

Given the social network of the Harry Potter series, I wanted to analyze the social network of the members of Dumbledore's Army (DA), which is a secret organization formed by Harry, Hermione, and Ron with the objective of teaching its members Defense Against the Dark Arts. The group also participated in the Second Wizarding War. Since the organization was a secret organization, I wanted to analyze their social networks to see how connected they are with the rest of the characters in the series. I assumed that most of them would have somewhat similar centralities and clusterings because one can only be part of a secret organization if you know someone from the inside already.

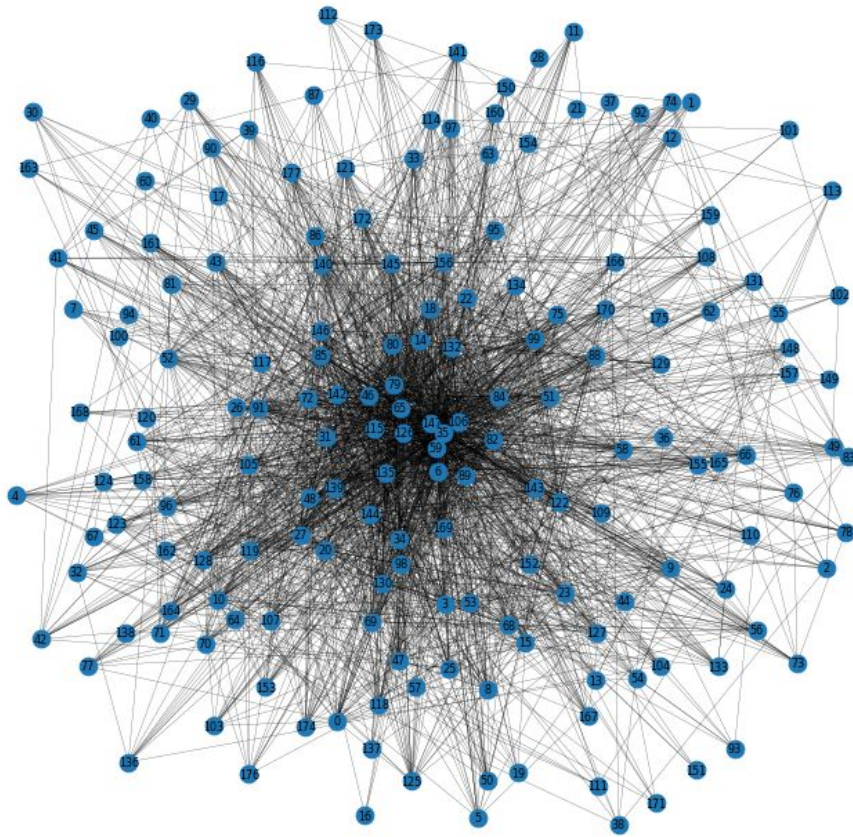
For reference, the members of DA are as follows:

Dataset ID	Name	House	Dataset ID	Name	House
106	Harry Potter	Gryffindor	98	Parvati Patil	Gryffindor
59	Hermione Granger	Gryffindor	48	Seamus Finnigan	Gryffindor
147	Ron Weasley	Gryffindor	56	Anthony Goldstein	Ravenclaw
127	Alicia Spinnet	Gryffindor	18	Cho Chang	Ravenclaw
68	Angelina Johnson	Gryffindor	80	Luna Lovegood	Ravenclaw
130	Dean Thomas	Gryffindor	43	Marietta Edgecombe	Ravenclaw
23	Colin Creevey †	Gryffindor	20	Michael Corner	Ravenclaw
142	Fred Weasley †	Gryffindor	97	Padma Patil	Ravenclaw
143	George Weasley	Gryffindor	9	Terry Boot	Ravenclaw
144	Ginny Weasley	Gryffindor	88	Ernie Macmillan	Hufflepuff
3	Katie Bell	Gryffindor	0	Hannah Abbott	Hufflepuff
10	Lavender Brown †	Gryffindor	47	Justin Finch-Fletchley	Hufflepuff
69	Lee Jordan	Gryffindor	8	Susan Bones	Hufflepuff
79	Neville Longbottom	Gryffindor	125	Zacharias Smith	Hufflepuff

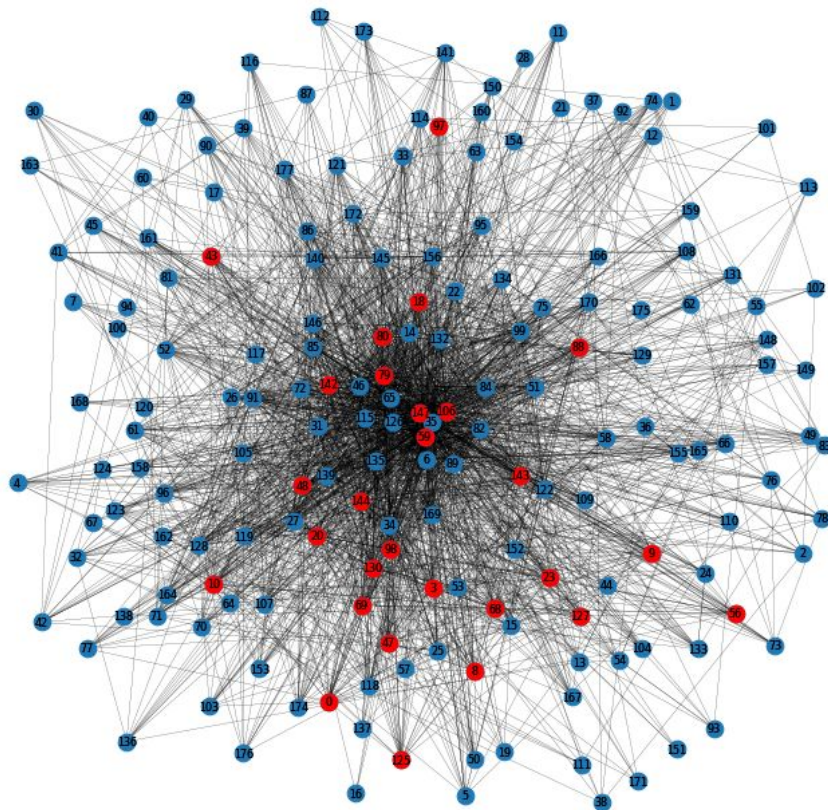
Note: Dennis Creevey was not in the dataset, and was removed from this list.

First, I wanted to get an overall idea of what the entire social network is like. I did this by looking at the average distance, the diameter, and the radius of the entire graph. I found that the average distance is 1.8785, and this tells me that, in general, the characters are very connected to each other. I found that the diameter is 3 and the radius is 2, which are surprisingly low considering the size of the social network. I think this may be because Harry Potter, or even the other main characters, is very strongly connected to almost all the characters in the series, so he might be what connects two characters of different social groups together. Sure enough, the main characters of the series, such as Harry, Hermione, and Ron, are in the list of center nodes. I also found that the transitivity is 0.396, and this tells me that the network isn't actually very dense, and most characters are just "acquaintances".

I also graphed the entire network and made a second graph where DA is marked red.



Graph of the entire network

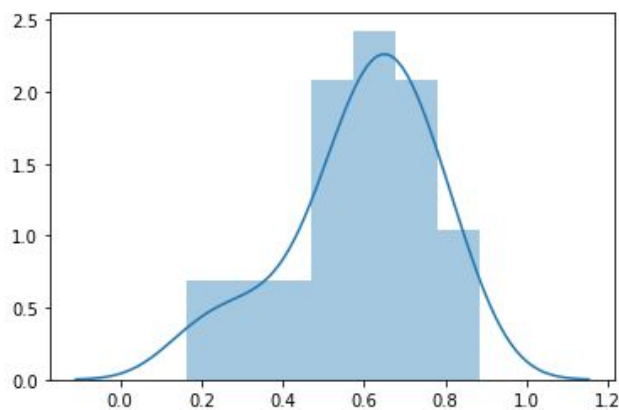


Graph of the entire network with DA marked red

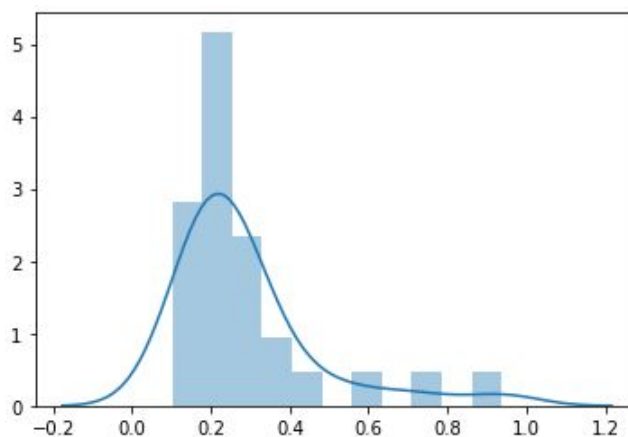
We can see that the graph is fairly dense in some parts, but sparse in other parts. I then proceeded to look into DA more closely. The results are summarized in the table below:

Analysis	With Main Trio		Without Main Trio	
	Mean	Standard Deviation	Mean	Standard Deviation
Local Clustering	0.593832	0.178547	0.637607	0.129778
Degree Centrality	0.286925	0.184342	0.232768	0.081872
Closeness Centrality	0.589202	0.087705	0.563293	0.028495
Betweenness Centrality	0.015053	0.044522	0.003280	0.005363

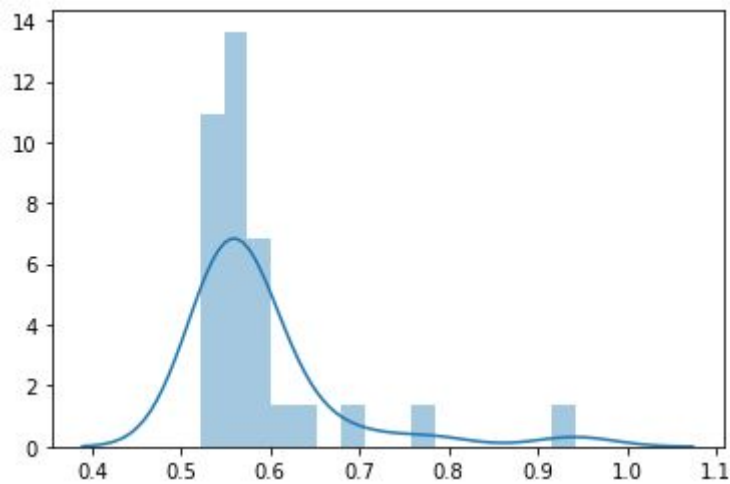
First, I looked at the local clustering coefficient of each member of the group. I found that the mean of their LCC's is 0.593832 while the standard deviation is 0.178547. This tells me that generally, their friends are most likely also mutuals since their social groups may be fairly clique-ish and less diverse. I also observed that the LCC of the main characters is significantly less than the mean, and this is because they have a lot more links to characters that may be outside the social circle of the other members of DA.



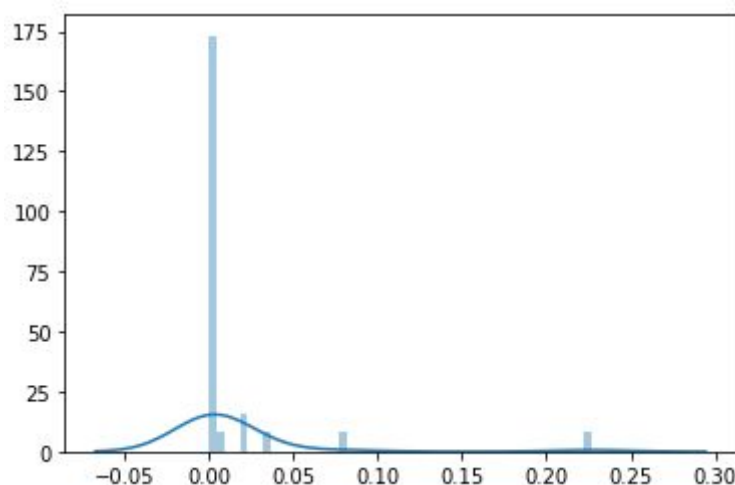
Second, I looked at the degree centrality of the group. I found that the mean of their degree centrality is 0.286925 while the standard deviation is 0.184342. The mean is fairly low, and this tells me that the members of DA are generally not that connected with the rest of the social network of Harry Potter. However, the standard deviation is very high, and this is because the main characters have a lot of connections with other characters outside of DA so their degree centrality is much higher.



Third, I looked at the closeness centrality of the group. I found that the mean of their closeness centrality is 0.589202 and the standard deviation is 0.184342. This tells me that each member of DA is fairly reachable from or connected to the other characters. Once again, Harry, Hermione, and Ron have a closeness centrality which is higher than the mean.



Lastly, I looked at the betweenness centrality of the group. I found that the mean of their betweenness centrality is 0.015053 and the standard deviation is 0.044522. This tells me that the characters of DA don't really bridge the other characters of the series. Even the main trio, whose results in the previous centrality analyses show that they are central in the social network, doesn't have a very high betweenness centrality. This may be because Harry Potter has a lot of smaller social networks and groups inside it, and these DA members are not necessarily the shortest path between them.



Without the main trio, the standard deviations become less, and this tells me that DA, with the exception of the main trio, is a tightly knit group with very similar social circles. The high centralities and low clustering of Harry, Hermione, and Ron also tells me that they are strongly connected to the rest of the social network.

Overall, it is interesting to observe how the members of Dumbledore's Army have very similar and close social circles. I think familiarity with each other and with each other's friends is one factor as to why they were able to become members of the group in the first place.