Advanced Network Graphics part B

Nick Lauerman

Contents

Libraries and data used

Libraries

```
library(UserNetR)
library(statnet)
```

```
## Loading required package: tergm
```

```
## Loading required package: ergm
```

```
## Loading required package: network
```

```
## network: Classes for Relational Data
## Version 1.16.0 created on 2019-11-30.
## copyright (c) 2005, Carter T. Butts, University of California-Irvine
##                     Mark S. Handcock, University of California -- Los Angeles
##                     David R. Hunter, Penn State University
##                     Martina Morris, University of Washington
##                     Skye Bender-deMoll, University of Washington
##  For citation information, type citation("network").
##  Type help("network-package") to get started.
```

```
##
## ergm: version 3.10.4, created on 2019-06-10
## Copyright (c) 2019, Mark S. Handcock, University of California -- Los Angeles
##                     David R. Hunter, Penn State University
##                     Carter T. Butts, University of California -- Irvine
##                     Steven M. Goodreau, University of Washington
##                     Pavel N. Krivitsky, University of Wollongong
##                     Martina Morris, University of Washington
##                     with contributions from
```

```
##                     Li Wang
##                     Kirk Li, University of Washington
##                     Skye Bender-deMoll, University of Washington
##                     Chad Klumb
## Based on "statnet" project software (statnet.org).
## For license and citation information see statnet.org/attribution
## or type citation("ergm").

## NOTE: Versions before 3.6.1 had a bug in the implementation of the bd()
## constriant which distorted the sampled distribution somewhat. In
## addition, Sampson's Monks datasets had mislabeled vertices. See the
## NEWS and the documentation for more details.

## NOTE: Some common term arguments pertaining to vertex attribute and
## level selection have changed in 3.10.0. See terms help for more
## details. Use 'options(ergm.term=list(version="3.9.4"))' to use old
## behavior.

## Loading required package: networkDynamic

##
## networkDynamic: version 0.10.1, created on 2020-01-16
## Copyright (c) 2020, Carter T. Butts, University of California -- Irvine
##                     Ayn Leslie-Cook, University of Washington
##                     Pavel N. Krivitsky, University of Wollongong
##                     Skye Bender-deMoll, University of Washington
##                     with contributions from
##                     Zack Almquist, University of California -- Irvine
##                     David R. Hunter, Penn State University
##                     Li Wang
##                     Kirk Li, University of Washington
##                     Steven M. Goodreau, University of Washington
##                     Jeffrey Horner
##                     Martina Morris, University of Washington
## Based on "statnet" project software (statnet.org).
## For license and citation information see statnet.org/attribution
## or type citation("networkDynamic").

##
## tergm: version 3.6.1, created on 2019-06-12
## Copyright (c) 2019, Pavel N. Krivitsky, University of Wollongong
##                     Mark S. Handcock, University of California -- Los Angeles
##                     with contributions from
##                     David R. Hunter, Penn State University
##                     Steven M. Goodreau, University of Washington
##                     Martina Morris, University of Washington
##                     Nicole Bohme Carnegie, New York University
##                     Carter T. Butts, University of California -- Irvine
##                     Ayn Leslie-Cook, University of Washington
##                     Skye Bender-deMoll
##                     Li Wang
##                     Kirk Li, University of Washington
## Based on "statnet" project software (statnet.org).
## For license and citation information see statnet.org/attribution
## or type citation("tergm").

## Loading required package: ergm.count
```

```
##
## ergm.count: version 3.4.0, created on 2019-05-15
## Copyright (c) 2019, Pavel N. Krivitsky, University of Wollongong
##                     with contributions from
##                     Mark S. Handcock, University of California -- Los Angeles
##                     David R. Hunter, Penn State University
## Based on "statnet" project software (statnet.org).
## For license and citation information see statnet.org/attribution
## or type citation("ergm.count").

## NOTE: The form of the term 'CMP' has been changed in version 3.2 of
## 'ergm.count'. See the news or help('CMP') for more information.

## Loading required package: sna

## Loading required package: statnet.common

##
## Attaching package: 'statnet.common'

## The following object is masked from 'package:base':
##
##     order

## sna: Tools for Social Network Analysis
## Version 2.5 created on 2019-12-09.
## copyright (c) 2005, Carter T. Butts, University of California-Irvine
##  For citation information, type citation("sna").
##  Type help(package="sna") to get started.

## Loading required package: tsna

##
## statnet: version 2019.6, created on 2019-06-13
## Copyright (c) 2019, Mark S. Handcock, University of California -- Los Angeles
##                     David R. Hunter, Penn State University
##                     Carter T. Butts, University of California -- Irvine
##                     Steven M. Goodreau, University of Washington
##                     Pavel N. Krivitsky, University of Wollongong
##                     Skye Bender-deMoll
##                     Martina Morris, University of Washington
## Based on "statnet" project software (statnet.org).
## For license and citation information see statnet.org/attribution
## or type citation("statnet").

## unable to reach CRAN
```

```
library(circlize)
```

```
## ========================================
## circlize version 0.4.8
## CRAN page: https://cran.r-project.org/package=circlize
## Github page: https://github.com/jokergoo/circlize
## Documentation: http://jokergoo.github.io/circlize_book/book/
##
## If you use it in published research, please cite:
## Gu, Z. circlize implements and enhances circular visualization
##   in R. Bioinformatics 2014.
## ========================================
```

```
##
## Attaching package: 'circlize'

## The following object is masked from 'package:sna':
##
##     degree
```

```
library(sna)
library(ggplot2)
library(Hmisc)
```

```
## Loading required package: lattice

## Loading required package: survival

## Loading required package: Formula

## Registered S3 method overwritten by 'Hmisc':
##   method          from
##   summary.formula ergm

##
## Attaching package: 'Hmisc'

## The following object is masked from 'package:network':
##
##     is.discrete

## The following objects are masked from 'package:base':
##
##     format.pval, units
```

Data

```
data(FIFA_Nether)
```

Specialized Network Diagrams (continued)

continuation with next subsectiom from part A.

Chord Diagrams

```
FIFAm <- as.sociomatrix(FIFA_Nether,
                        attrname = "passes")
names <- c("GK1",
           "DF3",
           "DF4",
           "DF5",
           "MF6",
           "FW7",
           "FW9",
           "MK10",
           "FW11",
           "DF2",
           "MF8")
rownames(FIFAm) <- names
```

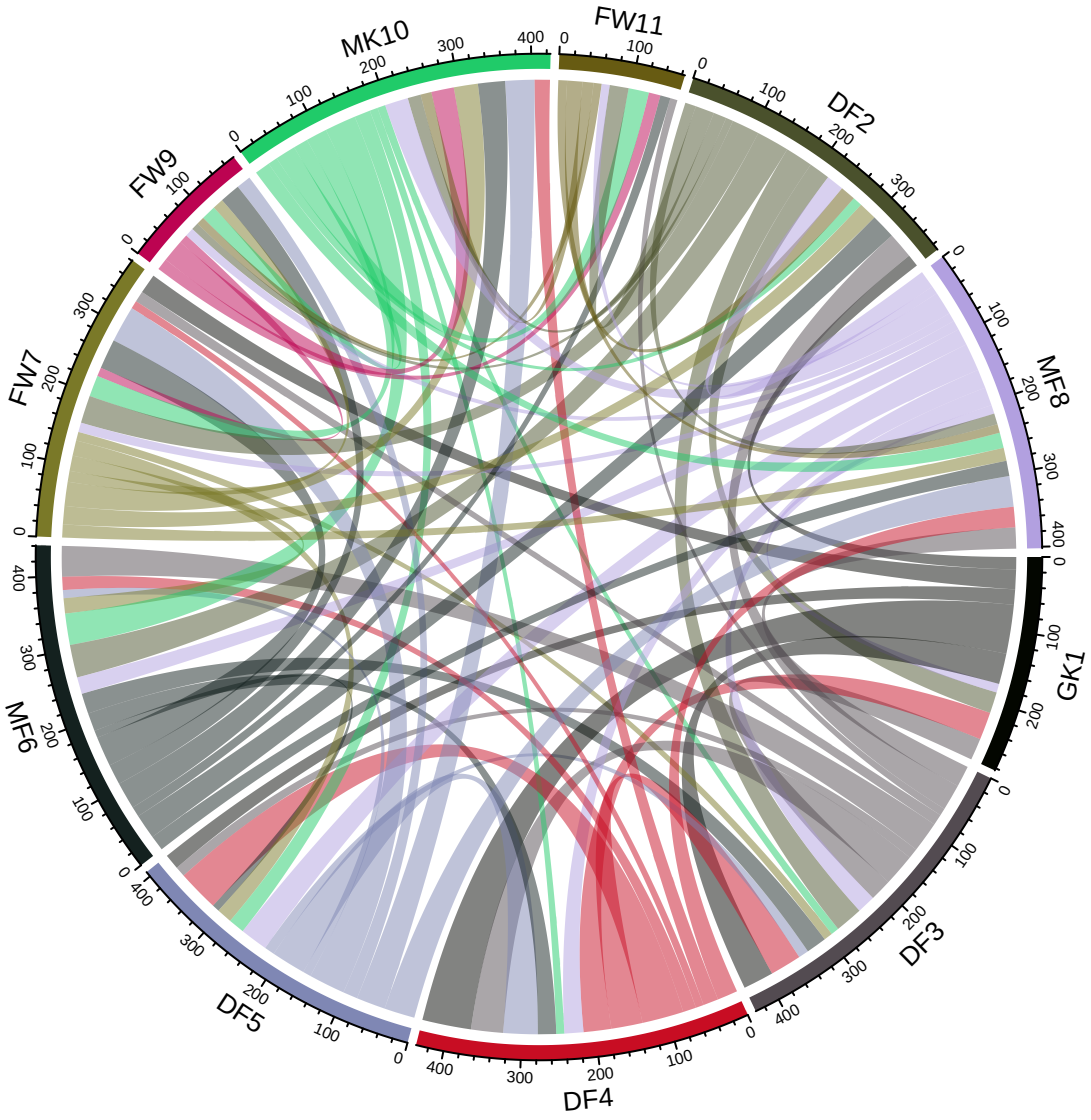
```r
colnames(FIFAm) <- names
FIFAm
```

```
##      GK1 DF3 DF4 DF5 MF6 FW7 FW9 MK10 FW11 DF2 MF8
## GK1    0  42  67  21   2  27   7    5    2  17   3
## DF3   30   0  44  14  42  15   8    7   10  36  29
## DF4   38  43   0  57  18  11   7   21    1   7  28
## DF5    6  14  47   0  11  50  20   40    1   4  42
## MF6    9  28  25  10   0  41  28   37   14  34  21
## FW7    4  12   1  21  21   0  15   33    9  25  18
## FW9    0   0   1   8   7  12   0   31   16   7   2
## MK10   1  11  11  22  43  29  20    0   28  13  21
## FW11   3   2   2   3   7   6  11   15    0  21  12
## DF2   29  38   8   3  45  38  10   18   26   0  15
## MF8   12  25  26  38  23  13  12   32   11  24   0
```

```r
FIFAm[FIFAm < 10] <- 0
FIFAm
```

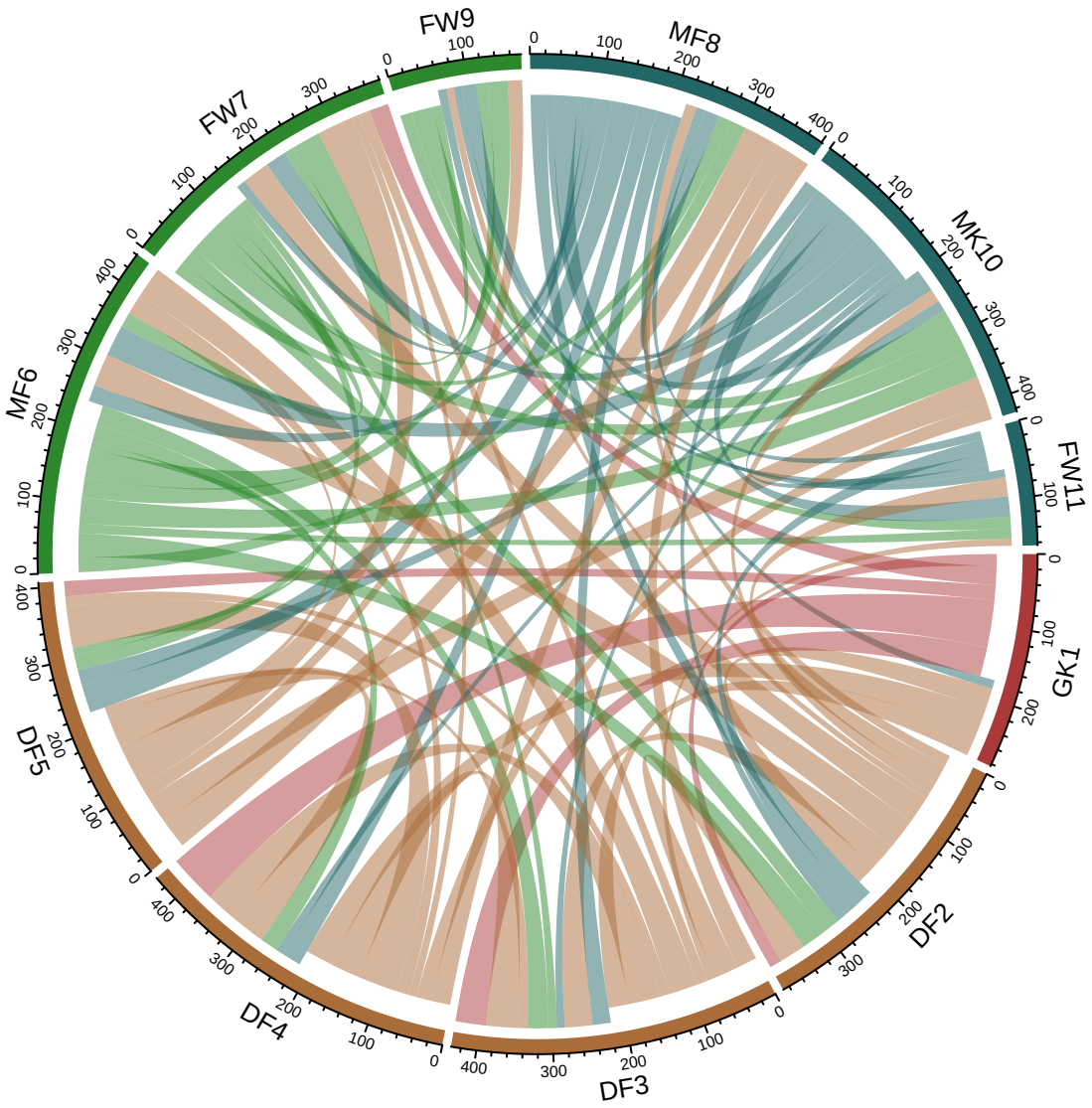
```
##      GK1 DF3 DF4 DF5 MF6 FW7 FW9 MK10 FW11 DF2 MF8
## GK1    0  42  67  21   0  27   0    0    0  17   0
## DF3   30   0  44  14  42  15   0    0   10  36  29
## DF4   38  43   0  57  18  11   0   21    0   0  28
## DF5    0  14  47   0  11  50  20   40    0   0  42
## MF6    0  28  25  10   0  41  28   37   14  34  21
## FW7    0  12   0  21  21   0  15   33    0  25  18
## FW9    0   0   0   0   0  12   0   31   16   0   0
## MK10   0  11  11  22  43  29  20    0   28  13  21
## FW11   0   0   0   0   0   0  11   15    0  21  12
## DF2   29  38   0   0  45  38  10   18   26   0  15
## MF8   12  25  26  38  23  13  12   32   11  24   0
```

```r
chordDiagram(FIFAm)
```




```
grid.col <- c("#AA3939",
              rep("#AA6C39",
                4),
              rep("#2D882D",
                  3),
              rep("#226666",
                  3))
chordDiagram(FIFAm,
             directional = TRUE,
             grid.col = grid.col,
             order = c("GK1",
                       "DF2",
                       "DF3",
                       "DF4",
```

```
                        "DF5",
                        "MF6",
                        "FW7",
                        "FW9",
                        "MF8",
                        "MK10",
                        "FW11"))
```

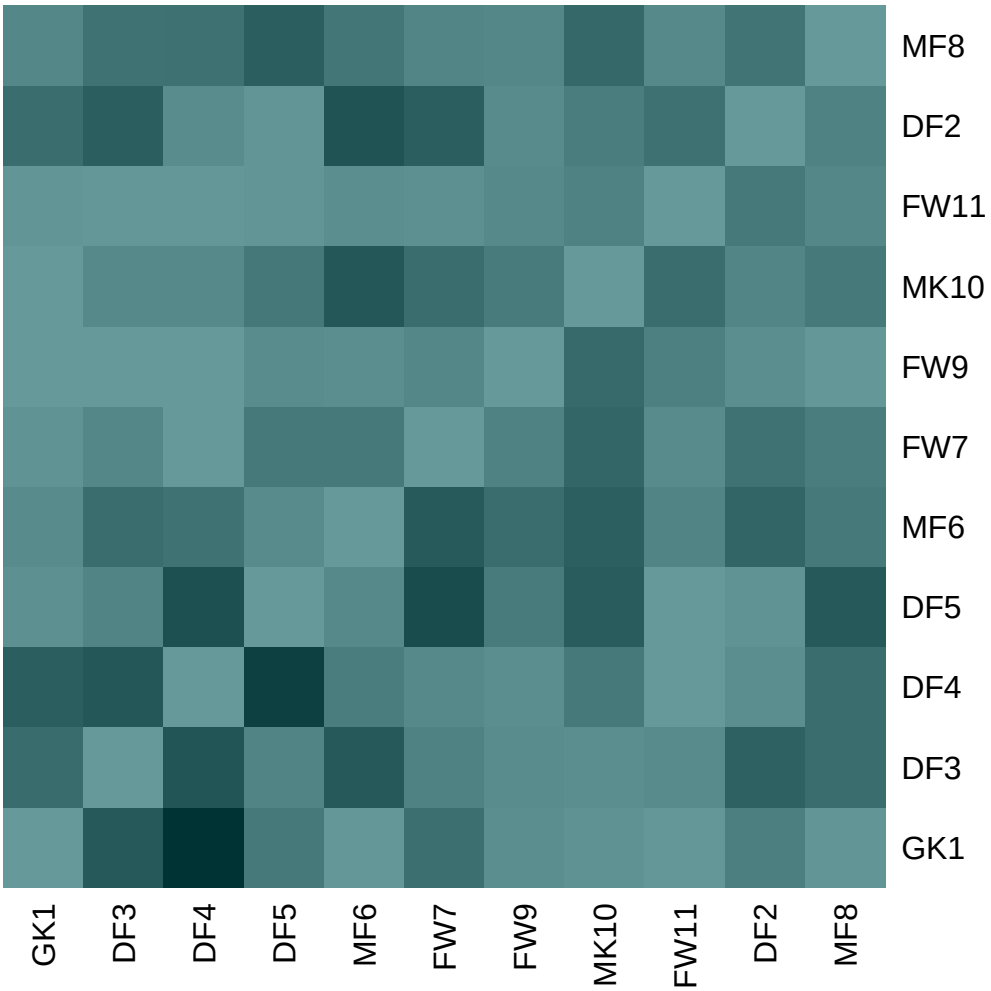


Heatmaps for Network data

```
data("FIFA_Nether")
FIFAm <- as.sociomatrix(FIFA_Nether,
                        attrname = "passes")
```

```r
colnames(FIFAm) <- c("GK1",
                     "DF3",
                     "DF4",
                     "DF5",
                     "MF6",
                     "FW7",
                     "FW9",
                     "MK10",
                     "FW11",
                     "DF2",
                     "MF8")
rownames(FIFAm) <- c("GK1",
                     "DF3",
                     "DF4",
                     "DF5",
                     "MF6",
                     "FW7",
                     "FW9",
                     "MK10",
                     "FW11",
                     "DF2",
                     "MF8")

palf <- colorRampPalette(c("#669999",
                           "#003333"))
heatmap(FIFAm,
        Rowv = NA,
        Colv = NA,
        col =  palf(60),
        scale = "none",
        margins = c(11,
                    11))
```



Creating network diagrams with other R packages

Network Diagrams with *ggplot2*

the function

```
edgeMaker <- function(whichRow, len = 100, curved = TRUE){
  fromC <- layoutCoordinates[adjacencyList[whichRow, 1], ]
  toC <- layoutCoordinates[adjacencyList[whichRow, 2], ]
  graphCenter <- colMeans(layoutCoordinates)
  bezierMid <- c(fromC[1], toC[2])
  distance1 <- sum((graphCenter - bezierMid)^2)
  if(distance1 < sum((graphCenter - c(toC[1],
                                      fromC[2]))^2)){
```

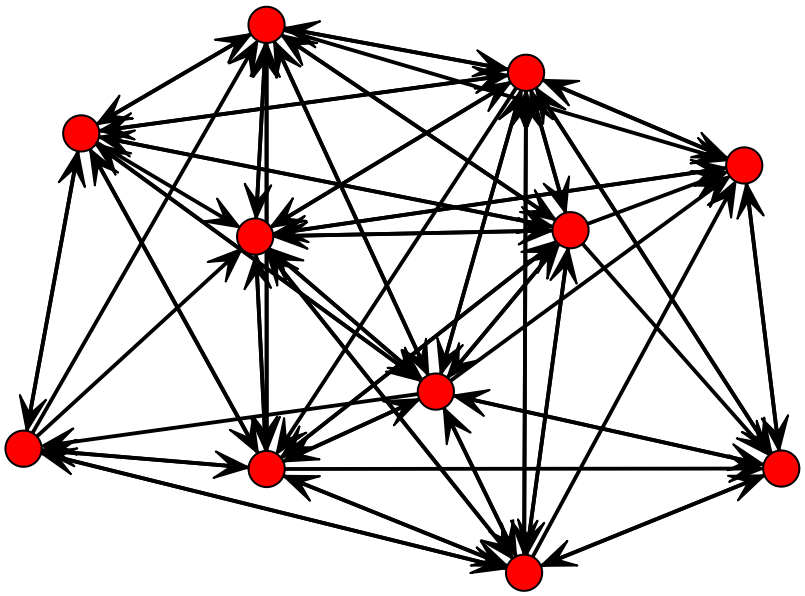
```
    bezierMid <- c(toC[1], fromC[2])
  }
  bezierMid <- (fromC + toC + bezierMid) / 3
  if(curved == FALSE){
    bezierMid <- (fromC + toC) / 2
  }
  edge <- data.frame(bezier(c(fromC[1],
                              bezierMid[1],
                              toC[1]),
                            c(fromC[2],
                              bezierMid[2],
                              toC[2]),
                            evaluation = len))
  edge$Sequence <- 1:len
  edge$Group <- paste(adjacencyList[whichRow,
                                    1:2],
                      collapse = ">")
  return(edge)
}
```

using the function

```
library(sna)
library(ggplot2)
library(Hmisc)

data("FIFA_Nether")
fifi.edge <- as.edgelist.sna(FIFA_Nether,
                             attrname = "passes")
fifi.edge <- data.frame(fifi.edge)
names(fifi.edge)[3] <- "value"
fifi.edge <- fifi.edge[fifi.edge$value >9, ]
adjacencyList <- fifi.edge

layoutCoordinates <- gplot(network(fifi.edge))
```



```
allEdges <- lapply(1:nrow(fifi.edge),
                   edgeMaker, len = 500, curved = TRUE)
allEdges <- do.call(rbind, allEdges)
```

now the plot

```
new_theme_empty <- theme_bw()
new_theme_empty$line <- element_blank()
new_theme_empty$rect <- element_blank()
new_theme_empty$strip.text <- element_blank()
new_theme_empty$axis.text <- element_blank()
new_theme_empty$plot.title <- element_blank()
new_theme_empty$axis.title <- element_blank()
new_theme_empty$plot.margin <- structure(c(0, 0, -1, -1),
                                         unit = "lines",
```

```
                                        valid.unit = 3L,
                                        class = "unit")

zp1 <- ggplot(allEdges) +
  geom_path(aes(x = x, y=y,
                group = Group,
                color = Sequence,
                size = -Sequence)) +
  geom_point(data = data.frame(layoutCoordinates),
             aes(x = x, y = y),
             size = 4,
             pch = 21,
             color = "black",
             fill = "gray") +
  scale_color_gradient(low = gray(0),
                       high = gray(9/10),
                       guide = "none") +
  scale_size(range = c(1/10, 1.5),
             guide = "none") +
  new_theme_empty
print(zp1)
```