

Network Analysis: Homework

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1 Nigeria Data Processing

- a) Process the data: turn this event dataset into a matrix.
- b) Specifically, summarize the interactions across all time periods into an adjacency matrix where:
 1. "1" indicates that i and j had a conflictual interaction sometime during the temporal span of the original dataset and zero otherwise.
 2. Make sure all actors that existed at any point during the temporal span are included in the adjacency matrix.

```
1 rm(list=ls())
2 # set working directory to Git location
3 setwd('/Users/jeffziegler/Documents/Git/')
4 # load libraries
5 library(tidyverse); library(igraph); library(plyr)
6 # load data
7 load("network2018_hw1/nigeria.rda")
8
9 #####
10 # (1) Nigeria Data Processing
11 #####
12
13 # create variable for row and column length of adjacency matrix to fill
14 rowLength <- length(unique(nigeria$sender))
15 colLength <- length(unique(nigeria$receiver))
16 # create adjacency matrix of sender and receiver, filled w/ zeroes
17 nigeriaAdjMat <- matrix(0, nrow=rowLength, ncol=colLength)
18 # adjust row and column names for sender and receiver
19 rownames(nigeriaAdjMat) <- unique(nigeria$sender)
20 colnames(nigeriaAdjMat) <- unique(nigeria$receiver)
21 # fill in adjacency matrix per year (i)
22 # start by sorting all unique years to iterate over
23 nigeriaAdjMatList <- lapply(sort(unique(nigeria$year)), function(i){
24   # find just those pairings for (1) a given year
```

```

25 currentYear <- nigeria[nigeria$year == i,]
26 # and (2) had a conflict (conflict == 1)
27 yearlyConflicts <- currentYear[currentYear$conflict == 1,]
28 # now that we know which pairings had conflicts
29 # fill in a "1" based on sender and receiver
30 for(i in 1:nrow(yearlyConflicts)){
31   nigeriaAdjMat[as.character(yearlyConflicts[i,]$sender),
32                 as.character(yearlyConflicts[i,]$receiver)] <- 1
33 }
34 # return the adjacency matrix, which will be placed in a list
35 return(nigeriaAdjMat)
36 })

```

2 Measurements & Community Detection

- a) Which actor is the most “influential” in the network? Justify your response and the measure you choose to estimate “influence.”
- b) Employ the blockmodel function from the sna package to explore potential group level structure in the data (see slides 61-63 from day 2 for details):
 - Run blockmodel with varying levels of k.
 - Save the node classifications from each run.
 - Now how do we choose k?
 - * You will do so through an out-of-sample cross-validation exercise (at least 10 folds).
 - * Report the AUC (ROC) and AUC (PR) statistics from each model.
- c) After having determined the k that gives the best out of sample performance, visualize your results as shown in slide 67 from the day 2 lecture

3 ERGMs

- a) Run a cross-sectional ERGM on the Nigerian conflict network, develop at least one or two network level hypotheses.
- b) Briefly discuss the results.
- c) Make sure to show that you checked for convergence.

4 Find your own data

- a) Locate data that relates to your field of interest.
- b) Transform the data, or a subset of it into a matrix, and plot (similar to step 1 in Section 1).

- c) Include descriptive features in your network graph (similar to step 2, but choose your own measurements).
- d) Run a model, it can be any network model from the course but justify your choices!
- e) Discuss the results in a brief write up. Present for 3-5 minutes to the class.