

# Network Analysis with R - in progress

Wieteska, Michal

set proper pdf encoding

remove all lists

```
ls()

## character(0)

rm(list = ls())
```

install/ load needed packages

```
install.packages("igraph") library(igraph)
```

read data - manual upload

```
SMEnetw <- read.csv(file.choose(), header = T, sep = ";", fileEncoding="UTF-8-BOM")
str(SMENetw)

## 'data.frame':    264 obs. of  3 variables:
##  $ SMEstart      : Factor w/ 16 levels "A","B","C","D",...: 1 13 4 6 5 12 7 15 2 10 ...
##  $ SMEend        : Factor w/ 18 levels "A","B","D","E",...: 18 2 11 17 7 18 2 11 17 7 ...
##  $ ContactFrequency: int  4 2 5 7 8 5 3 5 7 8 ...

#fix(SMENetw)
SME_analysis <- data.frame(SMENetw$SMEstart, SMENetw$SMEend, SMENetw$ContactFrequency)
library(igraph)

## Warning: package 'igraph' was built under R version 3.6.3

##
## Attaching package: 'igraph'

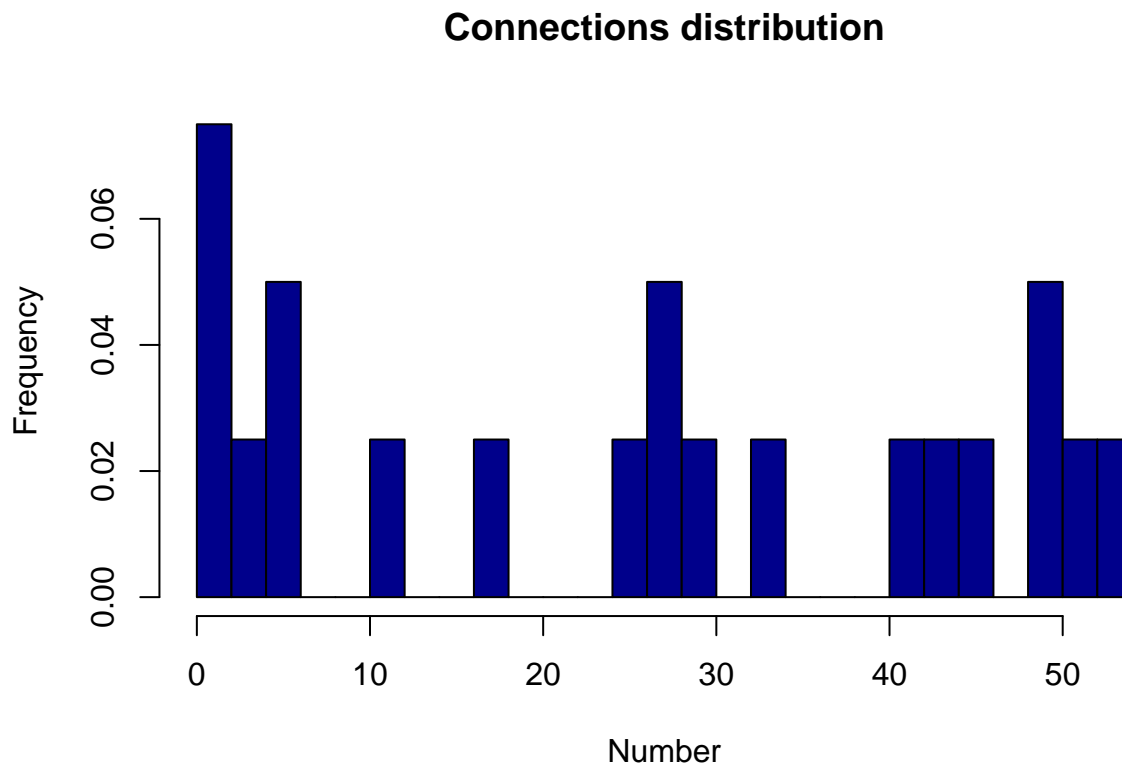
## The following objects are masked from 'package:stats':
##
##  decompose, spectrum
```

```
## The following object is masked from 'package:base':  
##  
##      union
```

```
SMEnetwork <- graph.data.frame(SME_analysis, directed = TRUE)
```

see contact frequency

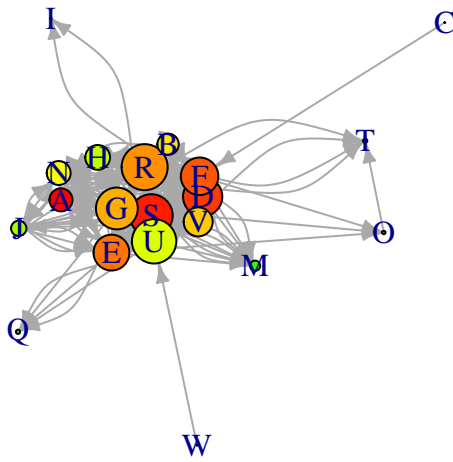
```
V(SMEnetwork)$ContactFrequency <- degree(SMEnetwork)  
hist(V(SMEnetwork)$ContactFrequency, breaks = 25, prob = T,  
     col = 'dark blue',  
     main = 'Connections distribution',  
     ylab = 'Frequency',  
     xlab = 'Number')
```



basic plot

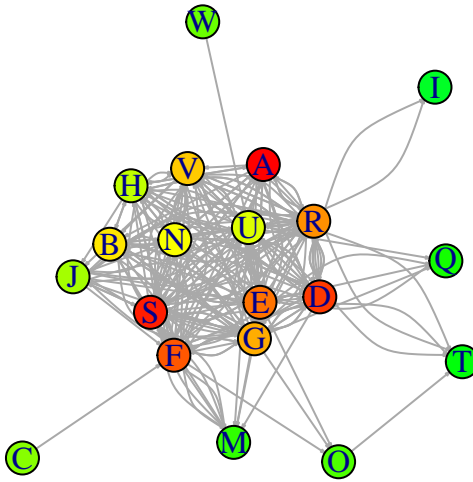
```
plot(SMEnetwork,  
     vertex.color = rainbow(53),  
     vertex.size = V(SMEnetwork)$ContactFrequency*0.4,
```

```
edge.arrow.size = 0.5,
layout=layout.fruchterman.reingold)
```



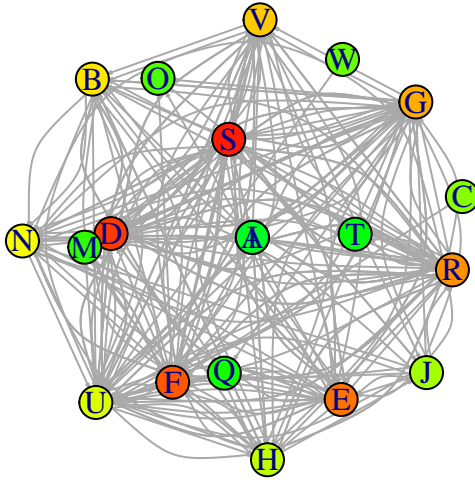
## outliers detection

```
plot(SMENetwork,
     vertex.color = rainbow(53),
     # vertex.size = V(SMENetwork)$degree*0.4,
     edge.arrow.size = 0.1,
     layout=layout.kamada.kawai)
```



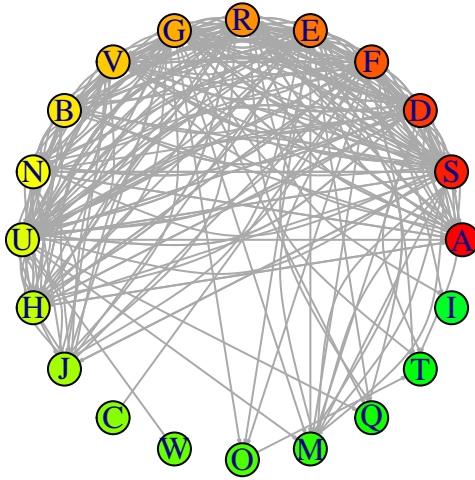
spherical view

```
plot(SMENetwork,
     vertex.color = rainbow(53),
     # vertex.size = V(SMENetwork)$degree*0.4,
     edge.arrow.size = 0.1,
     layout=layout.sphere)
```



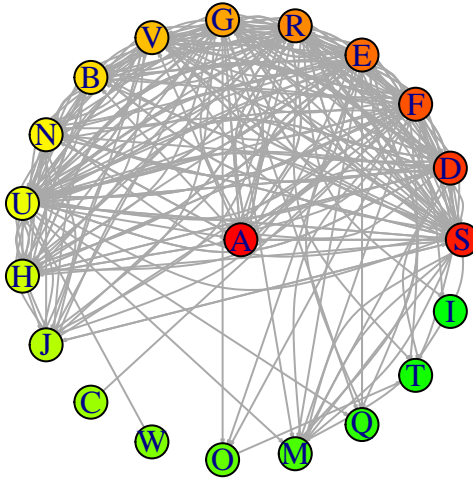
circle

```
plot(SMENetwork,
     vertex.color = rainbow(53),
     # vertex.size = V(SMENetwork)$degree*0.4,
     edge.arrow.size = 0.1,
     layout=layout.circle)
```



#who seems to be the boss?

```
plot(SMENetwork,
     vertex.color = rainbow(56),
     # vertex.size = V(SMENetwork)$degree*0.4,
     edge.arrow.size = 0.1,
     layout=layout.star)
```



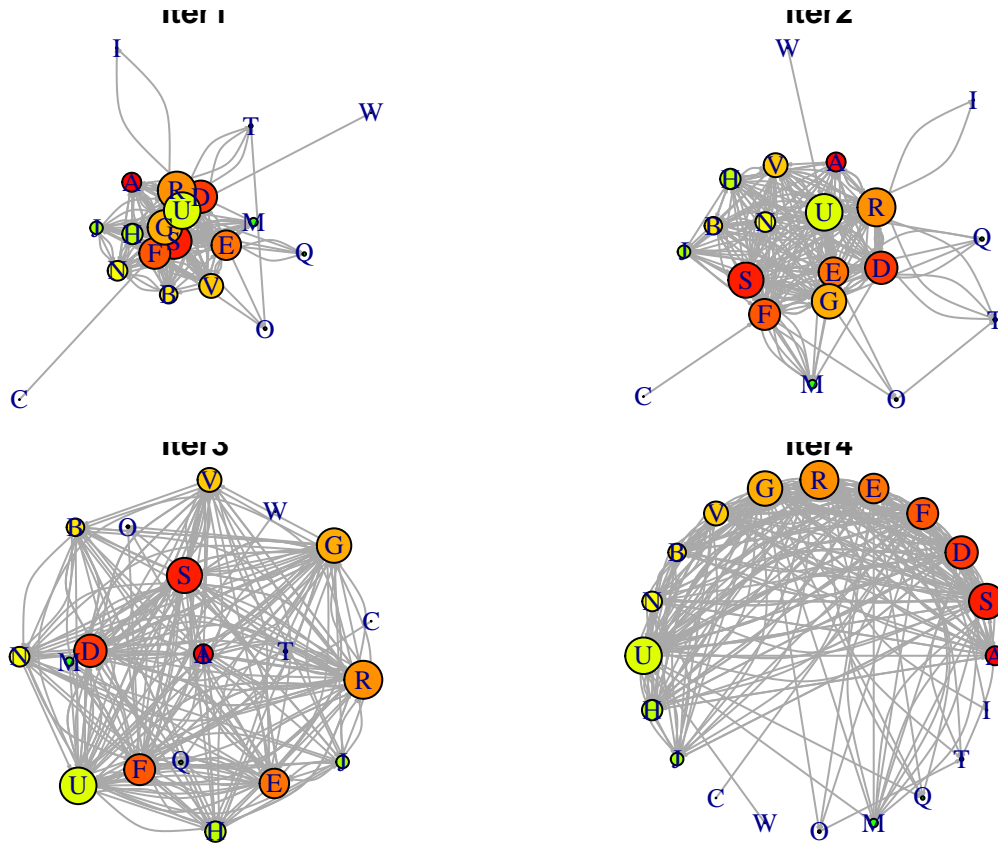
connect key plots

```
par(mfrow=c(2,2))
par(mar=c(0.25,0.25,0.1,0.1))
plot(SMEnetwork,
     vertex.color = rainbow(53),
     vertex.size = V(SMEnetwork)$ContactFrequency*0.4,
     edge.arrow.size = 0.1,
     main="Iter1",
     font.main=1,
     layout=layout.graphopt)
plot(SMEnetwork,
     vertex.color = rainbow(53),
     vertex.size = V(SMEnetwork)$ContactFrequency*0.4,
     edge.arrow.size = 0.1,
     main="Iter2",
     font.main=1,
     layout=layout.kamada.kawai)
plot(SMEnetwork,
     vertex.color = rainbow(53),
     vertex.size = V(SMEnetwork)$ContactFrequency*0.4,
     edge.arrow.size = 0.1,
     main="Iter3",
```

```

font.main=1,
layout=layout.sphere)
plot(SMEnetwork,
vertex.color = rainbow(53),
vertex.size = V(SMEnetwork)$ContactFrequency*0.4,
edge.arrow.size = 0.1,
main="Iter4",
font.main=1,
#xlab = 'iter4',
layout=layout.circle)

```



## Community detection, outlines graphically community areas

- by dendrogram

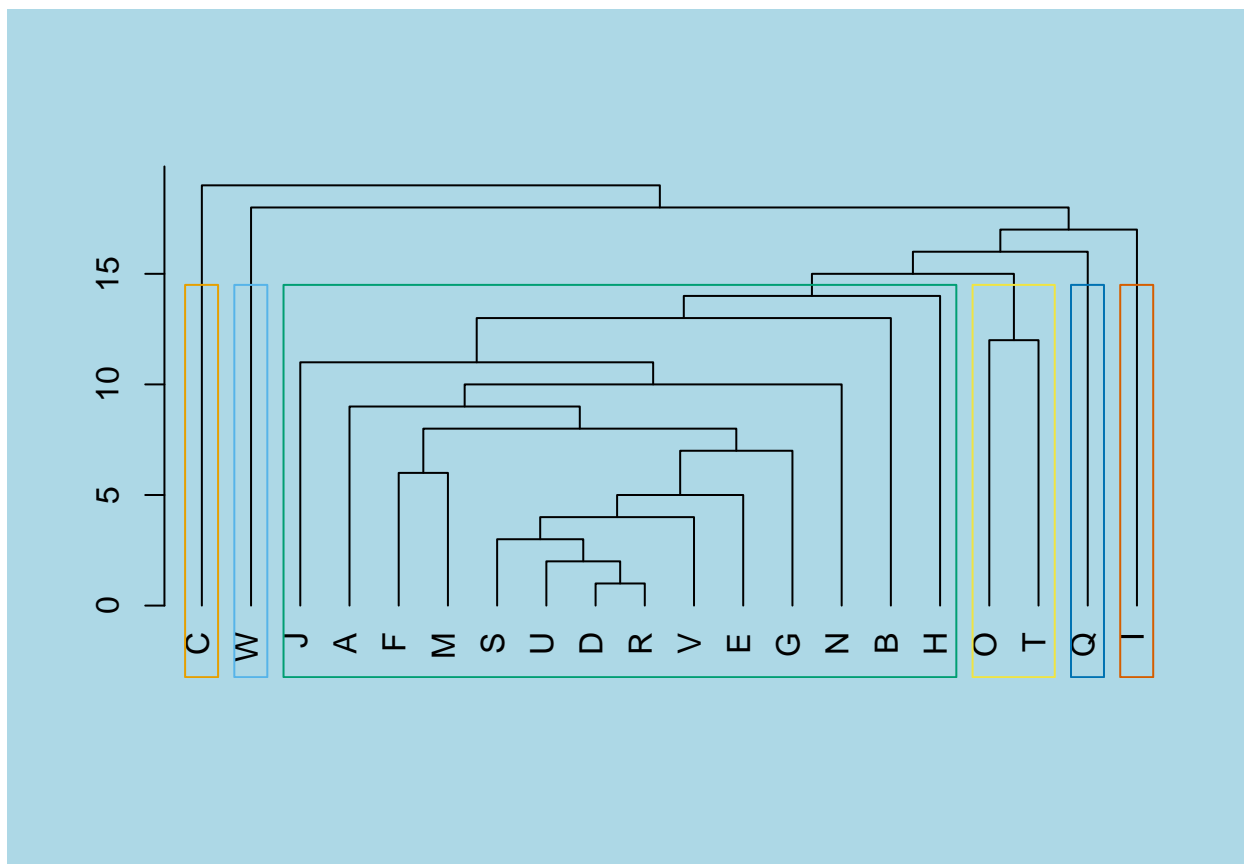
```

par(bg="lightblue") # set background

ceb <- cluster_edge_betweenness(SMEnetwork)
dendPlot(ceb, mode="hclust") # plot(hcd, type = "triangle", ylab = "Height")

```

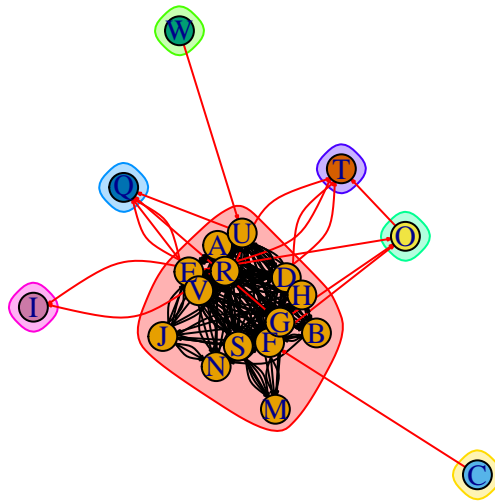




\* by network

```
SMEnetwork1 <- igraph::as_data_frame(SMEnetwork)
SMEnetwork2 <- graph.data.frame(SMEnetwork1, directed = F)
cnet <- cluster_edge_betweenness(SMEnetwork2)

plot(cnet,
     SMEnetwork,
     vertex.size = 13,
     vertex.label.cex = 0.9,
     edge.arrow.size=0.1,
     vertex.size = V(SMEnetwork2)$ContactFrequency*0.2,
     layout=layout.graphopt)
```



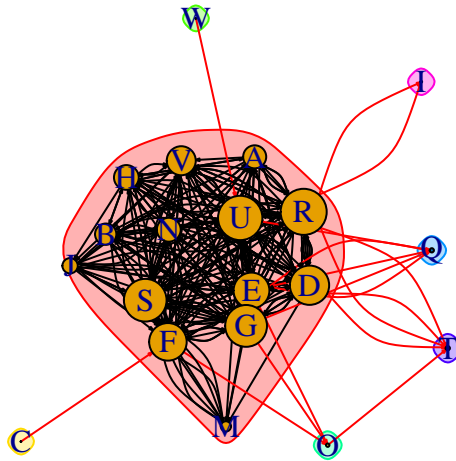
```

SMENetwork1 <- igraph::as_data_frame(SMENetwork)
SMENetwork2 <- graph.data.frame(SMENetwork1, directed = F)
cnet <- cluster_edge_betweenness(SMENetwork2)

plot(cnet,
      SMENetwork,
      vertex.color = rainbow(53),
      vertex.size = V(SMENetwork)$ContactFrequency*0.4,
      edge.arrow.size = 0.1,
      main="Iter1",
      font.main=1,
      layout=layout.kamada.kawai)

```

Iter1



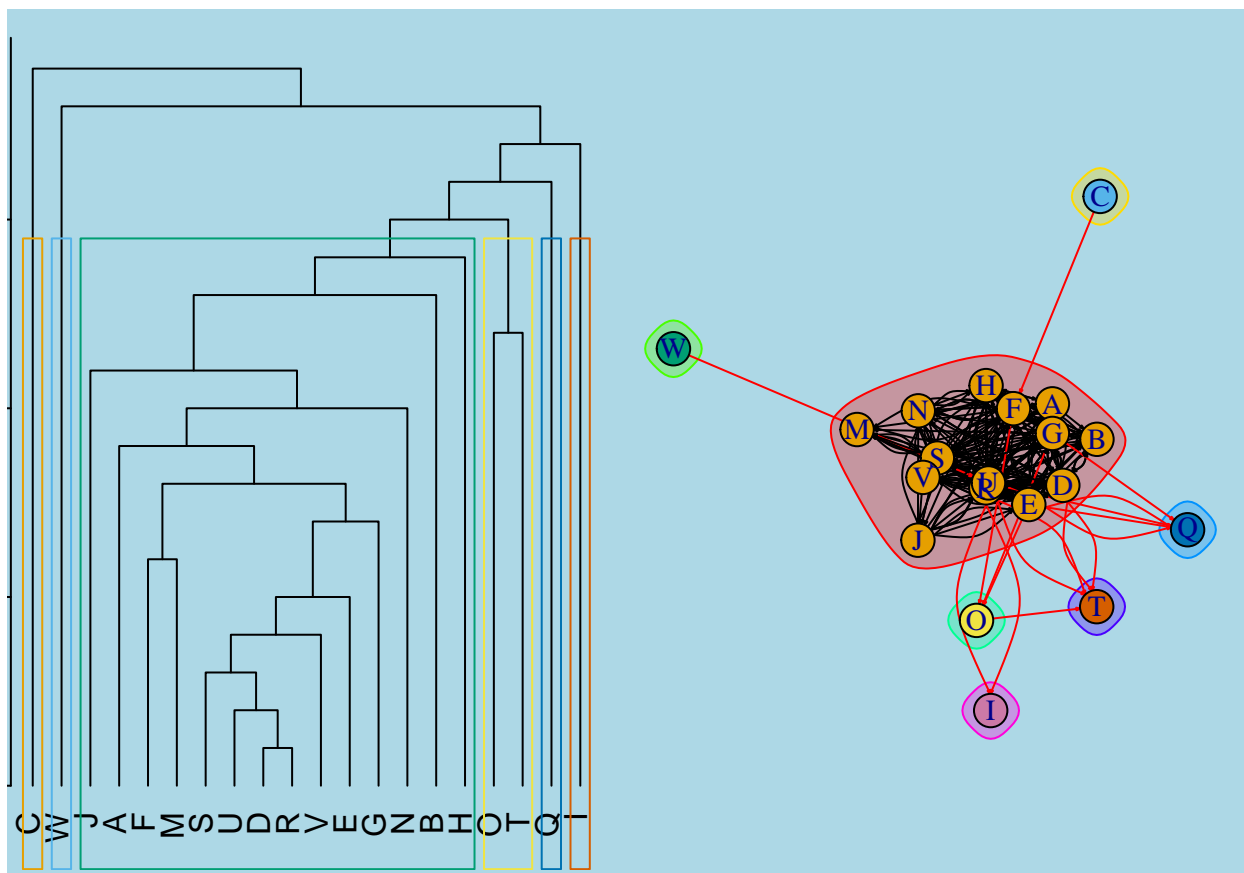
```
par(mfrow=c(1,2))
par(mar=c(0.1,0.1,0.75,0.75))

par(bg="lightblue") # set background

ceb <- cluster_edge_betweenness(SMEnetwork)
dendPlot(ceb, mode="hclust") # plot(hcd, type = "triangle", ylab = "Height")

SMEnetwork1 <- igraph::as_data_frame(SMEnetwork)
SMEnetwork2 <- graph.data.frame(SMEnetwork1, directed = F)
cnet <- cluster_edge_betweenness(SMEnetwork2)

library(igraph)
plot(cnet,
     SMEnetwork,
     vertex.size = 13,
     vertex.label.cex = 0.9,
     edge.arrow.size=0.1,
     vertex.size = V(SMEnetwork2)$ContactFrequency*0.2,
     layout=layout.graphopt)
```



# comments: 6 outliers identified for dendrogram (outside green box) and wetwork diagram (outside red area)