**Lab 10: Stochastic Actor-Based Modeling**

For this lab we will get introduced to stochastic actor-based modeling in R. We will use R to test the co-evolution of network ties and behaviors in a longitudinal data set. We will examine ways to discern the statistical significance and model fit for a stochastic actor-based model.

Complete all tasks and answer all questions for full credit.

**NOTE:** This lab session uses the statistical program R. Before starting, you will need to open R and install the social network analysis packages in R which we will need for the exercises. The first step in R will be to change the directory (File->Change dir…). Set the directory to your folder in the shared drive.

**Dataset:**

For this exercise, you will be working with the friendship data from a single grade in a single school in the Add Health study (Class 5809). The class is made up of 9th grade students. The dataset for the exercise consists of the 229 students who participated.

**Task 1.** Install the RSIENA and statnet packages in R.

1. Open a new session window in R.
2. Copy and paste the following code into the session window.

setwd("PATHNAME FOR FOLDER")

install.packages('RSiena')

install.packages('statnet')

install.packages('coda')

install.packages('igraph')

install.packages('intergraph')

library(RSiena)

library(statnet)

library(coda)

library(igraph)

library(intergraph)

**Task 2.** Read in network data to R.

1. class5809.txt is an adjacency matrix for the Add Health class 5809 data at time 1. class5809\_t2.txt is the adjacency matrix for class 5809 at time 2, one year after time 1. attr5809.txt is a matrix of attributes for class 5809, including the behavior variable ‘drinkfrq’ measured both at time 1 and time 2.
2. Read the data table into R with the following commands:

friend.data.w1 <- as.matrix(read.table("class5809.txt"))

friend.data.w2 <- as.matrix(read.table("class5809\_t2.txt"))

attr5809<-read.table("attr5809.txt",header=TRUE,stringsAsFactors=FALSE)

# Set the wave 2 friendship data to missing if the wave 2 data are missing

for (i in 1:nrow(attr5809)) {if (attr5809[i,50] > 98) {friend.data.w2[i,]=9}}

friend.data.w1[friend.data.w1 %in% c(6,9)] <- NA

friend.data.w2[friend.data.w2 %in% c(6,9)] <- NA

# Create the wave 1 and wave 2 alcohol frequency matrix

alcfrq<-cbind(attr5809[,47],attr5809[,50])

alcfrq[alcfrq %in% c(4,5,6)] <- 4

alcfrq[alcfrq %in% c(99)] <- NA

# Check dimensions to verify that adjacency and attribute matrices match

dim(friend.data.w1)

dim(alcfrq)

# Create the sienaNet object

friendties <- sienaNet(array(c(friend.data.w1, friend.data.w2),

dim=c(nrow(attr5809), nrow(attr5809), 2)))

alcdrinkbeh <- sienaNet(alcfrq, type="behavior")

# Name the attribute variables to be included in the models

ah\_pvt <- coCovar(attr5809[,36])

age <- coCovar(attr5809[,40])

male <- coCovar(attr5809[,42])

parentdrkfrq <- coCovar(attr5809[,55])

parentdrkfiv <- coCovar(attr5809[,56])

tobacco <- coCovar(attr5809[,58])

**Task 3.** Create the RSiena data object.

# Create the siena data object for running RSiena

data5809 <- sienaDataCreate(friendties,ah\_pvt,age,male,parentdrkfrq,

parentdrkfiv,tobacco,alcdrinkbeh)

eff5809 <- getEffects(data5809)

# Export statistics about the data objects

print01Report(data5809,modelname = 'class5809\_init')

**Task 4.** Open the 'class5809\_init' file in Word or Notepad and examine what output has been created by the program.

**Questions:**

**1. What are the network densities at wave 1 and wave 2?**

0.016 0.013

**2. How many adolescents are missing wave 2 data?**

470

**3. How many adolescents increase drinking frequency between wave 1 and wave 2?**

64

**Task 5.** Run the RSiena null model.

# Examine null model effects to be included

eff5809

# Run the null model

model5809 <- sienaModelCreate(useStdInits = FALSE,

projname = 'class5809\_run1')

ans5809 <- siena07(model5809, data=data5809, effects=eff5809,

batch=FALSE, verbose=FALSE)

ans5809

summary(ans5809)

**Questions:**

**4. Which effects are significant in the null model? Interpret the findings.**

reciprocity (estimate is more than double of standard error )

density (much less than 50 %)

**Task 6.** Add additional model effects. Rerun the RSiena models.

# Examine possible effects to include in the model

eff5809$effectName

# Include network co-evolution variables

dataset.5809 <- sienaDataCreate(friendties,ah\_pvt,age,male,parentdrkfrq,tobacco,alcdrinkbeh)

effects.5809 <- getEffects(dataset.5809)

effects.5809 <- includeEffects(effects.5809,transTrip,type="eval")

effects.5809 <- includeEffects(effects.5809,cycle3,type="eval")

effects.5809 <-

includeEffects(effects.5809,simX,type="eval",interaction1="age") #age similarity

effects.5809 <-

includeEffects(effects.5809,sameX,type="eval",interaction1="male") #same gender

effects.5809 <- includeEffects(effects.5809,simX,type="eval",interaction1="ah\_pvt") #similar scholastic aptitude

effects.5809 <- includeEffects(effects.5809,simX,type="eval",interaction1="alcdrinkbeh") #similar alcoholic use

effects.5809 <- includeEffects(effects.5809,name="alcdrinkbeh",maxAlt,interaction1="friendties") #maximum exposure

# effects.5809 <- includeEffects(effects.5809,name="alcdrinkbeh",avRecAlt,interaction1="friendties") #average exposure

effects.5809 <- includeEffects(effects.5809,name="alcdrinkbeh",effFrom,type="eval",interaction1="age") #age effect

effects.5809 <- includeEffects(effects.5809,name="alcdrinkbeh",effFrom,type="eval",interaction1="parentdrkfrq") #parent drinking effect

effects.5809 <- includeEffects(effects.5809,name="alcdrinkbeh",effFrom,type="eval",interaction1="tobacco") #tobacco effect

effects.5809 <- includeEffects(effects.5809,name="alcdrinkbeh",effFrom,type="eval",interaction1="ah\_pvt") #ah\_pvt effect

# Run the full model

model5809 <- sienaModelCreate(useStdInits = FALSE,

projname = 'class5809\_run2')

ans5809 <- siena07(model5809, data=dataset.5809, effects=effects.5809,

batch=FALSE, verbose=FALSE)

ans5809

summary(ans5809)

**Questions:**

**5. Which additional effects are significant in the model? Interpret the results.**

tobacco, reciprocity, alcdrinkbeh period 1, 3 cycle(imbalance or hierarchy), no significance to age

**Task 7**. Summary write-up. Write up a short description of your RSiena analysis of students in the Class5809 dataset. Suggest directions for future research.

From the analysis, we can say that tobacco, alcohol drinking frequency have significant impact on changes of network ties. I would like to test if gpa, MedianIncome have any impact on the change of ties. Also it would be worth knowing if children with higher aptitude are more likely to be mentioned as friends

or if gender has any impact on change of behavior.