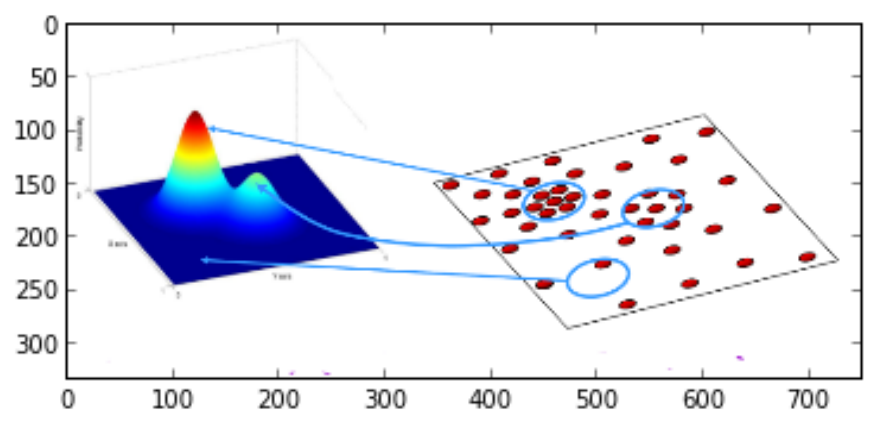
Ortalama Kaydirma ile Kumeleme (Mean Shift Clustering)

Kumeleme yapmak icin bir metot daha: Ortalama Kaydirma metotu. Bu metodun mesela K-Means'den farki kume sayisinin onceden belirtilmeye ihtiyaci olmamasidir, kume sayisi otomatik olarak metot tarafindan saptanir.

"Kume" olarak saptanan aslinda veri icindeki tum yogunluk bolgelerinin merkezleridir, yani alttaki resmin sag kismindaki bolgeler.

```
im=imread("dist.png"); imshow(im)
```

```
<matplotlib.image.AxesImage at 0xa3f3c4c>
```



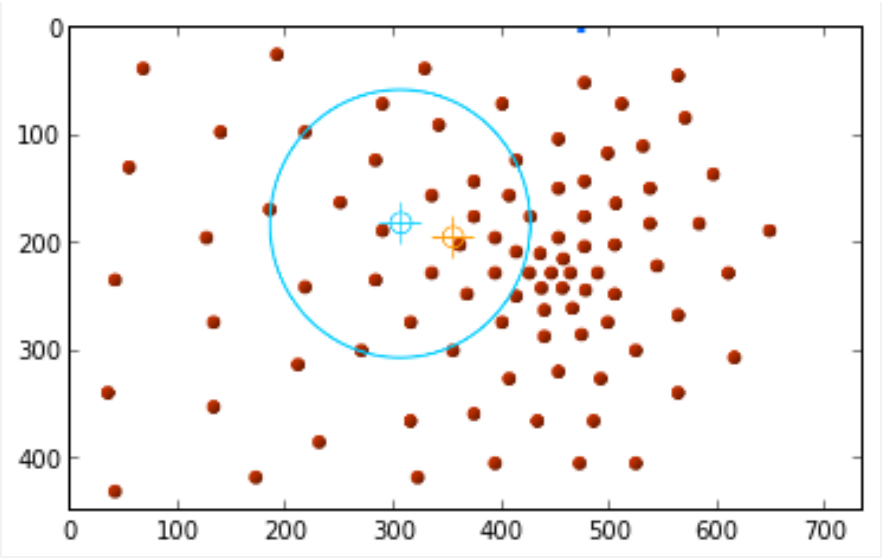
Baslangic neresidir? Baslangic tum noktalardir, yani her noktadan baslanarak

1. O nokta etrafinda (yeterince buyuk) bir pencere tanimla
2. Bu pencere icine dusen tum noktalari hesaba katarak bir ortalama yer hesapla
3. Pencereyi yeni ortalama noktayi merkezine alacak sekilde kaydir

Metotun ismi buradan geliyor, cunku pencere yeni ortalamaya dogru "kaydiriliyor".

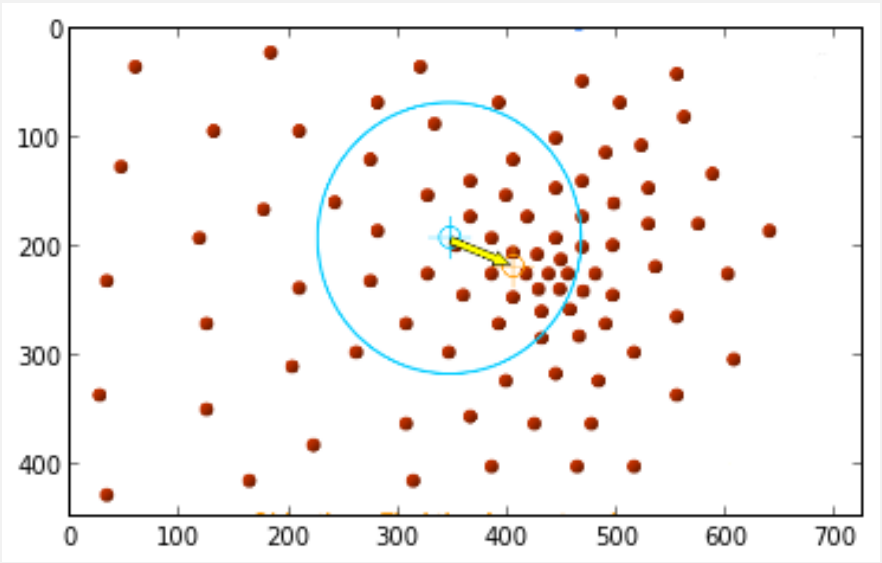
```
im=imread("mean_2.png"); imshow(im)
```

```
<matplotlib.image.AxesImage at 0x9b966ac>
```



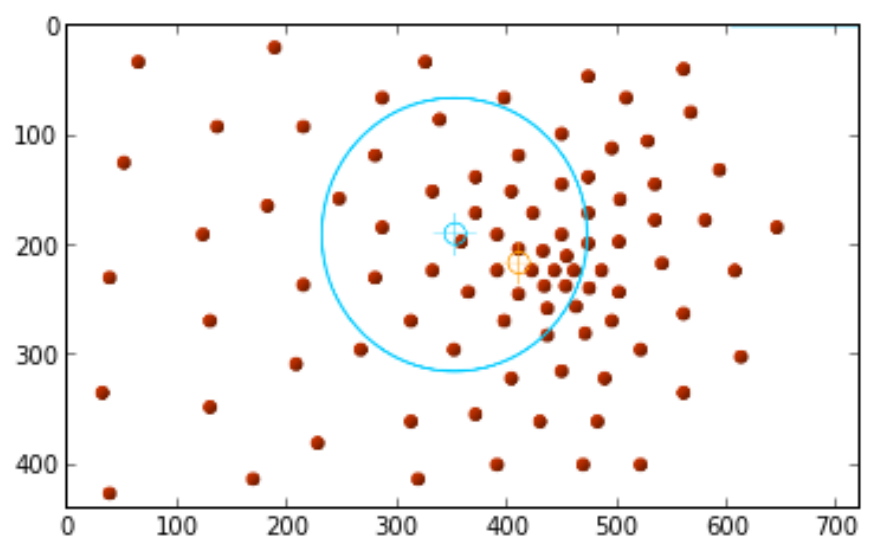

```
im=imread("mean_3.png"); imshow(im)
```

```
<matplotlib.image.AxesImage at 0x9cd99ec>
```



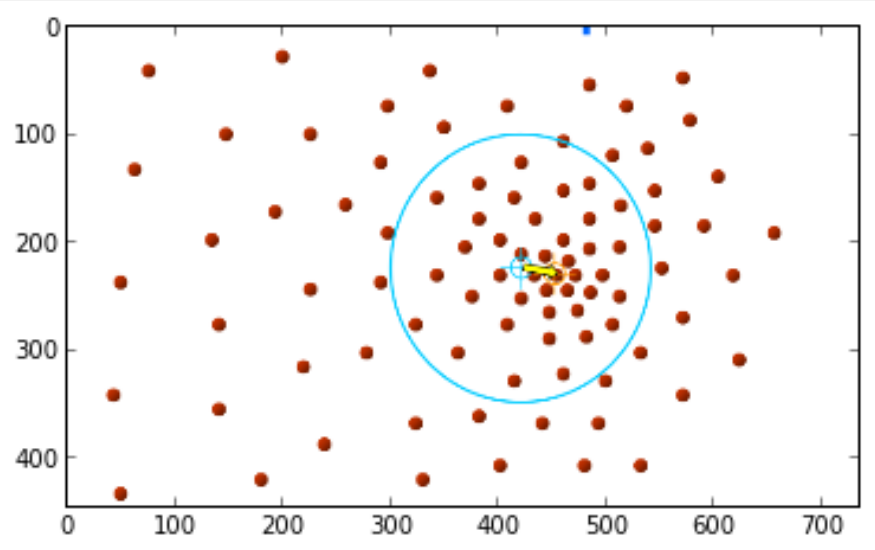

```
im=imread("mean_4.png"); imshow(im)
```

```
<matplotlib.image.AxesImage at 0x9e3cfac>
```



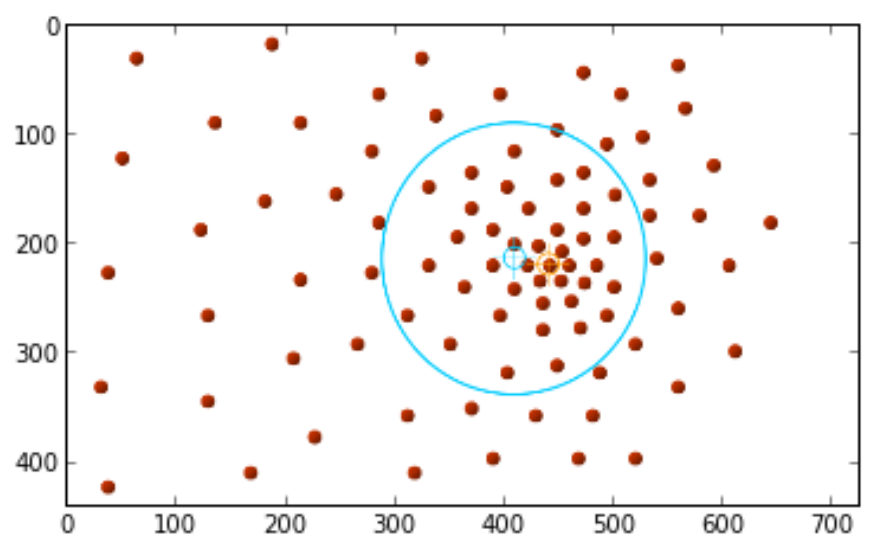

```
im=imread("mean_5.png"); imshow(im)
```

```
<matplotlib.image.AxesImage at 0x9f9b5ec>
```



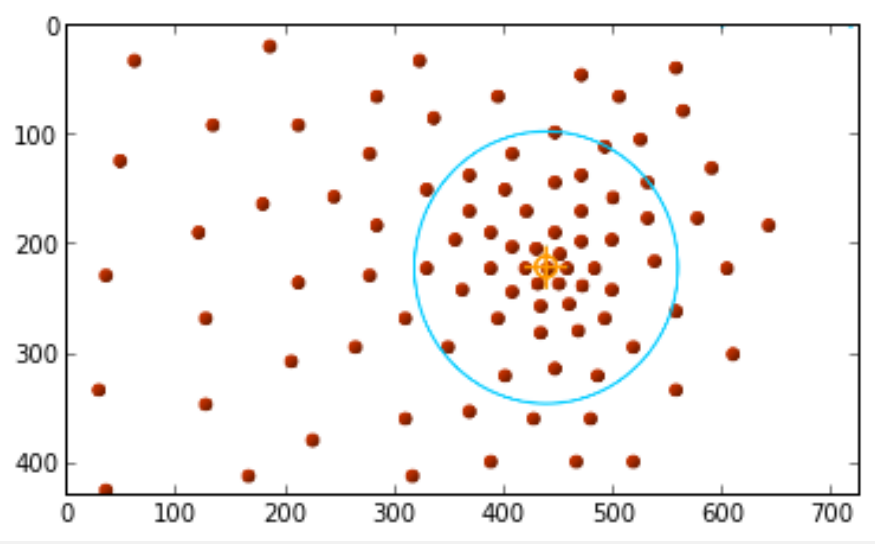

```
im=imread("mean_6.png"); imshow(im)
```

```
<matplotlib.image.AxesImage at 0xa13cd0c>
```




```
im=imread("mean_7.png"); imshow(im)
```

```
<matplotlib.image.AxesImage at 0xa2a132c>
```

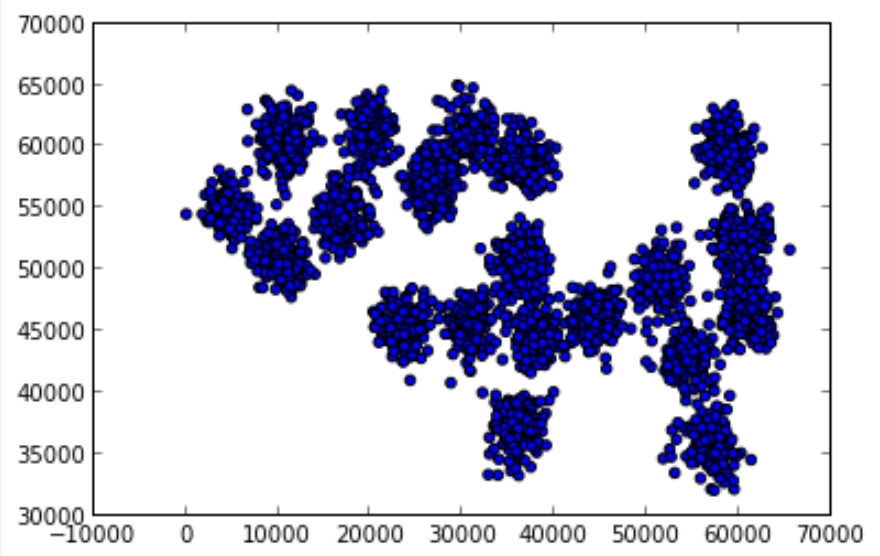



```
from pandas import *
data = read_csv("synthetic.txt",names=['a','b'],sep=" ")
print data.shape
data = np.array(data)
```

```
(3000, 2)
```

```
scatter(data[:,0],data[:,1])
```

```
<matplotlib.collections.PathCollection at 0x9f85d6c>
```




```
from numpy import *
from numpy import linalg as la

def mean_shift(dataPts, bandWidth):
    dataPts = asarray( dataPts )
    bandWidth = float( bandWidth )
    plotFlag = False

    numDim, numPts = dataPts.shape
    numClust = 0
    bandSq = bandWidth**2
    initPtInds = arange( numPts )
    #biggest size in each dimension
    maxPos = dataPts.max(0)
    #smallest size in each dimension
    minPos = dataPts.min(0)
    #bounding box size
    boundBox = maxPos-minPos
    #indicator of size of data space
    sizeSpace = la.norm(boundBox)
    #when mean has converged
    stopThresh = 1e-3*bandWidth
    #center of clust
    clustCent = []
    #track if a points been seen already
    beenVisitedFlag = zeros( numPts, dtype = uint8 )
    #number of points to possibly use as initilization points
```

```
    numInitPts = numPts
    #used to resolve conflicts on cluster membership
    clusterVotes = []

    while numInitPts:

        rand = random.rand()
        #pick a random seed point
        tempInd = int(floor( (numInitPts-1e-6)*rand ))
        #use this point as start of mean
        stInd = initPtInds[ tempInd ]
        # intilize mean to this points location
        myMean = dataPts[ :, stInd ]
        # points that will get added to this cluster
        myMembers = []
        #used to resolve conflicts on cluster membership
        thisClusterVotes = zeros( numPts, dtype = uint16 )

        while True:
            #dist squared from mean to all points still active
            sqDistToAll = (( myMean[:,newaxis] - dataPts )**2).sum(0)
            #points within bandWidth
            inInds = where(sqDistToAll < bandSq)
            #add a vote for all the in points belonging to this cluster
            thisClusterVotes[ inInds ] = thisClusterVotes[ inInds ]+1

            #save the old mean
            myOldMean = myMean
            #compute the new mean
            myMean = mean( dataPts[ :, inInds[0] ], 1 )
            #add any point within bandWidth to the cluster
            myMembers.extend( inInds[0] )
            #mark that these points have been visited
            beenVisitedFlag[myMembers] = 1

            if la.norm(myMean-myOldMean) < stopThresh:
                #check for merge posibilities
                mergeWith = None
                for cN in xrange( numClust ):
                    #distance from possible new clust max to old clust max
                    distToOther = la.norm( myMean - clustCent[ cN ] )
                    #if its within bandwidth/2 merge new and old
                    if distToOther < bandWidth/2:
                        mergeWith = cN
                        break

                # something to merge
                if mergeWith is not None:
                    #record the max as the mean of the two merged (I know biased twoards
                        new ones)
                    clustCent[ mergeWith ] = 0.5*( myMean + clustCent[ mergeWith ] )
```

```
                    #add these votes to the merged cluster
                    clusterVotes[ mergeWith ] += thisClusterVotes
                else:
                    #increment clusters
                    numClust = numClust+1
                    #record the mean
                    clustCent.append( myMean )
                    clusterVotes.append( thisClusterVotes )

                break

        initPtInds = where(beenVisitedFlag == 0)[0]
        numInitPts = len(initPtInds)

    data2cluster = asarray( clusterVotes ).argmax(0)

    return clustCent, data2cluster
```

```
dataPts = asarray([[1,1],[2,2],[3,3],[9,9],[9,9],[9,9],[10,10]]).T
print dataPts
print dataPts.shape
bandwidth = 2
print 'data points:', dataPts
print 'bandwidth:', bandwidth
clustCent, data2cluster = mean_shift(dataPts, 2)
print 'cluster centers:', sorted( asarray( clustCent ).squeeze().tolist() )
print 'data2cluster:', data2cluster
print len( clustCent )
print sorted( asarray( clustCent ).squeeze().tolist() )
```

```
[[ 1  2  3  9  9  9 10]
 [ 1  2  3  9  9  9 10]]
(2, 7)
data points: [[ 1  2  3  9  9  9 10]
 [ 1  2  3  9  9  9 10]]
bandwidth: 2
cluster centers: [[1.5, 1.5], [2.5, 2.5], [9.25, 9.25]]
data2cluster: [2 0 0 1 1 1 1]
3
[[1.5, 1.5], [2.5, 2.5], [9.25, 9.25]]
```

```
print asarray(data.T)[:30]
clustCent, data2cluster = mean_shift(asarray(data.T), 5000)
```

```
[[54620 52694 53253 ...,  8828  8879 10002]
 [43523 42750 43024 ..., 59102 59244 61399]]
```

```
print asarray(clustCent)[:6]
print asarray(clustCent).shape
```

```
[[ 36612.3541253   47646.45712961]
 [ 51485.64457831  49092.07831325]
 [ 44379.26285714  46182.84571429]
 [ 58673.90322581  59703.51612903]
 [ 17186.66049383  54836.2345679 ]
 [ 32502.45283019  59820.74339623]]
(17, 2)
```

```
scatter(data[:,0],data[:,1])
plt.hold(True)
for x in asarray(clustCent): plot(x[0],x[1],'rd')
```