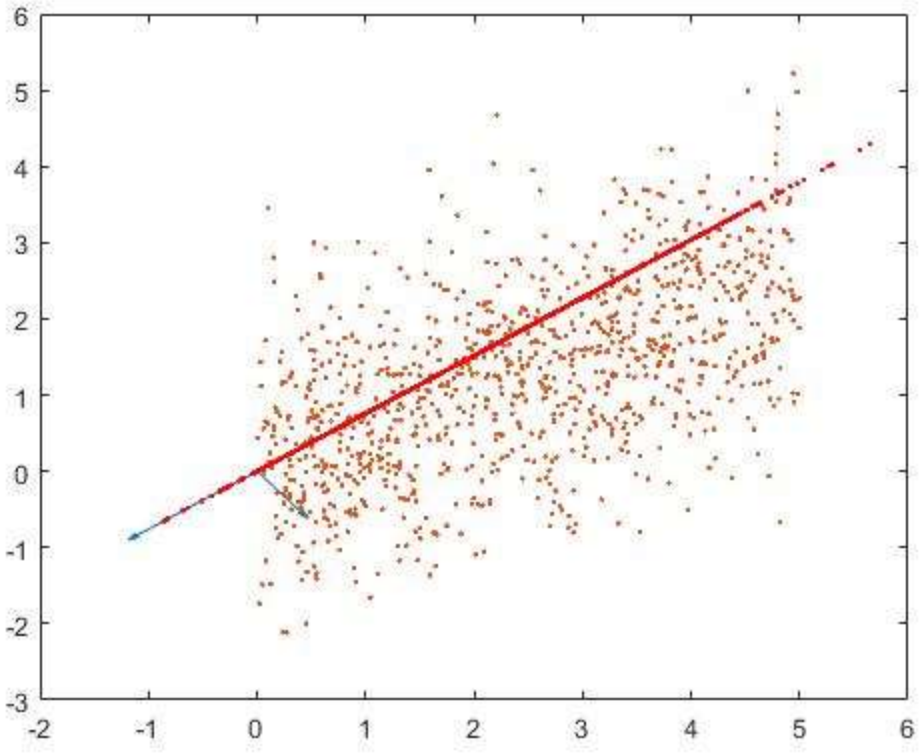
Task 1 ---

Principle Components Analysis has two main application. to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables and in reduction of possible dimensions.



V



Vn

Output—

v =

2.7421

0.7270

vn =

0.7904

0.2096

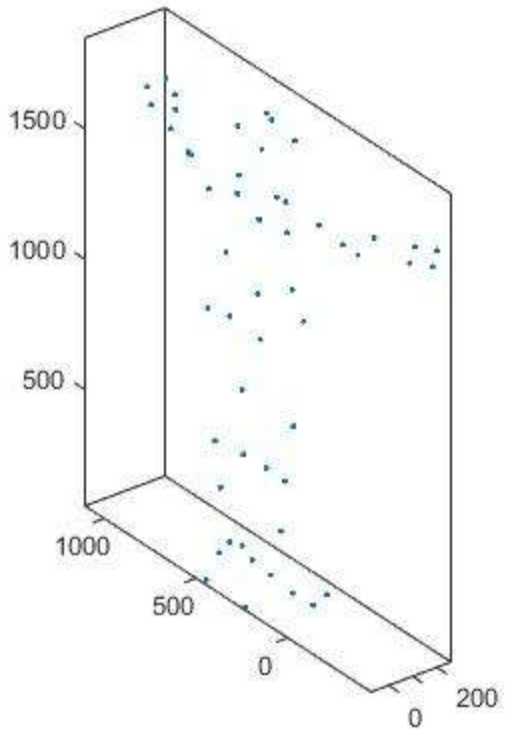
Code –

```
x=5*rand(1000,1);
y=0.5*x+randn(1000,1);
plot(x,y,'.');
```

```
xy=[x,y];

[newbasevals, PC,v]=pca(xy);

newbasevals = xy*PC;

iPC=inv(PC);
xy_reconstructed = newbasevals * iPC;

v
vn=v./sum(v)

[newbasevals, PC,v]=pca(xy,1);
xy_reduced = newbasevals(:,1)*iPC(1,:);
plot(x,y,'.');
hold on
plot(xy_reduced(:,1),xy_reduced(:,2),'r.');
```

Task 2 –

PCA may be applied for 3D data. In following example you will use data taken from human and dog. Your task will be to find backbone which is the greatest elongation of a body.



Code –

```
load markers.mat
plot3(xyz(:,1),xyz(:,2),xyz(:,3),'.')
axis equal
box on

[vals, PC,v]=pca(xyz);
[vals, PC,v]=pca(xyz,1);

iPC=inv(PC);
xy_reduced = vals(:,1)*iPC(1,:);

plot(x,y,'.');
```

```
hold on
plot(xy_reduced(:,1),xy_reduced(:,2),'r.');
```

Task 3 ---

your task will be to write procedure opening each folder inside „att_faces” and load all pictures and save them in rows.

Code –

```
root='att_faces'; % name of folder
kat=dir(root); % read all items in given directory

O=[]
for i=1:size(kat, 1)
   if kat(i).isdir == 1 % reads only directories
      subdir=[root,'\',kat(i).name]; % create paths to directories names
      subkat=dir([subdir,'\*.pgm']); % get all .pgm images
      for j=1:size(subkat, 1)
         o=imresize(imread([subdir,'/',subkat(j).name]),0.5); % read image
         O=[O;(o(:))']; % save image as a row


      end
   end
end


[newbasevals, PC,v]=pca(double(O));
% first one
PCC1=PC(:,1);
PCC1r=reshape(PCC1,56,[]);
```

```
figure
imagesc(PCC1r)
colormap gray
% and second
PCC2=PC(:,2);
PCC2r=reshape(PCC2,56,[]);
figure
imagesc(PCC2r)
colormap gray

plot3(newbasevals(:,1),newbasevals(:,2),newbasevals(:,3),'.')
% highlight kperson
hold on
k=1;
range=((k-1)*10+1):(k*10);
plot3(newbasevals(range,1),newbasevals(range,2),newbasevals(range,3),'ro')
k=15;
range=((k-1)*10+1):(k*10);
plot3(newbasevals(range,1),newbasevals(range,2),newbasevals(range,3),'go')
k=23;
range=((k-1)*10+1):(k*10);
plot3(newbasevals(range,1),newbasevals(range,2),newbasevals(range,3),'mo')
k=30;
range=((k-1)*10+1):(k*10);
plot3(newbasevals(range,1),newbasevals(range,2),newbasevals(range,3),'yo')
k=37;
range=((k-1)*10+1):(k*10);
plot3(newbasevals(range,1),newbasevals(range,2),newbasevals(range,3),'co')
```