

Finding bin-Laden's Successor Using Social Network Analysis

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1 Introduction

Abstract: After 9/11, CIA was (badly in) search of their number one terrorist from designated terrorist group Al-Qaeda; Osama bin Mohammed Laden. They quell the Al-Qaeda, smash the terrorist in 5Afghanistan and created chaos. After Osama's removal there was need of suitable replacement, to run, operate Al-Qaeda they required frontier. There was some handful of people, who could hoist Bin Laden's ideology. The paper will be discussing the possible successor of bin-laden using media based sampled and social network analysis. The result explains how the conclusion is drawn using network science concepts.

2 Introduction

Immediately after 9/11 happened, CIA's rapid response team slipped into Afghanistan. The team of furious officers started their operation to crush Al-Qaeda, destroy Talibanes and capture and kill Osama bin Laden the mastermind behind 9/11. The operation "Jawbreaker" began on September 26, 2001, just after 9/11 happened. Soon after the launch, American drone started killing clump of terrorists through air strike on targeted locations. The mission has changed the American warfare, in history of CIA; who's focus has been on collecting the intelligence and do the analysis to provide input to the policy

makers of US [1].

Osama bin Mohammed Laden or infamously known as Osama bin Laden got removed from Al-Qaeda and shifted to far south of Afghanistan and after staying some days there he moved on to country nearer from there. The Al-Qaeda become weaker and weaker, in order to rejuvenate the movement, usually leaders of terrorist group choose the chief, who can upraise the terrorism again.

To limit such actions, terrorist network should be identified and analyzed. Such analysis of terrorist's network is important, which can help to remove the terrorism from its root. Even after quelling the terrorist organization, potential leader from the terrorist group stand up and start the movement of terrorism again.

No doubt bin-Laden was good in inspiring people under the name of Islam, raise money, train recruiters. Long before his assassination, bin-Laden was reluctant from al-Qaeda, was living in small city of Pakistan. Even after bin laden was concealed, al-Qaeda survived. Al-Qaeda is type of organization, who survived even after its leader. After bin-Laden's solitude, Ayman al-Zawahiri was in charge of al-Qaeda for years.

Dynamics of terrorist network is a less explored area, this paper will explore the area and find most suitable replacement of bin-Laden using Social Network Analysis (SNA). Of course, to become bin-Laden's successor, one should have all the quality which bin-

Laden had.

3 Analyzing (bin-Laden’s) al-Qaeda network

The data is collected from websites, newspaper, media source and additional sources who supplement the information about terrorist groups specifically al-Qaeda and its associates. The collected data used for analysis is purposively sampled. This paper refers data provided in “PRESPECTIVE ON TERRORISM” [2]. Selection of samples are based of strong connectivity of individuals with some initially identified important terrorist of al-Qaeda. Samples hop the individual who does not produce enough connection evidence with al-Qaeda’s terrorist operation. The sampled network consists of n=54 high-profile al-Qaeda terrorist, who were strongly connected with the terrorist activity. **Sample Inside:** The collected samples are categorized mainly in four categories illustrated in table below.

Most of the terrorist are coming from the age between 20 to 49, all are male, accumulates about 60%, there are some Unknown entries as well, who’s age are not available. The samples kept the captured and dead samples, even they can’t be replacement of bin-Laden, they are material to the analysis through their connectivity to important nodes. Overall 75.9% of terrorist comes from Middle-East, 29.6% from Northern Africa region and some (16.7%) hold multiple nationality.

The terrorist belongs to different terrorist activity, sampled data contains the individuals who where involved in terrorist activity corroborated with al-Qaeda. 74.1% of terrorist in samples belong to al-Qaeda, 14.8% with Afghan-Soviet war and other (such as Egyptian Islamic Jihad) are 33.3%. The specification reveals the involvement in different activities of terrorist group, most of the members were involved in Operations about 29.6%, while public relation and politics 11.1%, another major chunk involved in military-training & weapons., other are theology, assistance and others mentioned in table2.

Large part of terrorist mission is unspecified ac-

Group	Values	Frequ- ency	Percentage
Age	20-34	10	18.5
	35-49	22	40.7
	50<	9	16.7
	Unknown	13	24.1
Status	Alive	17	31.5
	Captured	15	27.8
	Dead	22	40.7
Nationality	Afghanistan	2	3.7
	Bosnia	2	3.7
	Egypt	9	16.7
	Iraq	2	3.7
	Jordan	2	3.7
	Kuwait	4	7.4
	Libya	2	3.7
	Morocco	2	3.7
	Pakistan	3	5.6
	Palestine	2	3.7
	Saudi Arabia	13	24.1
	Sudan	2	3.7
Relationship	Yemen	8	14.8
	Other	12	22.2
	Family	3	5.6
	Close Friend	8	14.8
	Professional	3	5.6
	Unknown	40	74.1

Table 1: al-Qaeda Terrorist network characteristic

According to collected data, part from it majority of terrorist engaged in September 11 incident about 24.1%, USS cole bombing involvement was 9.3% followed by world trade center 93 attached with 7.4% terrorist involvement and so on.

3.1 Analytic Approach

Social Network Analysis is the process of investigating social structures through the use of networks and graph theory [3]. It is helpful in analyzing the nodes (individual actors, people) and the ties, edges considered to be link between individuals and how deep they are connected in the network through degree

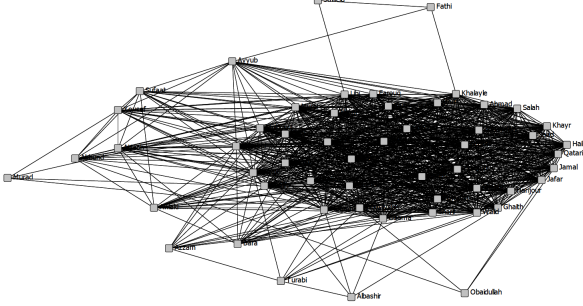
Variables	Values	Frequency	Percentage
Participation	2Al-Qaeda Member	40	74.1
	Afghanistan-Soviet war	8	14.8
	Other Affiliations	18	33.3
Specialization	Operations	16	29.6
	Public Relations Politics	6	11.1
	Finance	6	11.1
	Theology	6	11.1
	Assistant	4	7.4
	Senior Position	6	11.1
	Military-Training Weapons	12	22.2
	Liaison	2	3.7
	Unspecified	14	25.9
Mission	September 11th, 2001	14	24.1
	USS Cole Bombing	5	9.3
	World Trade center 93	4	7.4
	Bojinka Plot	3	5.6
	Daniel Pearl	2	3.7
	10/28/02 and US diplomats	2	3.7
	Other	11	20.4
	Unspecified /Unknown	25	46.3

Table 2: al-Qaeda Terrorist network activity

of a node. Researchers suggest that network analysis complements conventional approaches through its insights into terrorist organizations and their internal processes [4]. SNA investigates multiple levels of analysis simultaneously [5]. SNA studies the actors involvement in network and its connectedness. The actor may be embedded in core or periphery each is significant based on its action. Node act as actor and links reveals the association of one node to another node. The following research is both exploratory and predictive. The analysis using the centrality measure

to examine the composition and structure of al-Qaeda network. Centrality measure is important method to analyze the terrorist network. Similar approach had been used to capture the Saddam Hussain by American military in Iraq [7]. There are many ideas of centrality like degree and diffusion base centrality, path based centrality. Degree and diffusion based centrality has different technique like Degree centrality, Eigenvector centrality, Katz, Pagerank. The path based centrality has like closeness, betweenness centrality [8]. Here three common centrality meth-

Figure 1. al-Qaeda Terrorist Network, members and links between members



ods are considered. Degree Centrality is related to spreading and collection of information. As the degree of a node is higher, which tend to have higher connectedness it tends the higher probability of information flow and secure the advantageous position in a network. Eigenvector centrality is based on the idea of degree centrality, however it considers some advancement. Suppose a hub is connected to other node with small degree, but the node with small degree is connected to a large hub. Such nodes are helpful in collecting information, and how strategically nodes are connected to the “key players” in a network. This reachability is essential to influence other nodes and spread the ideology. Betweenness centrality is a measure of importance of a node for connectivity between many nodes pair. Those nodes act as broker, which controls the flow of information. Network may be sparse or dense, its an important aspect of network analysis. The dense part of a network would be core of it, most of the actions, commands would be released from there, while the periphery is loosely connected nodes. Understanding this structure helps in identifying the potential candidate.

3.2 Analysis:

Sampled data is categorized in age, status, nationality, relationship, participation in terrorist activity, specialization, mission they were involved. Figure 1 illustrate the network of al-Qaeda sampled data.

Network shown above represent the network topology of al-Qaeda; the details centrality measure of

Name	Degree (rank)	Betweenness	Eigenvector
Said Ba-haji	48 (1)	38.34 (3)	0.163 (1)
Abu Salah al-Yemeni	47 (2)	19.68 (7)	0.163 (1)
Abd al-Hadi al-Iraqi*	45 (3)	14.39 (12)	0.16 (3)
Muhamad Ibrahim Makkawi	45 (3)	14.39 (12)	0.16 (3)
Ibn al-Shaykh al-Libi	45 (3)	59.98 (1)	0.159 (5)
Abu Basir al-Yemeni	45 (3)	31.74 (4)	0.159 (5)
Nawaf M. Salim al-Hazmi	44 (7)	10.38 (17)	0.159 (5)
Abu Mohammad al-Masri	44 (7)	9.98 (18)	0.159 (5)
Midhat Mursi	44 (7)	9.98 (18)	0.159 (5)
Osama bin-Laden	44 (7)	24.54 (6)	0.157 (13)
Qaed Salim Sinan al-Harethi	43 (11)	8.91 (19)	0.158 (10)
halid al-Mihdhar	43 (11)	7.51 (23)	0.158 (11)
Ramzi bin al-Shibh*	43 (11)	7.13 (24)	0.158 (10)
Khalid Shaikh Mohammed*	43 (11)	31.56 (5)	0.155 (18)
Tawfiq Attash Khallad*	42 (15)	4.94 (29)	0.157(13)

Name	Degree (rank)	Betweenness	Eigenvector
Zacarias Mous-saoui*	42 (15)	5.92 (25)	0.156 (15)
Mohamed Atta	42 (15)	5.41 (26)	0.156 (15)
Saeed al-Ghamdi	42 (15)	5.41 (26)	0.156 (15)
Omar al-Farouq	42 (15)	16.82 (9)	0.155 (18)
Ayman al-Zawahiri	42 (15)	10.53 (16)	0.155 (18)
Mohammed Jamal Khalifa	42 (15)	18.87 (8)	0.154 (28)
Saluiman Abu Ghaith	42 (15)	16.79 (10)	0.154 (28)
Abd al-Rahim al-Nashiri*	41 (23)	4.22 (30)	0.155 (18)
Ahmad Said al-Kadr	41 (23)	3.99 (31)	0.155 (18)
Zakariya Essabar	41 (23)	3.39 (33)	0.155 (18)
Hani Saleh Hasan Hanjour	41 (23)	3.39 (33)	0.155 (18)
Ziad Jarrah	41 (23)	3.39 (33)	0.155 (18)
Shaikh Saiid al-Sharif	41 (23)	3.39 (33)	0.155 (18)
Marwan al-Shehhi	41 (23)	3.39 (33)	0.155 (18)
Abu Zubaydah*	41 (23)	5.11 (28)	0.154 (28)
Ahmad Fadeel al-Khalayle	41 (23)	38.51 (2)	0.153 (31)

Name	Degree (rank)	Betweenness	Eigenvector
Mafouz Ould Walid	41 (23)	8.01 (22)	0.153 (31)
Tariq Anwar al-Sayyid Ahmad	40 (33)	0.153 (39)	0.153 (31)
Mohammed Salah	40 (33)	1.59 (39)	0.153 (31)
Abu Jafar al-Jaziri	40 (33)	12.57 (14)	0.152 (35)
Abd al-Aziz al-Jamal	40 (33)	12.57 (14)	0.152 (35)
Abu Zubair al-Haili*	39 (37)	0 (48)	0.152 (35)
Zaid Khayr	39 (37)	0 (48)	0.152 (35)
Hamza al-Qatari	39 (37)	0 (48)	0.152 (35)
Saad bin-Laden	39 (37)	0 (48)	0.152 (35)
Walid bin-Attash*	21 (41)	3.94 (32)	0.068 (42)
Anwar al-Awlaki	20 (42)	2.86 (38)	0.069 (41)
Abu Ayyub al-Masri	20 (42)	14.95 (11)	0.065 (43)
Ramzi Yousef*	19 (44)	8.82 (20)	0.061 (45)
Abu Bara al-Yemeni	17 (45)	0.41 (45)	0.062 (44)
Yazid Sufaat	16 (46)	1.43 (42)	0.051 (46)

Name	Degree (rank)	Betweenness	Eigenvector
Mullah Obaidullah Akhund*	16 (46)	8.52 (21)	0.048 (47)
Abdallah Azzam	11 (48)	0.75 (44)	0.04 (48)
Hassan Turabi*	9 (49)	1.44 (41)	0.029 (49)
Omar Al-bashir*	5 (50)	0 (48)	0.016 (50)
Obaidullah	4 (51)	0.26 (47)	0.013 (51)
Abdul Hakim Murad*	4 (51)	0 (48)	0.013 (51)
Yasser Fathi Ibraheem	3 (53)	1 (43)	0.006 (53)
Salem Sa'ed Salem bin-Suweid	2 (54)	0.33 (46)	0.004 (54)

= Captured
~ = Deceased

Table 3: al-Qaeda Terrorist network degree, betweenness and eigenvector measure

nodes is given in table3. Considering the degree centrality/connectedness of nodes, Salem Sa'ed Salem bin-Suweid, Yasser Fathi Ibraheem, Abdul Hakim Murad, Obaidullah, Omar Albashir are among which have very low connectedness in network. Suweid is most isolated node in the network which provide higher privacy ultimately better better hiding possibility, however the very low control over the network. Apart from it, Said Bahaji has highest degree, al-Yemeni, al-Iraqi Makkwai follows him in degree centrality. Higher the degree centrality, higher the chances it can influence the network the most. Simultaneously, it is highly vulnerable [8].

Considering the betweenness centrality, it identifies

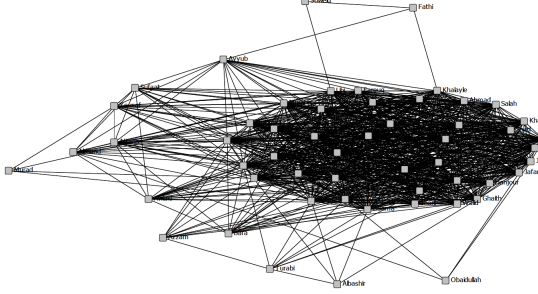
the liaison position. The node (liaison) act as bridge between the member and responsible for the flow of information. Nodes like Murad, Albashir, Saad bin-Laden, Hamza al-Qatari, Zaid Khayr, Abu Zubair al-Haili who has the betweenness centrality equals to 0, depends on broker to access the information. Ibn al-Shaykh al-Libi has the highest in the network with 59.98. Same time has the higher degree 45, this will presents the large number of redundant ties and reduces the brokerage position. Ahmad Fadeel al-Khalayle has higher betweenness, however he has fewer connection in comparison with al-Libi.

Eigenvector centrality reveals the connectedness of node to other group/hub of nodes. The network content the 15 lowest ranked actors, out of which 14 are not al-Qaeda members placed in outer side of network. Al-Yemeni and Bahaji holds the high eigenvector centrality value, these are the most important nodes of a network

In this network Bahaji scores high in all three centralities, not lower than third rank, while bin-Suwied scores lowest. There are advantages of being on position first, but the disadvantages can't be ignored. Rank high will provide more control, freedom and leverage. However, he had similar implication as Ibn al-Shaykh al-Libi has, redundant ties. On other end bin-suweid has only two connections, which provide him security and on other hand low access and control over information.

There are other prominent replacement available considering the centrality measures. Tawfiq Attash Khallad is the most suitable replacement of bin-Laden in terms of importance, however he was captured in 2003 by CIA. Nawaf Muhammad Salim al-Hazmi Midhat Mursi, and Abu Mohammad al-Masri are good replacement considering the connectedness but all there can fill in the gap all two out of them are deceased and Mursi was killed in 2008 drone attack in Pakistan [9] [10]. The option left with al-Masri, who got pursued by Federal Bureau of Investigation (FBI). Considering the liaison aspect, no one can hold bin-Laden's status in the network. However, the Kahlid Shaikh Mohammed was captured in 2003 by CIA [11] and Abu Salah al-Yemeni was killed in Khot 2002 [12]. Option left is Al-Masri, who's connectedness is similar to bin-laden. However only connect-

Figure 2. al-Qaeda Terrorist Network Core/Periphery, core indicated



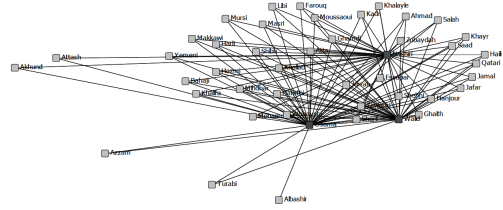
edness considers the number of node connected but not about quality of connection. To further evaluate the network, core/periphery analysis is given ahead.

Figure 2 illustrate the core and periphery in network. The network contents $n=40$ elements in core and $n=14$ elements in periphery [13]. The secrecy is paramount in such networks, so to maintain it, the networks are more decentralized [13]. Decentralize network do not have distinct cluster, instead centralize network consists of small core and large periphery. The core is densely interconnected and peripheral have fewer connection. The leaders of the group got positioned somewhere periphery of network. This provide secrecy and make leader's detection harder. However, looking at the network it not seems like bin-Laden is positioned in periphery.

Centrality measure helped to identify the positions of potential candidates, core/periphery help to narrow down the possible leadership candidates. The similarity measure focuses on direct relationship with the leader (bin-Laden). The following network illustrate the relationship relevant to bin-Laden. The network shows that Mafouz Ould Walid and Abd al-Rahim al-Nashiri has similar relationship in network like bin-Laden has. It is clear that social connectedness of bin-Laden is shared with Walid and al-Nashiri which is about 83.5%. Exploring both leaders for potential successor.

Al-Nashiri was from Saudi Arabia, who was involved in charge of terrorist operations in the Persian Gulf, Taliban affiliate, mastermind of the USS Cole bombing, and participant of the French

Figure 3. al-Qaeda Terrorist Network, similarities



tanker attack in 2002 [14]. The another option Walid; a terrorist leader, as well as senior leader, respected Islamic theologian, scholar and close friend of bin-Laden and al-Zawahiri [15]. He is also associated with Institute of Islamic studies in Afghanistan and el-Hijra Construction [16] [17]. Considering the network measure (social capital) and personal attributes (human capital), both were suitable options, even as a appropriate successor al-Nashir was captured in 2002 and detained in a CIA black site; so its automatically cut down from possibility. Now remains the potential successor Walid, the most suitable replacement of bin-Laden.

The 37-year old Islamic scholar Mafouz Ould Walid emerge as presumptive leader of al-Qaeda. Further investigation about the positioning and sustaining of the Walid, also followed research can help to identify the global al-Qaeda supporter and potential involvement in future activity. However, to limit the scope of paper, points are left for further discussion.

4 Conclusion

While performing analysis of networks, it turns out that the criminal and terrorist network differ in intention/target and structural positioning of individual in a network. Criminal activities is in intention to harm in terms of financial object. Instead terrorist organization used to damage economy, social structure, political, constitutional phenomenon and majorly to humanity. The network structure also differs in criminal and terrorist network; for criminal network the

leader of a network ideally position on the periphery of such network, while in terrorist it is said to be that such network doesn't even have the core, however this is not observed in case of bin-Laden. Even the past leaders were all in core of the network, this position is suitable for injecting the Jihad ideology. It will be obvious that the successor of bin-Laden should share similar ideology and similar position in network structure which bin-Laden shared. Individuals position in network is very important in prospect of selecting the successor. The network position identifies its social capital, and this should not be different from the predecessor. This will ensure to the extend that the ability of individual's compatibility to the position, required skills and expertise. Where the SNA will play important role in identifying such possibility and narrow down the analysis. After September 11th, Pentagon declare him as bin-Laden top aide.

5 Acknowledgement

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