

**CSE3021**

**Social and Information Networks**

**FACULTY: PUNITHA K – SCOPE**

**SLOT: B2 + TB2**

**PROJECT REPORT**

**EXAMINING AND ANALYISING 9/11 ATTTACK AS A SOCIAL NETWORK**

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**ABSTRACT**

This project looks at mapping covert networks using data available from news sources on the World Wide Web. Specifically, we examine the network surrounding the tragic events of September 11th 2001. Through public data we are able to map a portion of the network centered on the 19 dead hijackers. This map gives us some insight into the terrorist organization, yet it is incomplete. Suggestions for further work and research are offered.

Famous dataset of the terrorists involved in the 9/11 bombing of the World Trade Centres in 2001. Data was extracted from news reports and ties range from at school with to on same plane. Ties are undirected and binary. Relations are a mix of prior-contacts like trained together, lived together, financial transactions, at school with, on same flight

## **INTRODUCTION AND BACKGROUND**

We were all shocked by the tragic events of September 11, 2001. In the non-stop stream of news and analysis one phrase was continuously repeated - "terrorist network." Everyone talked about this concept, and described it as amorphous, invisible, resilient, and dispersed.

We will set out to map this network of terrorist cells that had so affected all of the lives.

Our aim would be to uncover network patterns that would reveal Al Qaeda's preferred methods of stealth organization. If we know what patterns of organization they prefer, we may know what to look for as we search them out in countries across the world.

**DATA SOURCE**

Our data sources were publicly released 4 research papers

For guidance we turned to previous work by social network theorists who had studied covert, secret, or illegal networks. We found four excellent papers that formed a working foundation for the knowledge we would use to pursue this project.

1. Uncloaking Terrorist Network(By Valdis E.Krebs) November 4th-1st April.This Reasearch paper is our main source for our project.This research paper provides us the Complete Dataset required for this project
2. Malcolm Sparrow (Sparrow, 1991) examines the application of social network analysis to criminal activity. Sparrow describes three problems of criminal network analysis that I soon encountered.
3. Incompleteness - the inevitability of missing nodes and links that the investigators will not uncover.
4. Fuzzy boundaries - the difficulty in deciding who to include and who not to include.
5. Dynamic - these networks are not static, they are always changing.

Instead of looking at the presence or absence of a tie between two individuals, Sparrow suggests looking at the waxing and waning strength of a tie depending upon the time and the task at hand.

1. Wayne Baker and Robert Faulkner (Baker and Faulkner, 1993) suggest looking at archival data to derive relationship data. The data they used to analyze illegal price-fixing networks were mostly court documents and sworn testimony. This data included accounts of observed interpersonal relationships from various witnesses.
2. Bonnie Erickson (Erickson, 1981) reveals the importance of trusted prior contacts for the effective functioning of a secret society. The 19 hijackers appeared to have come from a network that had formed while they were completing terrorist training in Afghanistan. Many were school chums from many years ago, some had lived together for years, and others were related by kinship ties. Deep trusted ties, that were not easily visible to outsiders, wove this terror network together.

**DATA GATHERING**

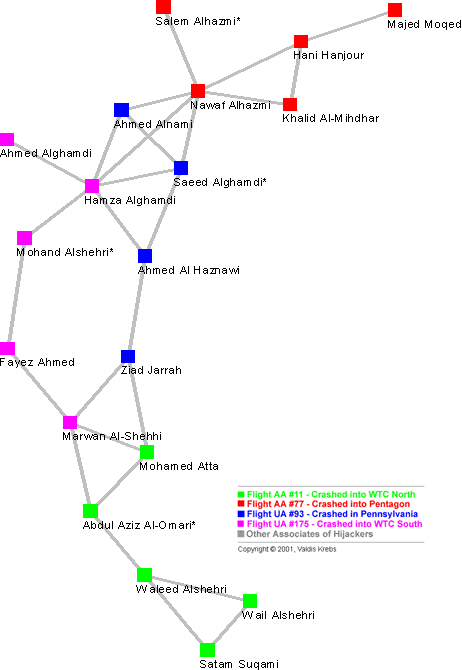
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Within one week of the attack, information from the investigation started to become public. We soon knew there were 19 hijackers, which planes they were on, and which nation's passports they had used to get into America. As more information about the hijackers' past was uncovered he decided to map links of three strengths (and corresponding thickness). The tie strength would largely be governed by the amount of time together by a pair of terrorists. Those living together or attending the same school or the same classes/training would have the strongest ties. Those traveling together and participating in meetings together would have ties of moderate strength and medium thickness. Finally, those who were recorded as having a single transaction together, or an occasional meeting, and no other ties, we classified as weak ties that were shown with the thinnest links in the network.

We started our mapping project upon seeing several summaries of data about the hijackers in major newspapers (Sydney Morning Herald, 2001; Washington Post, 2001). These data collections contained information about the nodes/hijackers and their links/relationships. From two to six weeks after the event, it appeared that a new relationship or node was added to the network on a daily basis. Several false stories appeared about a cell in Detroit. These stories, originally reported with great fanfare, were proven false within one week. This made us very cautious about adding a link or a node to the network.

The network was created iteratively as data became available.

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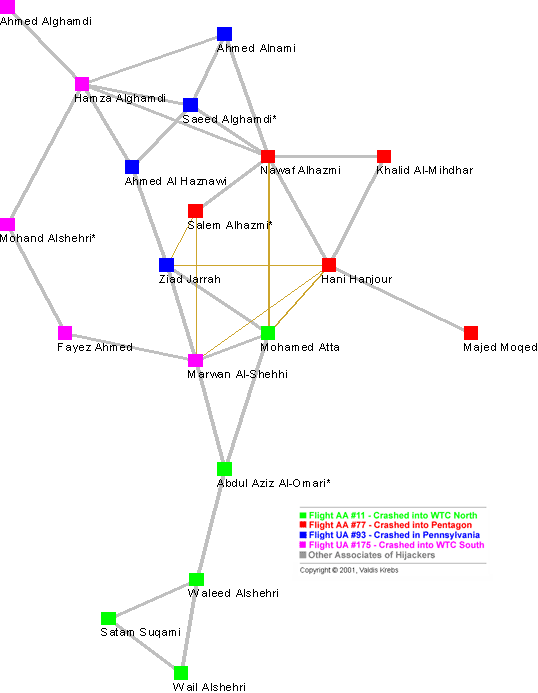


The network metrics for the network in [Figure 2](https://firstmonday.org/ojs/index.php/fm/article/download/941/863?inline=1#fig2) are found in [Table 1](https://firstmonday.org/ojs/index.php/fm/article/download/941/863?inline=1#tab1). For a small network of less than 20 nodes, we see a long average path length of 4.75 steps. Several of the hijackers are separated by more than 6 steps. From this metric and bin Laden's comments above we see that covert networks trade efficiency for secrecy.

**Table 1: Small-World Network Metrics**

|  |  |  |
| --- | --- | --- |
|  | **Clustering Coefficient** | **Average Path Length** |
| **Contacts** | 0.41 | 4.75 |
| **Contacts + Shortcuts** | 0.42 | 2.79 |

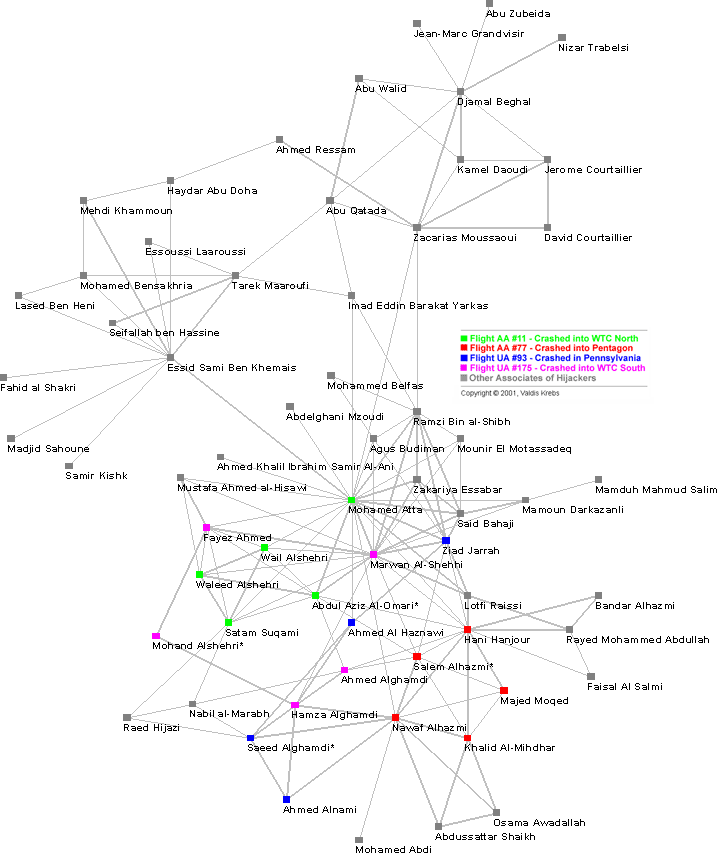
Yet, work has to be done, plans have to be executed. How does a covert network accomplish its goals? Through the judicious use of transitory shortcuts (Watts, 1999) in the network. Meetings were held that connected distant parts of the network to coordinate tasks and report progress. After coordination was accomplished, the cross-ties went dormant. One well documented meeting of the hijacker network took place in Las Vegas. The ties from this and other meetings are shown in gold in [Figure 3](https://firstmonday.org/ojs/index.php/fm/article/download/941/863?inline=1#fig3).



**Figure 3**

Six (6) shortcuts were added to the network temporarily in order to collaborate and coordinate. These shortcuts reduced the average path length in the network by over 40% thus improving the information flow in the network - see [Table 1](https://firstmonday.org/ojs/index.php/fm/article/download/941/863?inline=1#tab1). When the network is brought closer together by these shortcuts, all of the pilots ended up in a small clique - the perfect structure to efficiently coordinate tasks and activities. There is a constant dynamic between keeping the network hidden and actively using it to accomplish objectives (Baker and Faulkner, 1993).

The 19 hijackers did not work alone. They had other accomplices that did not get on the planes. These co-conspirators were conduits for money and also provided needed skills and knowledge. [Figure 4](https://firstmonday.org/ojs/index.php/fm/article/download/941/863?inline=1#fig4) shows the hijackers and their network neighborhood - their direct and indirect associates.



**Figure 4**

After one month of investigation it was 'common knowledge' that Mohamed Atta was the ring leader of this conspiracy. Again, bin Laden verified Atta's leadership role in the video tape (U.S. Department of Defense, 2001). Looking at the diagram he has the most connections. In [Table 2](https://firstmonday.org/ojs/index.php/fm/article/download/941/863?inline=1#tab2) we see that Atta scores the highest on all network centrality metrics - Degrees, Closeness, and Betweenness (Freeman, 1979). The network metric Degrees reveals Atta's *activity* in the network. Closeness measures his ability to *access* others in the network and monitor what is happening. Betweenness shows his *control* over the flow in the network - he plays the role of a *broker* in the network. These metrics support his leader status.

 DATA SET

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**USING R STUDIO**

Code:

#LOADING PACKAGES

library (igraph)

library (readr)

library (haven)

library (ggplot2)

C\_Network <- read.csv('D:\\Documents\\Social Networks\\9\_11\_hijackers.csv')

D\_Network <- read.csv('D:\\Documents\\Social Networks\\9\_11\_hijackers.csv')

#####################################################################

# Formatting the Data to Create an iGraph Style Edge List and Graph #

#####################################################################

#Creating an iGraph Style Edgelist

C\_EdgeList <- C\_Network

#Creating a Graph Obeject for Subsequent Analyses

#Importantly, we define here whether the graph will be directed or not

C\_Graph=graph.data.frame(C\_EdgeList, directed=TRUE)

#Creating an iGraph Style Edgelist

D\_EdgeList <- D\_Network

#Creating a Graph Obeject for Subsequent Analyses

#Importantly, we define here whether the graph will be directed or not

D\_Graph=graph.data.frame(D\_EdgeList, directed=TRUE)

#####################

# Visualizations #

#####################

#C Network: First Try

#Layout Options

set.seed(3952) # set seed to make the layout reproducible

layout1 <- layout.fruchterman.reingold(C\_Graph) #Creating a layout object to tell iGraph what layout I want

#Node or Vertex Options: Color

V(C\_Graph)$color <- "grey"

V(C\_Graph)[degree(C\_Graph, mode="in")>8]$color <- "yellow" #Destinguishing High Degree Nodes as yellow

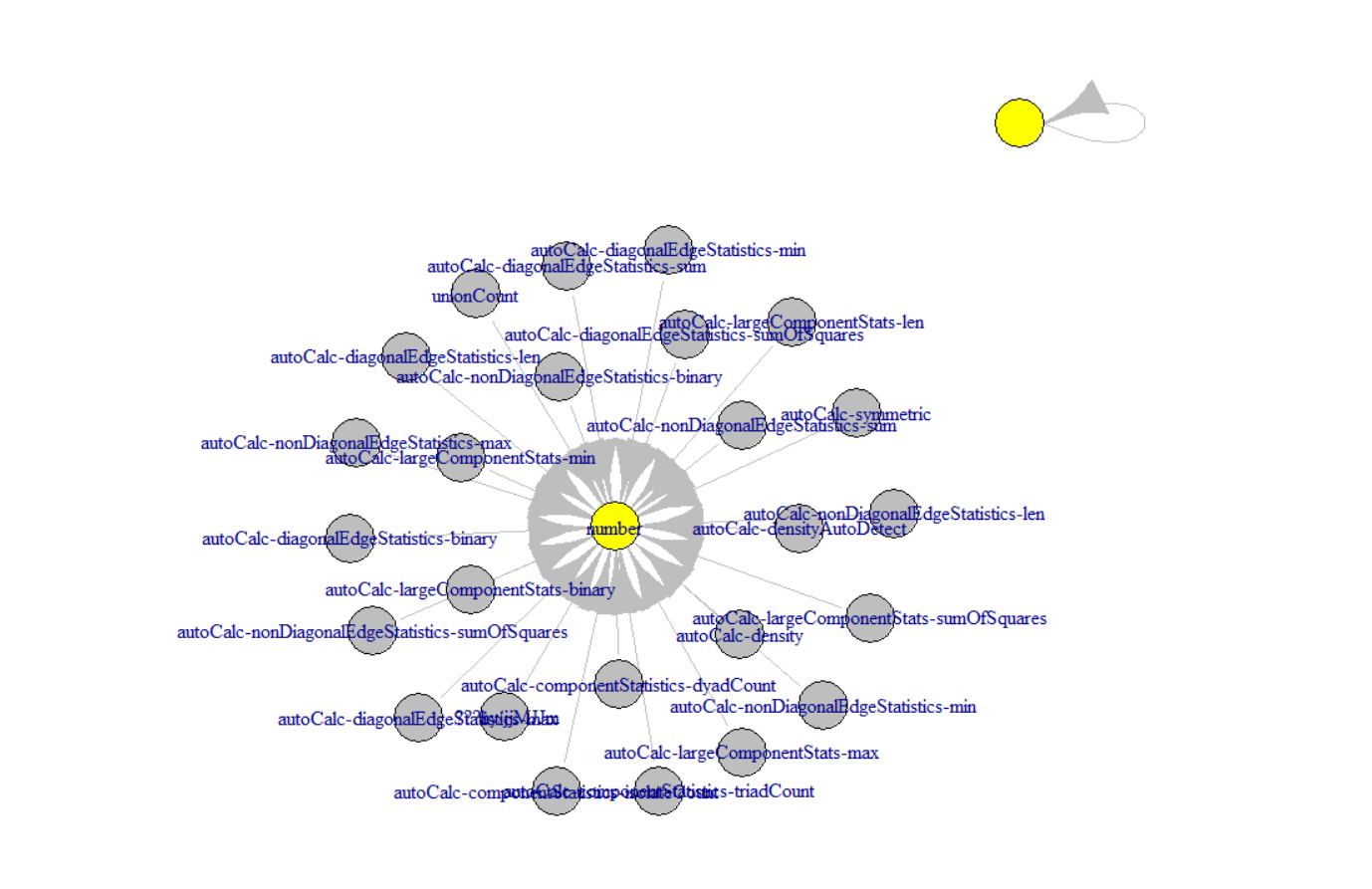
#Edge Options: Siz

E(C\_Graph)$color <- "grey"

#Plotting

plot(C\_Graph)

#Verdict: Pretty Ugly, let's try to fix this.



##########################

# D Networks #

##########################

#Removing Self-Loops (Repondents Nominating Themselves)

D\_Graph2<-simplify(D\_Graph, remove.multiple=TRUE, remove.loops=TRUE)

#Layout Options

set.seed(3952) # set seed to make the layout reproducible

layout1 <- layout.fruchterman.reingold(D\_Graph2,niter=500)

#Node or Vetex Options: Size and Color

V(D\_Graph2)$size=degree(D\_Graph, mode = "in")/5 #because we have wide range, I am dividing by 5 to keep the high in-degree nodes from overshadowing everything else.

#V(D\_Graph2)$color <- ifelse(D\_Attributes[V(D\_Graph2), 2] == "Researcher", "blue", "red")

#Edge Options: Color

E(D\_Graph2)$color <- "grey"

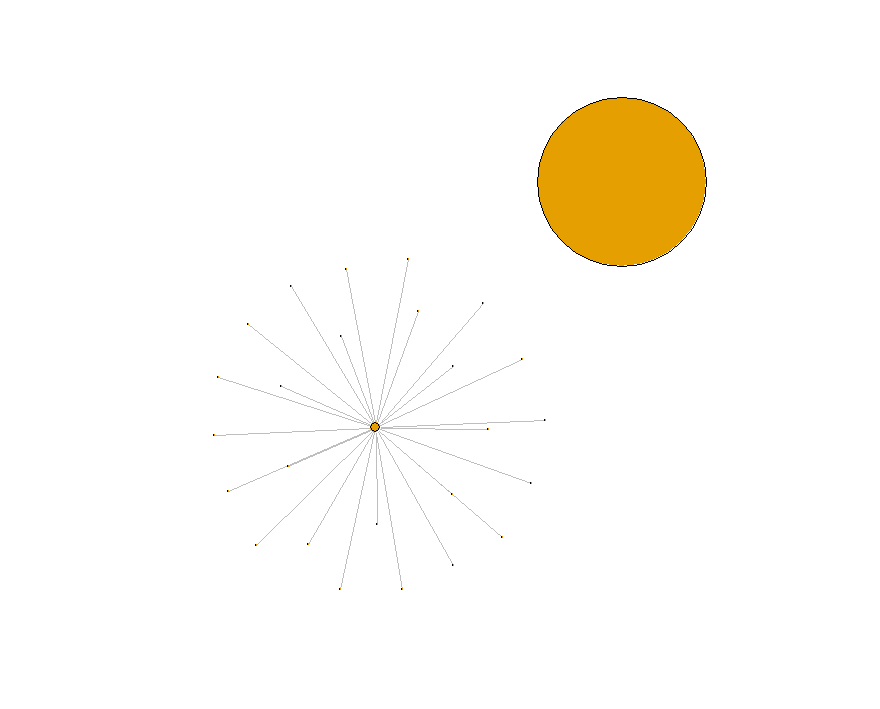
#Plotting, Now Specifying an arrow size and getting rid of arrow heads

#We are letting the color and the size of the node indicate the directed nature of the graph

plot(D\_Graph2, edge.arrow.size=0.25,edge.arrow.mode = "-", vertex.label = NA)

#Verdict, Maybe a different layout?

#Verdict: Maybe a bit better, but maybe not??



#######################################################################

# Thinking about the Network in Terms of Connectivity and Position #

#######################################################################

#CONNECTIVITY

#Density

graph.density(D\_Graph2,loop=FALSE)

graph.density(C\_Graph2, loop=FALSE)

#Average Path Length

mean\_distance(D\_Graph2)

mean\_distance(C\_Graph2)

#Degree Distribution

degree\_distribution(D\_Graph2)

D\_DegreeDis <- degree\_distribution(D\_Graph2) #Turns this into a data object we can export

D\_DegreeDis2 <- as.data.frame(D\_DegreeDis)

qplot(D\_DegreeDis, data=D\_DegreeDis2, geom="histogram", binwidth=.001)

#Clustering Coefficeint

transitivity(D\_Graph2)

transitivity(C\_Graph2)

D\_Trans <- transitivity(D\_Graph2)



#POSITION

#Degree: In, Out, All Centrality

D\_OutDegree <- degree(D\_Graph2, mode = "out")

D\_OutDegree <- as.data.frame(D\_OutDegree)

degree(D\_Graph2, mode = "in")

D\_InDegree <- degree(D\_Graph2, mode = "in")

D\_InDegree <- as.data.frame(D\_InDegree)

#Layout Options

set.seed(3952) # set seed to make the layout reproducible

layout1 <- layout.fruchterman.reingold(D\_Graph2,niter=500)

#Node or Vetex Options: Size and Color

V(D\_Graph2)$size=degree(D\_Graph, mode = "all")/5 #because we have wide range, I am dividing by 5 to keep the high in-degree nodes from overshadowing everything else.

# V(D\_Graph2)$color <- ifelse(D\_Attributes[V(D\_Graph2), 2] == "Researcher", "blue", "red")

#Edge Options: Color

E(D\_Graph2)$color <- "grey"

#Plotting, Now Specifying an arrow size and getting rid of arrow heads

#We are letting the color and the size of the node indicate the directed nature of the graph

plot(D\_Graph2, edge.arrow.size=0.25,edge.arrow.mode = "-", vertex.label = NA)

#Closeness Centrality

closeness(D\_Graph2, mode="in")

D\_InCloseness <- closeness(D\_Graph2, mode="in")

D\_InCloseness <- as.data.frame(D\_InCloseness)

D\_OutCloseness <- closeness(D\_Graph2, mode="out")

D\_OutCloseness <- as.data.frame(D\_OutCloseness)

closeness(D\_Graph2, mode="out")

closeness(D\_Graph2, mode="all")

#Layout Options

set.seed(3952) # set seed to make the layout reproducible

layout1 <- layout.fruchterman.reingold(D\_Graph2,niter=500)

#Node or Vetex Options: Size and Color

V(D\_Graph2)$size=closeness(D\_Graph, mode = "out")/.05#because we have wide range, I am dividing by 5 to keep the high in-degree nodes from overshadowing everything else.

# V(D\_Graph2)$color <- ifelse(D\_Attributes[V(D\_Graph2), 2] == "Researcher", "blue", "red")

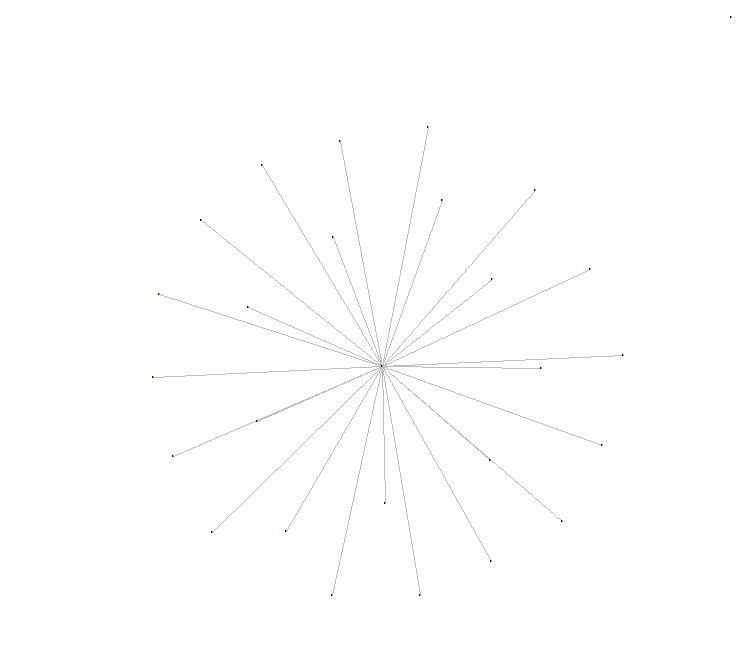
#Edge Options: Color

E(D\_Graph2)$color <- "grey"

#Plotting, Now Specifying an arrow size and getting rid of arrow heads

#We are letting the color and the size of the node indicate the directed nature of the graph

plot(D\_Graph2, edge.arrow.size=0.25,edge.arrow.mode = "-", vertex.label = NA)



#Closeness Centrality

closeness(D\_Graph2, mode="in")

D\_InCloseness <- closeness(D\_Graph2, mode="in")

D\_InCloseness <- as.data.frame(D\_InCloseness)

D\_OutCloseness <- closeness(D\_Graph2, mode="out")

D\_OutCloseness <- as.data.frame(D\_OutCloseness)

closeness(D\_Graph2, mode="out")

closeness(D\_Graph2, mode="all")

#Layout Options

set.seed(3952) # set seed to make the layout reproducible

layout1 <- layout.fruchterman.reingold(D\_Graph2,niter=500)

#Node or Vetex Options: Size and Color

V(D\_Graph2)$size=closeness(D\_Graph, mode = "out")/.05#because we have wide range, I am dividing by 5 to keep the high in-degree nodes from overshadowing everything else.

# V(D\_Graph2)$color <- ifelse(D\_Attributes[V(D\_Graph2), 2] == "Researcher", "blue", "red")

#Edge Options: Color

E(D\_Graph2)$color <- "grey"

#Plotting, Now Specifying an arrow size and getting rid of arrow heads

#We are letting the color and the size of the node indicate the directed nature of the graph

plot(D\_Graph2, edge.arrow.size=0.25,edge.arrow.mode = "-", vertex.label = NA)

#Betweeness Centrality

D\_Betweeness <- betweenness(D\_Graph2)

D\_Betweeness <- as.data.frame(D\_Betweeness)

#Layout Options

set.seed(3952) # set seed to make the layout reproducible

layout1 <- layout.fruchterman.reingold(D\_Graph2,niter=500)

#Node or Vetex Options: Size and Color

V(D\_Graph2)$size=betweenness(D\_Graph)/200 #because we have wide range, I am dividing by 5 to keep the high in-degree nodes from overshadowing everything else.

V(D\_Graph2)$color <- ifelse(D\_Attributes[V(D\_Graph2), 2] == "Researcher", "blue", "red")

#Edge Options: Color

E(D\_Graph2)$color <- "grey"

#Plotting, Now Specifying an arrow size and getting rid of arrow heads

#We are letting the color and the size of the node indicate the directed nature of the graph

plot(D\_Graph2, edge.arrow.size=0.25,edge.arrow.mode = "-", vertex.label = NA)

#Eigen Vector Centrality

eigen\_centrality(D\_Graph2)

D\_EigenCentrality <- eigen\_centrality(D\_Graph2)

D\_EigenCentrality <- as.data.frame(D\_EigenCentrality)

#Layout Options

set.seed(3952) # set seed to make the layout reproducible

layout1 <- layout.fruchterman.reingold(D\_Graph2,niter=500)

#Node or Vetex Options: Size and Color

V(D\_Graph2)$size=eigen\_centrality(D\_Graph)/5 #because we have wide range, I am dividing by 5 to keep the high in-degree nodes from overshadowing everything else.

V(D\_Graph2)$color <- ifelse(D\_Attributes[V(D\_Graph2), 2] == "Researcher", "blue", "red")

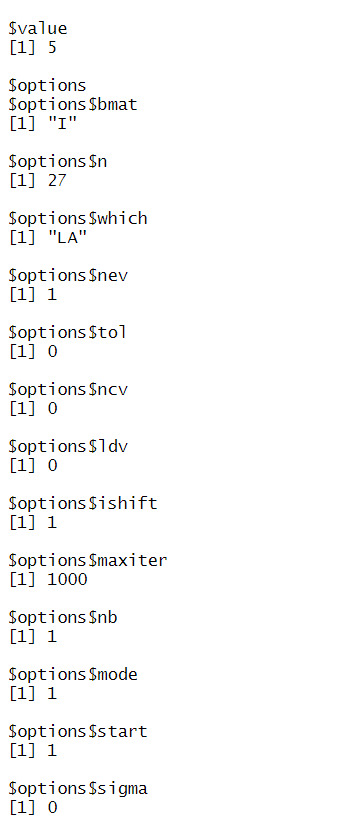
#Edge Options: Color

E(D\_Graph2)$color <- "grey"

#Plotting, Now Specifying an arrow size and getting rid of arrow heads

#We are letting the color and the size of the node indicate the directed nature of the graph

plot(D\_Graph2, edge.arrow.size=0.25,edge.arrow.mode = "-", vertex.label = NA)



######################################################

# Segue to Advanced Network Visualization Techniques #

######################################################

GNC <- cluster\_edge\_betweenness(D\_Graph2, weights = NULL)

V(D\_Graph2)$color <-membership(GNC) #Plot setting specifying the coloring of vertices by community

D\_Graph2$palette <- diverging\_pal(length(GNC)) #Plot setting specifying the color pallette I am using (iGraph supports 3)

plot(D\_Graph2, edge.arrow.size=0.25,edge.arrow.mode = "-", vertex.label = NA)

#Verdict: This is one answer, probably not the best one, but more on that next time.

**CONCLUSION:**

**Table 2: Hijacker Network Neighborhood**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Degrees \* possible false ID** | | **Betweenness** | | **Closeness** | |
| 0.361 | Mohamed Atta | 0.588 | Mohamed Atta | 0.587 | Mohamed Atta |
| 0.295 | Marwan Al-Shehhi | 0.252 | Essid Sami Ben Khemais | 0.466 | Marwan Al-Shehhi |
| 0.213 | Hani Hanjour | 0.232 | Zacarias Moussaoui | 0.445 | Hani Hanjour |
| 0.180 | Essid Sami Ben Khemais | 0.154 | Nawaf Alhazmi | 0.442 | Nawaf Alhazmi |
| 0.180 | Nawaf Alhazmi | 0.126 | Hani Hanjour | 0.436 | Ramzi Bin al-Shibh |
| 0.164 | Ramzi Bin al-Shibh | 0.105 | Djamal Beghal | 0.436 | Zacarias Moussaoui |
| 0.164 | Ziad Jarrah | 0.088 | Marwan Al-Shehhi | 0.433 | Essid Sami Ben Khemais |
| 0.148 | Abdul Aziz Al-Omari\* | 0.050 | Satam Suqami | 0.424 | Abdul Aziz Al-Omari\* |
| 0.131 | Djamal Beghal | 0.048 | Ramzi Bin al-Shibh | 0.424 | Ziad Jarrah |
| 0.131 | Fayez Ahmed | 0.043 | Abu Qatada | 0.409 | Imad Eddin Barakat Yarkas |
| 0.131 | Salem Alhazmi\* | 0.034 | Tarek Maaroufi | 0.409 | Satam Suqami |
| 0.131 | Satam Suqami | 0.033 | Mamoun Darkazanli | 0.407 | Fayez Ahmed |
| 0.131 | Zacarias Moussaoui | 0.029 | Imad Eddin Barakat Yarkas | 0.404 | Lotfi Raissi |
| 0.115 | Hamza Alghamdi | 0.026 | Fayez Ahmed | 0.401 | Wail Alshehri |
| 0.115 | Said Bahaji | 0.023 | Abdul Aziz Al-Omari\* | 0.399 | Ahmed Al Haznawi |
| 0.098 | Khalid Al-Mihdhar | 0.022 | Hamza Alghamdi | 0.399 | Said Bahaji |
| 0.098 | Saeed Alghamdi\* | 0.017 | Ziad Jarrah | 0.391 | Agus Budiman |
| 0.098 | Tarek Maaroufi | 0.015 | Ahmed Al Haznawi | 0.391 | Zakariya Essabar |
| 0.098 | Wail Alshehri | 0.013 | Salem Alhazmi\* | 0.389 | Mamoun Darkazanli |
| 0.098 | Wail Alshehri | 0.013 | Salem Alhazmi\* | 0.389 | Mamoun Darkazanli |
| 0.098 | Waleed Alshehri | 0.012 | Lotfi Raissi | 0.389 | Mounir El Motassadeq |
| 0.082 | Abu Qatada | 0.012 | Saeed Alghamdi\* | 0.389 | Mustafa Ahmed al-Hisawi |
| 0.082 | Agus Budiman | 0.011 | Agus Budiman | 0.372 | Abdelghani Mzoudi |
| 0.082 | Ahmed Alghamdi | 0.007 | Ahmed Alghamdi | 0.372 | Ahmed Khalil Al-Ani |
| 0.082 | Lotfi Raissi | 0.007 | Ahmed Ressam | 0.365 | Salem Alhazmi\* |
| 0.082 | Zakariya Essabar | 0.007 | Haydar Abu Doha | 0.361 | Hamza Alghamdi |
| 0.066 | Ahmed Al Haznawi | 0.006 | Kamel Daoudi | 0.343 | Abu Qatada |
| 0.066 | Imad Eddin Barakat Yarkas | 0.006 | Khalid Al-Mihdhar | 0.343 | Tarek Maaroufi |
| 0.066 | Jerome Courtaillier | 0.004 | Mohamed Bensakhria | 0.339 | Ahmed Alghamdi |
| 0.066 | Kamel Daoudi | 0.003 | Nabil al-Marabh | 0.335 | Waleed Alshehri |
| 0.066 | Majed Moqed | 0.002 | Jerome Courtaillier | 0.332 | Djamal Beghal |
| 0.066 | Mamoun Darkazanli | 0.002 | Mustafa Ahmed al-Hisawi | 0.332 | Khalid Al-Mihdhar |
| 0.066 | Mohamed Bensakhria | 0.002 | Said Bahaji | 0.332 | Saeed Alghamdi\* |
| 0.066 | Mounir El Motassadeq | 0.002 | Wail Alshehri | 0.328 | Majed Moqed |
| 0.066 | Mustafa Ahmed al-Hisawi | 0.001 | Abu Walid | 0.324 | Ahmed Ressam |
| 0.066 | Nabil al-Marabh | 0.001 | Mehdi Khammoun | 0.323 | Ahmed Alnami |
| 0.066 | Rayed Mohammed Abdullah | 0.001 | Mohand Alshehri\* | 0.323 | Nabil al-Marabh |
| 0.049 | Abdussattar Shaikh | 0.001 | Raed Hijazi | 0.321 | Haydar Abu Doha |
| 0.049 | Abu Walid | 0.001 | Rayed Mohammed Abdullah | 0.319 | Mohamed Bensakhria |
| 0.049 | Ahmed Alnami | 0.001 | Waleed Alshehri | 0.316 | Essoussi Laaroussi |
| 0.049 | Haydar Abu Doha | 0.000 | Abdelghani Mzoudi | 0.316 | Jerome Courtaillier |
| 0.049 | Mehdi Khammoun | 0.000 | Abdussattar Shaikh | 0.316 | Kamel Daoudi |
| 0.049 | Osama Awadallah | 0.000 | Abu Zubeida | 0.316 | Seifallah ben Hassine |
| 0.049 | Raed Hijazi | 0.000 | Ahmed Alnami | 0.314 | Rayed Mohammed Abdullah |
| 0.033 | Ahmed Ressam | 0.000 | Ahmed Khalil Al-Ani | 0.313 | Raed Hijazi |
| 0.033 | Bandar Alhazmi | 0.000 | Bandar Alhazmi | 0.311 | Abdussattar Shaikh |
| 0.033 | David Courtaillier | 0.000 | David Courtaillier | 0.311 | Bandar Alhazmi |
| 0.033 | Essoussi Laaroussi | 0.000 | Essoussi Laaroussi | 0.311 | Faisal Al Salmi |
| 0.033 | Faisal Al Salmi | 0.000 | Faisal Al Salmi | 0.311 | Mohand Alshehri\* |
| 0.033 | Lased Ben Heni | 0.000 | Faisal Al Salmi | 0.311 | Osama Awadallah |
| 0.033 | Mohammed Belfas | 0.000 | Jean-Marc Grandvisir | 0.308 | Mehdi Khammoun |
| 0.033 | Mohand Alshehri\* | 0.000 | Lased Ben Heni | 0.308 | Mohamed Abdi |
| 0.033 | Seifallah ben Hassine | 0.000 | Madjid Sahoune | 0.307 | David Courtaillier |
| 0.016 | Abdelghani Mzoudi | 0.000 | Majed Moqed | 0.307 | Mohammed Belfas |
| 0.016 | Abu Zubeida | 0.000 | Mamduh Mahmud Salim | 0.305 | Lased Ben Heni |
| 0.016 | Ahmed Khalil Al-Ani | 0.000 | Mohamed Abdi | 0.303 | Fahid al Shakri |
| 0.016 | Fahid al Shakri | 0.000 | Mohammed Belfas | 0.303 | Madjid Sahoune |
| 0.016 | Jean-Marc Grandvisir | 0.000 | Mounir El Motassadeq | 0.303 | Samir Kishk |
| 0.016 | Madjid Sahoune | 0.000 | Nizar Trabelsi | 0.281 | Mamduh Mahmud Salim |
| 0.016 | Mamduh Mahmud Salim | 0.000 | Osama Awadallah | 0.264 | Abu Walid |
| 0.016 | Mohamed Abdi | 0.000 | Samir Kishk | 0.250 | Abu Zubeida |
| 0.016 | Nizar Trabelsi | 0.000 | Seifallah ben Hassine | 0.250 | Jean-Marc Grandvisir |
| 0.016 | Samir Kishk | 0.000 | Zakariya Essabar | 0.250 | Nizar Trabelsi |
|  |  |  |  |  |  |
| **0.081** | **Average** | **0.032** | **Average** | **0.052** | **Average** |
| **0.289** | **Centralization** | **0.565** | **Centralization** | **0.482** | **Centralization** |