SBM

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SBM

We try to investigate the presence of latent variable with clusters in order to explain probability of connections between groups.

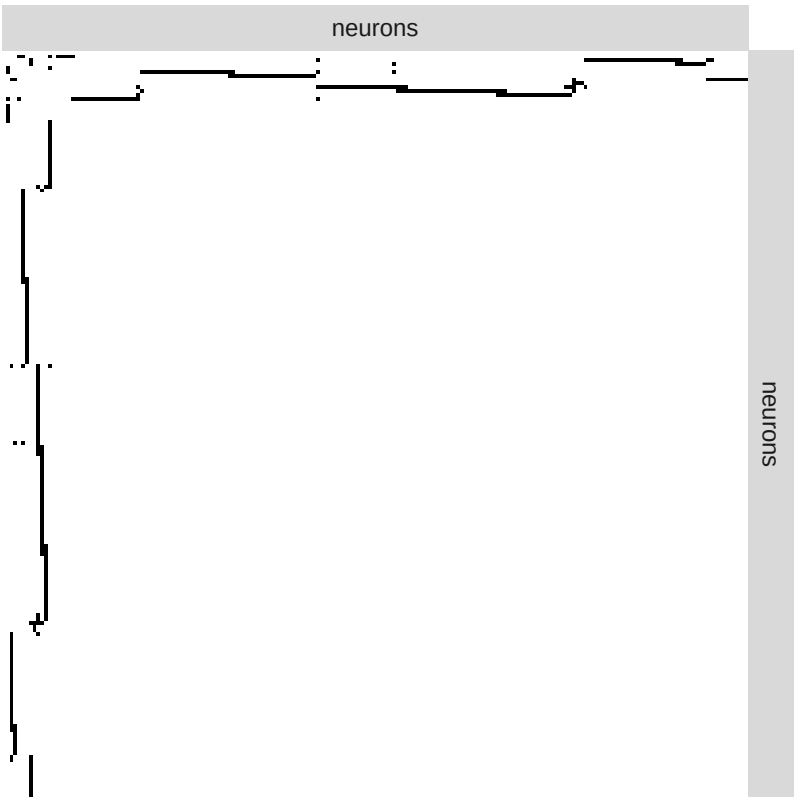
Preliminary steps

We start by making an undirected version of our graph to work with.

```
neurons_g <- read_graph("Data/mouse_visual.cortex_2.graphml","graphml")
Y = as_adjacency_matrix(neurons_g, sparse = F)
diag(Y) = NA
neurons_g_undirected <- as.undirected(neurons_g, mode="collapse" )
Y_undirected = as_adjacency_matrix(neurons_g_undirected, sparse = F)
```

Below we have a visual rappresentation of the adjacency matrix.

```
plotMyMatrix(Y_undirected, dimLabels = list(row = 'neurons', col = 'neurons'))
```



We can clearly see that our network is sparse, and only the first neurons are involved in synapsis.

Bernoulli

We try to fit a Stochastic Blockmodel. According to assumptions of this model, observed links are governed by the membership of a node in a certain block.

> Number of blocks and membership of nodes are unknown.

Since we have unweighted connections, we can assume a Bernoulli distribution for the tie-variable.

```
sbm1 = estimateSimpleSBM(Y_undirected, "bernoulli", dimLabels = 'neurons',
                         estimOptions = list(verbosity = 1))
```

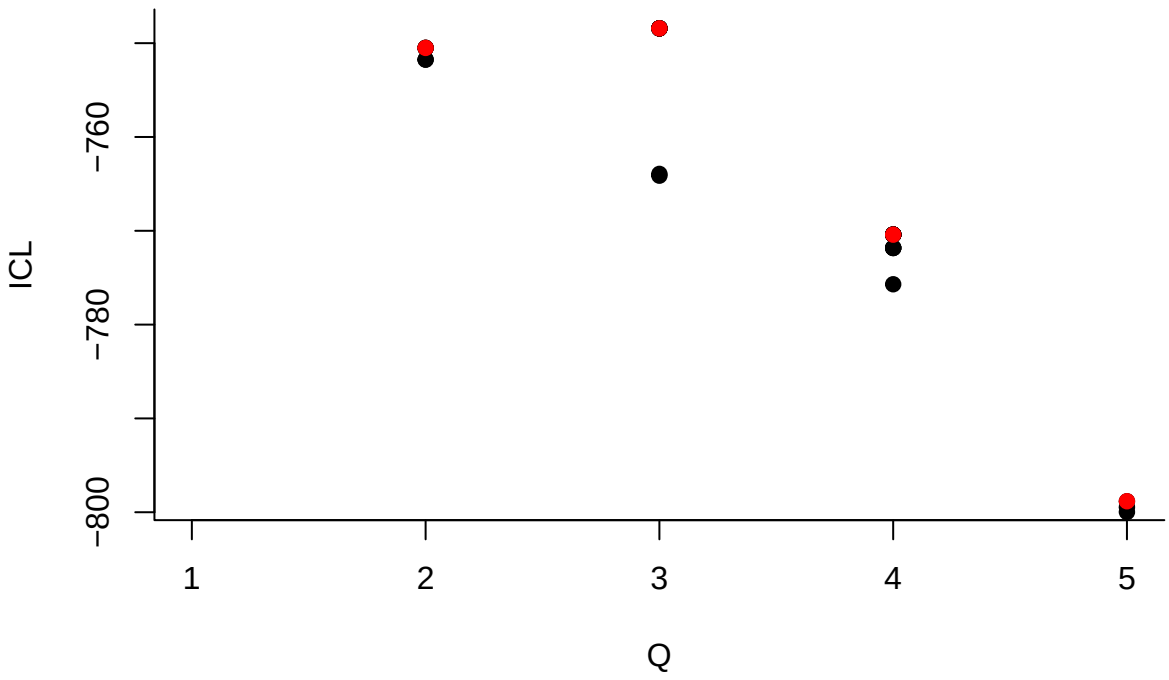
```
-> Estimation for 1 groups

-> Computation of eigen decomposition used for initalizations

-> Pass 1

-> Pass 2

-> Pass 3
```



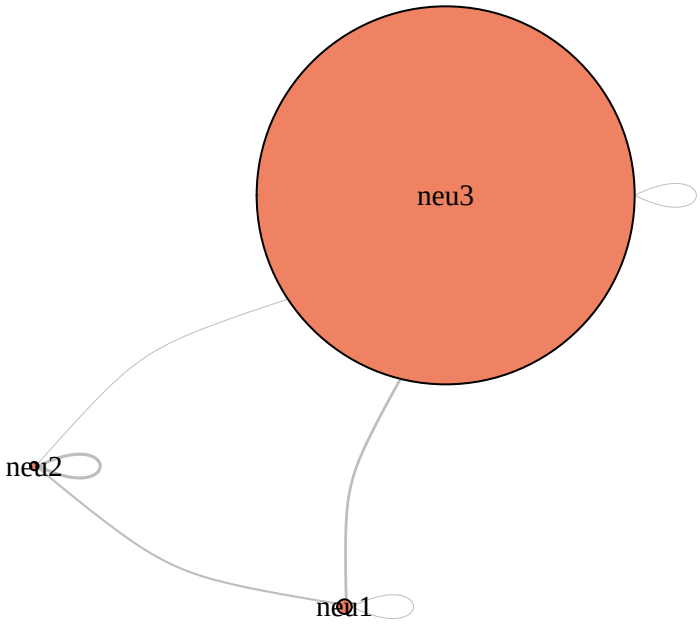

```
sbm1$nbBlocks; sbm1$blockProp; round(sbm1$connectParam$mean,3)
```

```
[1] 3
```

```
[1] 0.03635480 0.02099384 0.94265137
```

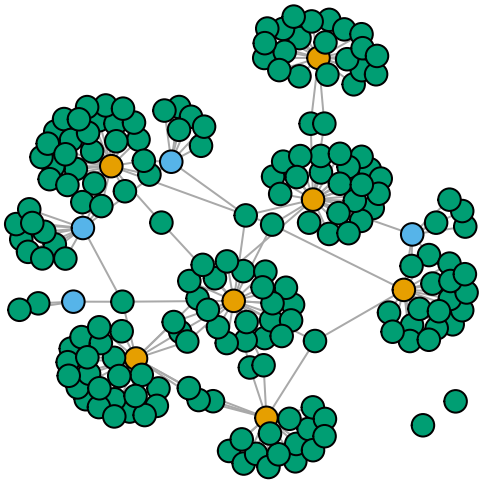
```
      [,1]  [,2]  [,3]
[1,] 0.004 0.107 0.138
[2,] 0.107 0.159 0.040
[3,] 0.138 0.040 0.000
```

```
plot(sbm1, type = "meso")
```



We can observe a big cluster with respect to other two ones, so we plot the true graph to check which are neurons in each block.

```
plot(neurons_g_undirected, vertex.size=10,vertex.label=NA,vertex.color = sbm1$memberships)
```



We can see that the biggest cluster is made by target neurons and the first and second block are composed both by all pyramidal neurons. According to our background knowledge, connections between pairs of neurons are indeed regulated by a group membership, in sense that we observe a tie only between nodes of different type. However, this group membership is not unobserved, but completely observed. In conclusion, SBM does not bring more informations to our analysis.