Kevin Flood

SM450A

Using Sage to Model, Analyze, and Dismember Terror Groups

In dismembering a Terrorist network in which many people may be involved it is important to understand how a social network works. Because we find ourselves in a situation where modeling Terrorist networks is kind of hard, in that we don't have a whole lot of specific information on the exact connectivity of a Terrorist group, it is easier to use a model based on organizations that have similar makeup, in eco-terror groups. These groups, such as PETA, the Animal Liberation Front, and Earth Liberation Front have close ties that allows each to operate in ways that funding, networking, and eco-terrorist actions can take place. In understanding how one may make arrests, or maybe in the case of terrorist groups, kills, in an eco-terrorist group may make it easier to dismember the group, or at the very least cause weakness, in a very efficient way.

Graph Theory

The best way of modeling and understanding terrorist groups is to graph them based on how different elements of the group are connected to others. We can do this by making simple connected graphs. Within these graphs each element (or person) within the group is represented by a vertex while each relationship to another person is represented by an edge. The overall collective dynamics of the group are plotted in a graph that connects the vertices with the edges, and allows for a visual look into the makeup of a terrorist organization. This sort of organization is great in that sage can dissect the graph and allow for the analysis of certain aspects of the culture of social networking within a terrorist organization. Certain functions within sage make

it easy to construct a graph, or take more information gathered from intelligence and add certain things to the graph to more accurately depict the graph.

Functions to help build the graph

For some graph G that represents the graph of a terrorist network, it is essential to be able to add to the graph in order for a full representation of the organization of the group is catalogued. These are some functions that are needed to do this:

G.add_vertex() – if a person is recruited into the group it is necessary to update the graph by adding a vertex.

G.add_edge() – whenever a new person is added to the group they must be included through the relationship with the person who recruited them. This function is also applicable to the making of a relationship between two or more existing members of the group.

G.name() – gives a label to the vertices in order to know who is who in the graph.

Functions to analyze the graph

Now that we have a graph we know to be G that represents our terrorist group, the best way to study how to dismantle would be to use certain functions within sage that allows us to analyze the importance of each edge, therefore the importance of each person within the terrorist web.

G.num_vertex() – The number of vertices is very important so we know how many people are within the terrorist network.

G.num_edge() – The number of edges is important so we know how many relationships are within the terrorist network.

G.degree() – the degree of a certain vertex expresses how many edges come out of that certain vertex, which allows us to determine how many relationships each person within the group has.

G.neighbors() – this allows us to understand who each person within the group knows. This is important to know so that we can understand who each person knows and how taking out a certain vertex could affect the group.

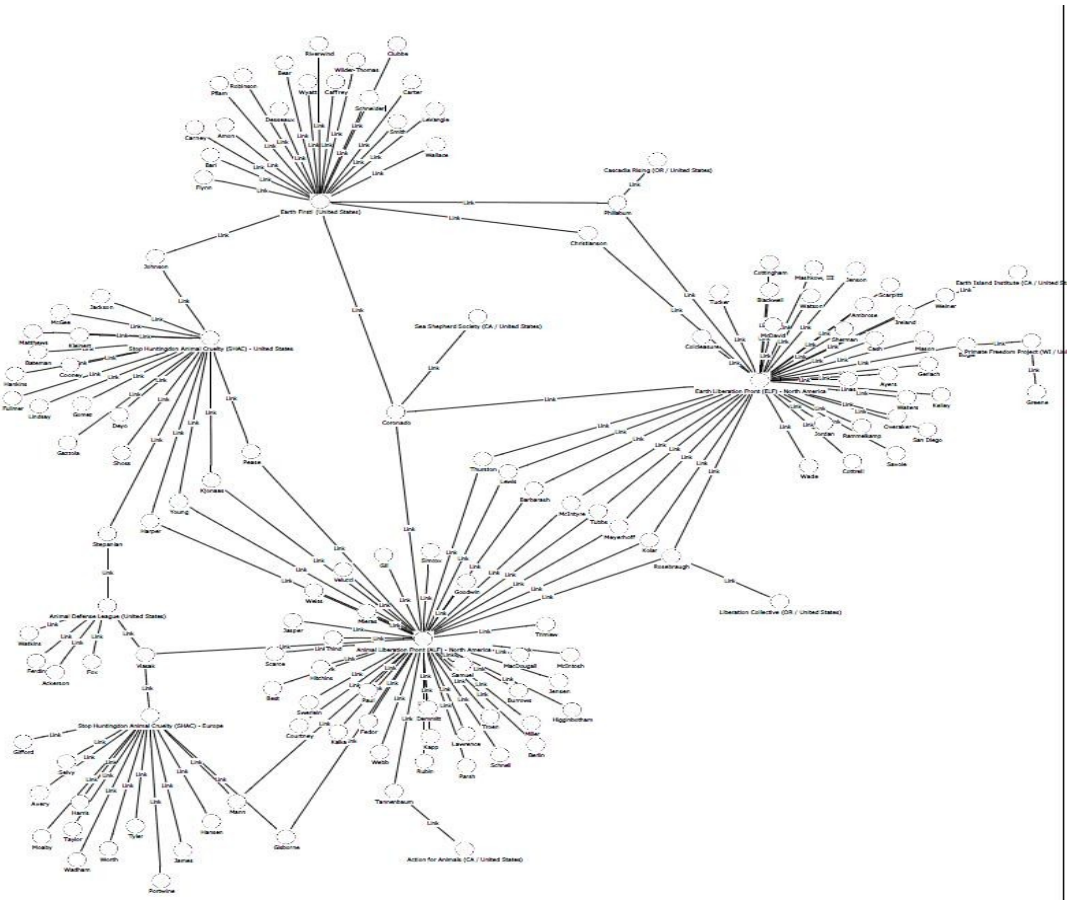
G.shortest_path() – this function allows us to understand how far apart two people within the group are. In the terrorist organization this is important to analyze so that we can see how close one person could be to another person, and how the length of a path can affect

G.cliques_maximum() – this function allows us to see the cliques with the greatest number of members. These cliques are groups of people within the greater sphere of the network that all know each other as a bunch. This can help to distinguish certain groups or cells within the organization.

G.centrality_closeness() – this function gives each vertex a certain importance based on how close it is to every other point on the graph. This allows us to understand which points are closest to the other points of the graph.

Using these functions as tools of analysis for the graph allow for a better understanding of each vertex, or person, in the network, which ultimately leads to a better understanding of how the network itself works. Based on this analysis we can see how removing certain vertices, or arresting/killing certain terrorists, can affect the network. To better understand the functions and

how they may affect a terrorist network we will use a model of an eco-terror group to display the different functions.



We will be looking at the vertex that is being pointed at by the red arrow which is labeled ‘Coronado.’

G.degree(Coronado) = 4; there are four relationships that Coronado has

G.shortest_path(Coronado,Animal Liberation Front) = 1 ; It seems as though Coronado is very closely related to most points on the graph, which is very important in that his position within the network seems to be significant.

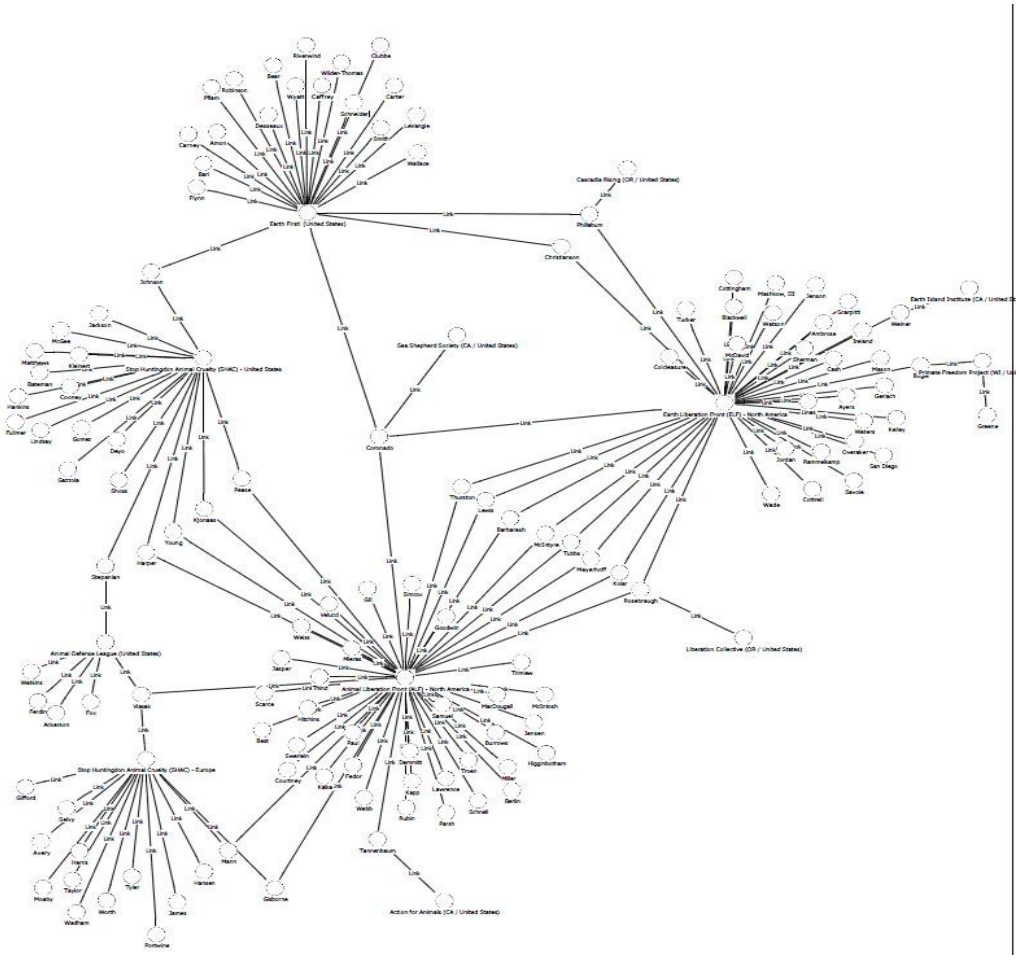
G.neighbors(Coronado) = Animal Liberation Front, Earth Liberation Front, Sea Shepherds, and Earth Freed. This shows that Coronado is connected to many major groups within the network.

G.cliques() – The main cliques within the network are evident in that they are described by group names, such as Animal Liberation Front, Earth Liberation Front, etc.

G.num_vertices() = 138, lets us know how many people are in the group, or our scope.

These are just a few functions that have allowed us to closer understand Coronado's importance within the organization. From this information we can determine that Coronado is an important aspect to the organization. With his removal from the group, through his arrest, we will be

looking at a graph that looks like this:



With the deletion of Coronado from the group using the function G.delete_edge(Coronado), we can see a significant change within the network. The Sea Shepherds no longer have any connection to any other group, and are cut off from the rest of the network, which could affect structure, financing, and recruiting. It also distances the Animal Liberation Front from Earth Free, which makes more distant lines of communication which makes it easier to see interactions between the groups. Because of his arrest, Coronado has allowed us to isolate certain parts of the network and weaken certain ties between others. The removal of just one key point has allowed us to overall affect the network.

The analysis of each point and its importance to the group is very important in more efficiently dismantling the terrorist network. This allows us to understand how important to the overall network a person may be, whether they are connecting multiple cliques, have many friends, or are most closely related to the most people. This would allow our military to better train their efforts on arresting or killing the right people, the most important to the overall group, even if they may not be the leaders. Being able to thoroughly understand this graph theory and implement these functions within sage is important in being able to more efficiently take down a terrorist group.

Sources Cited

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