Índex de continguts

Entorn de desenvolupament

Prerequisits:

- Mac OS 10.7.4 + JRE 1.6.0.29[1] + XCode 4.3.x + XCode command line tools + MacPorts[2]

Instal·lar Python i els paquets necessaris de Python través de MacPorts:

```
# xcode-select -switch /Applications/Xcode.app/Contents/Developer/

# port selfupdate; port upgrade outdated; port uninstall inactive

# port install python27

# port select --set python python27

# port install py27-htmldocs

# port install py27-numpy

# port install py27-pil

# port install py27-scipy

# port install py27-matplotlib
```

Instal·lar l'IDE NetBeans 6.9.1[3], a continuació instal·lar des de l'IDE el complement "Python" (Eines > Complements > Complements disponibles > Python).

Afegir una nova plataforma de Python que etiqueti a la de MacPorts. Dins de l'IDE anar a "Eines > Python Platforms" i crear una nova plataforma on el binari es troba en /opt/local/bin/python, establir la nova plataforma com la predeterminada.
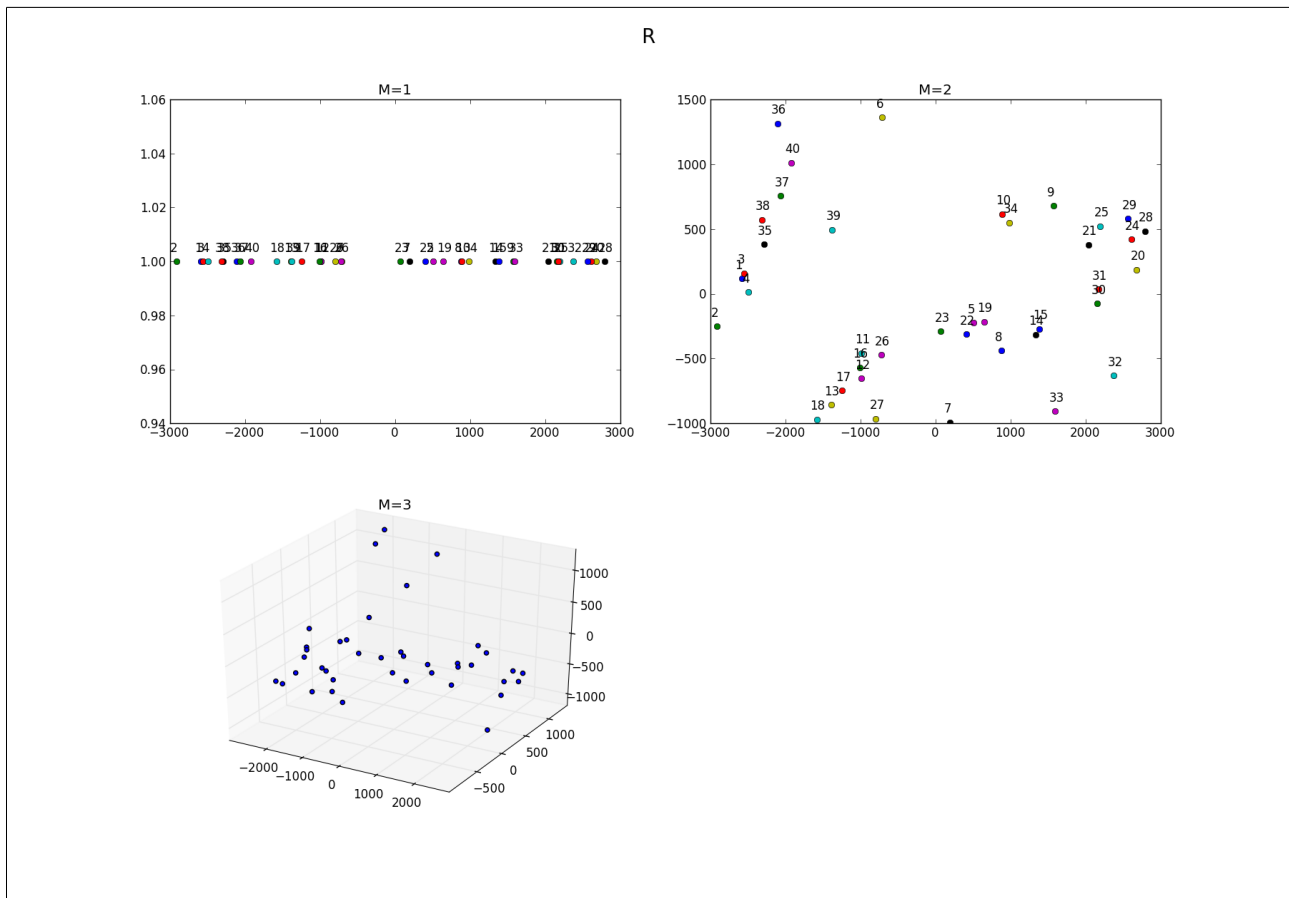
NOTA:

En obrir el projecte python de la PRAC, en les propietats del projecte establir la plataforma python configurada en el pas previ (Category: Python > Python Platform : [etiqueta plataforma python]).

---

1   JRE for Lion: http://support.apple.com/es_ES/downloads/#macos
2   MacPorts for Lion: http://www.macports.org/
3   IDE NetBeans 6.9.1: http://netbeans.org/downloads/6.9.1/index.html?pagelang=ca_ES

Exercici 1

Amb M1 es pot distingir una divisió de les dades en almenys 2 grups, observant un entorn sense dadades al voltant del 0, podent separar els valors positius dels negatius en dos classes. Amb M=2 es podien separar mes o menys les dades amb la recta y(x)=x+c. Amb M=3 mes o menys es podien agrupar les dades en dos plans, separant el pla amb les dades amb màxima agrupació de les altres.

Altrament amb M1=1, i M=2 a través de les anotacions es denota que les imatges pròximes en la seqüencia estan agrupades, observant semblances entre les imatges pròximes en la seqüència.

Exercici 2

Sortida activitat 2 (activitat2.py):

```
Activitat 2


Enllac simple:
> Num. elements x grup: [39, 1]
> Grup: 0
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara130.jpg
```

```
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara132.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara133.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara79.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara81.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara80.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara9.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara8.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara131.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara84.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara142.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara250.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara241.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara166.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara269.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara196.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara202.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara309.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara161.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara178.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara246.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara274.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara299.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara298.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara247.jpg
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara300.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara301.jpg
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara306.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara183.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara184.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara207.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara287.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara185.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara208.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara209.jpg
```

```
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara289.jpg
> Grup: 5
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara157.jpg
> Centroide G1:  [18.209430009890827, -34.8846863477658]
> Centroide G2:  [-710.16864013671875, 1360.5023193359375]

Enllac complex:
> Num. elements x grup: [25, 15]
> Grup: 0
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara130.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara132.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara133.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara131.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara79.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara81.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara84.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara8.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara80.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara9.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara142.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara250.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara241.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara166.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara161.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara269.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara157.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara183.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara184.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara207.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara287.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara289.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara185.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara208.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara209.jpg
> Grup: 8
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara178.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara180.jpg
```

```
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara312.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara196.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara202.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara309.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara306.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara246.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara274.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara299.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara298.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara247.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara275.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara300.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara301.jpg
> Centroide G1:  [-1173.3560406494141, -89.749500656127935]
> Centroide G2:  [1955.5933430989583, 149.58247121175131]

Enllac mitjana:
> Num. elements x grup: [19, 21]
> Grup: 0
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara130.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara132.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara133.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara79.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara81.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara131.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara8.jpg
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara9.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara84.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara183.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara184.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara207.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara287.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara289.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara185.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara208.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara209.jpg
```
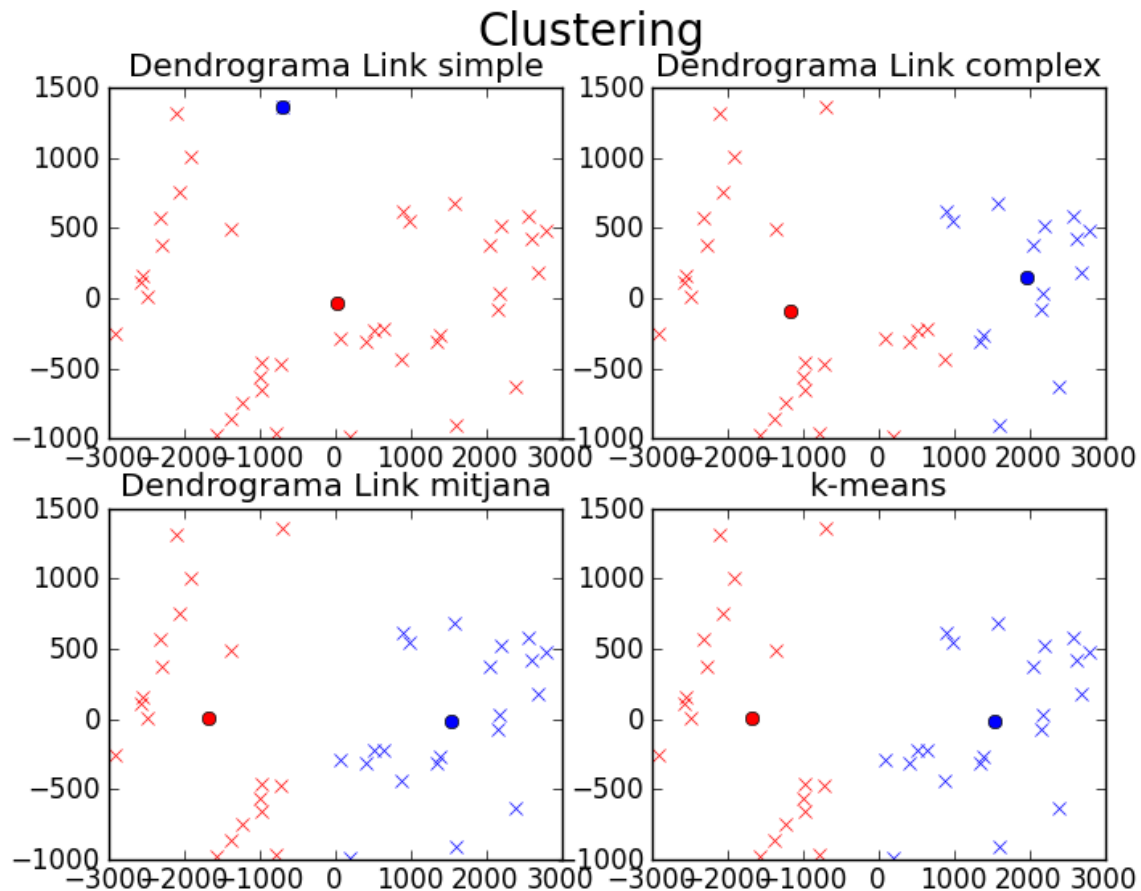
```
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara157.jpg
> Grup: 4
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara142.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara250.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara241.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara166.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara269.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara161.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara196.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara202.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara309.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara178.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara180.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara312.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara246.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara274.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara299.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara298.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara247.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara275.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara300.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara301.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara306.jpg
> Centroide G1:  [-1685.9475129780017, 12.143884056492857]
> Centroide G2:  [1525.3810417538598, -10.987345014299665]

k-means:
> Num. elements x grup: [19, 21]
> Grup: 0
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara130.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara131.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara132.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara133.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara157.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara183.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara184.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara185.jpg
```

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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara207.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara208.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara209.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara287.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara289.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara79.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara8.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara80.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara81.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara84.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara9.jpg
> Grup: 1
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara142.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara161.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara166.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara178.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara180.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara196.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara202.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara241.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara246.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara247.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara250.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara269.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara274.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara275.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara298.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara299.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara300.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara301.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara306.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara309.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara312.jpg
> Centroide G1:  [-1685.94751298    12.14388406]
> Centroide G2:  [ 1525.38104175   -10.98734501]
```

S'han agrupat les imatges en 2 clústers amb el Rating PCA de les components amb més valor propi, mitjançant l'agrupament amb dendrogrames utilitzant tres mètodes d'enllaç, i amb k-means. Es descarta el mètode d'agrupament amb dendrograma utilitzant enllaç simple ja que quasi bé no realitza cap separació, ja que en un clúster tenim 39 imatges mentre i en l'altre 1.

El dendrograma amb enllaç mitjana i k-means realitzen el mateix agrupament i tenen els mateixos centroides, mentre que el dendrograma amb enllaç complex varia lleugerament dels dos anteriors.

En els dos darrers mètodes d'agrupament (dendrograma amb enllaç mitjana i k-means) s'observen dos grups separats en l'eix de les ordenades x=0.

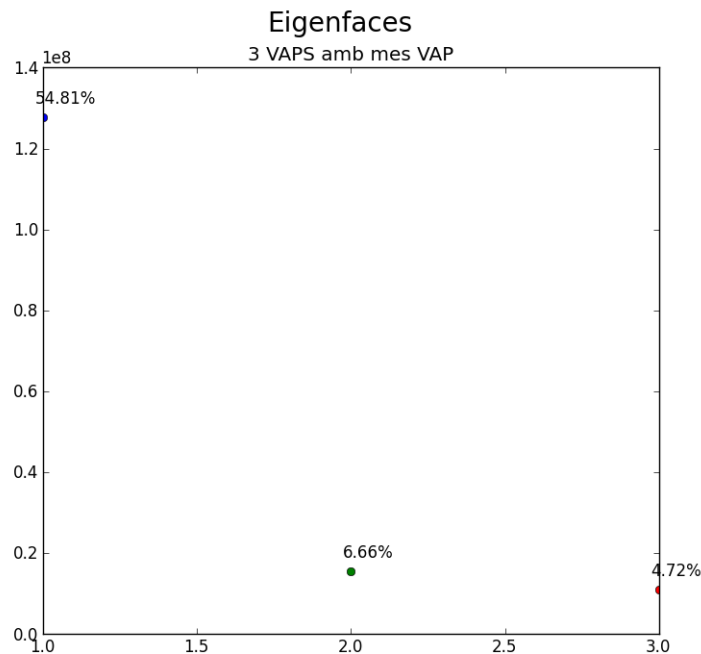# Exercici 3

Sortida activitat 3 (activitat3.py):

```
Activitat 3


3 VAPS amb mes VAP: [  1.27787504e+08   1.55324930e+07   1.10045540e+07]

> Percentatge recontruccio: 66.19 %



2 VAPS amb mes VAP: [  1.27787504e+08   1.55324930e+07]
```

```
> Percentatge recontruccio: 61.47 %
```

Eigenfaces

3 VAPS amb mes VAP

Dels 40 valors propis el de més valor acumula més del 54% del pes de la reconstrucció, mentre que el següent valor influeix un 6,66%, i el tercer un 4,72%. En el supòsit que s'utilitzin totes les eigenfaces el percentatge de reconstrucció és del 100%, si s'utilitzen les 3 amb més valor propi el percentatge de reconstrucció és del 66,19%, i si s'utilitzen les 2 amb més valor propi el percentatge de reconstrucció és del 61,47%.

Exercici 4
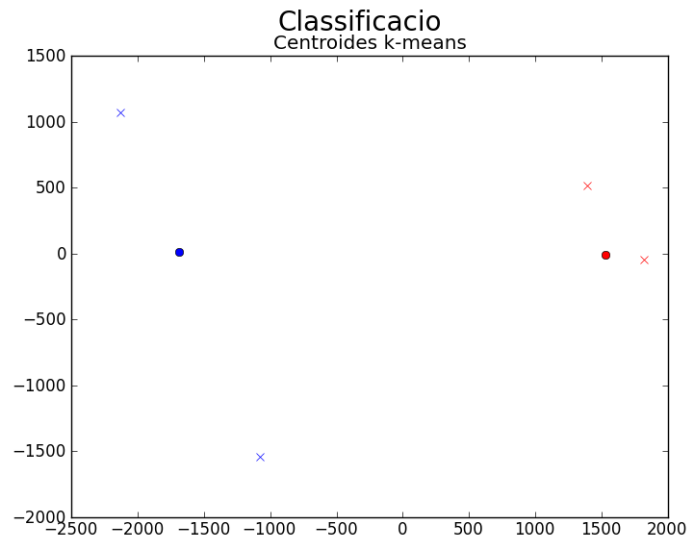
Sortida activitat 4 (activitat4.py):

```
Activitat 4


k-means:

> Grups: {0: [4, 6, 7, 8, 9, 13, 14, 18, 19, 20, 21, 22, 23, 24, 27, 28, 29, 30, 31,
32, 33], 1: [0, 1, 2, 3, 5, 10, 11, 12, 15, 16, 17, 25, 26, 34, 35, 36, 37, 38, 39]}

> Num. elements x grup: [21, 19]

> Centroide G1:  [ 1525.38104175   -10.98734501]

> Centroide G2:  [-1685.94751298    12.14388406]


Classificacio minima distancia euleriana als centroides:

> Grup: 0

/Users/robert/NetBeansProjects/Practica/src/cares_noves_practica/cara3.jpg
```

```
/Users/robert/NetBeansProjects/Practica/src/cares_noves_practica/cara51.jpg

> Grup: 1

/Users/robert/NetBeansProjects/Practica/src/cares_noves_practica/cara235.jpg

/Users/robert/NetBeansProjects/Practica/src/cares_noves_practica/cara315.jpg
```

Classificacio
Centroides k-means

Si s'augmentessin el nombre de grups, o es requeris una classificació més exhaustiva, segurament una bona opció seria utilitzar classificadors lineals i classificadors basats en kernels, que amb una representació de les dades en l'hiperplà permeten una construcció més versàtil de clústers.

Annex ex. 2 i 4 amb kNN amb d. euclidianes i manhattan

Comparació sortida classificació kNN sobre les imatges d'entrenament coneixent el sexe de les 20 primeres imatges conegudes i desconeixent els sexe de les altres 20, utilitzant distància euclidiana i distància manhattan. Sortida activitat2ambkNN.py:

```
Activitat 2 amb kNN


Conneixent el sexe de les 40 cares conegudes
> Num. elements x grup: [10, 30]
> Grup: homes
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara8.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara9.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara79.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara80.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara81.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara84.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara130.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara131.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara132.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara133.jpg
> Grup: dones
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara142.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara157.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara161.jpg
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara312.jpg
> Centroide G1:  [-2261.3498901367188, -456.28940143585203]
> Centroide G2:  [753.78326772054038, 152.09648208618165]

kNN
> formatant dades per al classificador...

kNN amb d.euclidiana conneixent el sexe de les primeres 20 cares conegudes
> entrenament...
> prec.: 65.00 %
> Num. elements x grup: [17, 23]
> Grup: homes
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara8.jpg
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara287.jpg
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara312.jpg
> Grup: dones
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara309.jpg
> Centroide G1:  [-790.55587230009189, -304.89616854050581]
> Centroide G2:  [584.32386779785156, 225.35805710502294]


kNN amb d.manhattan conneixent el sexe de les primeres 20 cares conegudes
> entrenament...
> prec.: 65.00 %
> Num. elements x grup: [17, 23]
> Grup: homes
```

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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara9.jpg
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> Grup: dones
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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara274.jpg

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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara306.jpg

/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara309.jpg

> Centroide G1:  [-790.55587230009189, -304.89616854050581]

> Centroide G2:  [584.32386779785156, 225.35805710502294]
```

En aquesta activitat s'ha obtingut la mateixa classificació utilitzant els dos mètodes per calcular les distàncies:

Homes   Dones

Classificació de les noves imatges utilitzant els centoides obtinguts en l'activitat 2 amb kNN (d. Euclidiana), sortida activitat4ambkNN.py:

```
Activitat 4 amb knn d.euclidiana


kNN

> formatant dades per al classificador...


kNN amb d.euclidiana conneixent el sexe de les primeres 20 cares conegudes

> entrenament...

> prec.: 65.00 %

> Num. elements x grup: [17, 23]

> Grup: homes
/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara8.jpg

/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara9.jpg

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/Users/robert/NetBeansProjects/Practica/src/cares_practica/cara309.jpg
> Centroide G1:  [-790.55587230009189, -304.89616854050581]
> Centroide G2:  [584.32386779785156, 225.35805710502294]


Classificacio minima distancia euleriana als centroides:
> Grup: homes
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/Users/robert/NetBeansProjects/Practica/src/cares_noves_practica/cara51.jpg
> Grup: dones
/Users/robert/NetBeansProjects/Practica/src/cares_noves_practica/cara235.jpg
/Users/robert/NetBeansProjects/Practica/src/cares_noves_practica/cara315.jpg
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Classificacio
centoides grups kNN distancia euclidiana