## Findings

1. Using PageRank, we can identify "important/influential" vertices in the graph, and thereby, officers who are most frequently connected to other officers when the associated allegations category has changed. As one can see, the officers who have a high pagerank when allegations are changed also tend to have some of the highest complaint percentiles (often 90+). So there is something to be said in the sense that officers who are fielding some of the highest complaint percentiles are generally the same officers involved in changed allegations. There is just a small minority of exceptions in the list below of officers who don't have a very high complaint percentile, but are still quite frequently linked to allegation changes. There might be something interesting about this subset as one couldn't necessarily argue that their pagerank is being driven by the sheer volume of complaints.

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+-----+------------+------------+-------------------+------------------+
|   id|officer_fname|officer_lname|complaint_percentile|          pagerank|
+-----+------------+------------+-------------------+------------------+
|21309|        Eric|       Olson|  94.46720123291016|  14.6843363535723|
|28758|       Jesse|      Torres| 43.90639877319336|14.484175385091378|
|17176|     Ricardo|      Mancha| 83.57720184326172|14.033271002320387|
|27725|        Mark|      Struke| 82.25520324707031|13.656611151876517|
|25980|     Roberto|        Sena| 88.70120239257812|12.517037105678986|
|21941|      Daniel|   Passarelli| 89.08329772949219|12.004761240422239|
|32086|       Shane|       Jones| 97.64240264892578|11.045369399725754|
|11686|     Timothy|     Hawkins|  87.7688980102539|10.949908884745193|
|31997|     Emerico|    Gonzalez| 92.91960144042969|10.855702489793506|
|20177|    Nathaniel|      Myles| 93.80229949951172|10.103644595649541|
|18384|    Kathleen|     Mc Lean| 94.97540283203125|10.018741684885711|
|12440|    Terrance|      Hollis| 27.52669906616211| 9.624971127388415|
|32159|       Jorge|     Martinez| 99.81659698486328| 9.515512072442359|
|29379|     Artemio|      Vargas| 74.81559753417969| 9.110292972755232|
|15273|        Karl|      Kruger| 88.70120239257812| 9.067880632233914|
|29612|       Frank|    Villareal|  99.2876968383789| 8.949792463004878|
|13903|       Julie|       Joyce| 71.59449768066406| 8.797037105983549|
|27962|        John|    Swarbrick| 77.83419799804688| 8.618667197571575|
| 3998|      Justin|     Carrillo| 75.12129974365234| 8.440248247900932|
| 7273|      Daniel|     Dowling| 84.99870300292969| 8.247455360497561|
+-----+------------+------------+-------------------+------------------+
only showing top 20 rows
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2. Using the Label Propagation Algorithm we were able to cluster the officers co-accused on allegations when the category changed. The clusters are identified as "labels." Below are sample results for two different allegations.
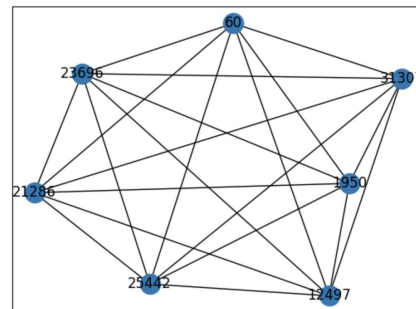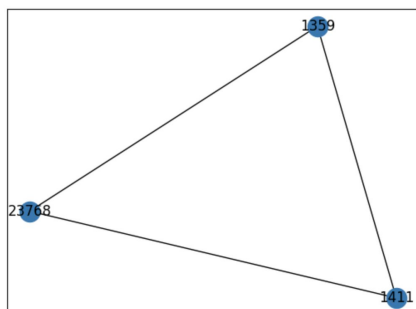
src	dst	crid	old_category	new_category
60	1950	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant
60	21286	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant
60	23696	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant
60	12497	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant
31307	1950	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant
31307	21286	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant
31307	23696	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant
31307	12497	1039676	UNNECESSARY DISPLAY OF WEAPON ON DUTY	Search Of Premise Without Warrant

The web on the right corresponds to the chart immediately above. The allegation here changed from "unnecessary display of weapon on duty" to "search of premise without warrant", which are not particularly related allegations. You can see who the officers were that were involved and how they were connected. This type of analysis has the power to really understand how the allegation changes relate to clusters of officers. We've already shown the officers with high complaint rates are frequently involved in allegation changes (with PageRank in part 1). The LPA approach gives us some insight into how those officers might actually be congregrating with each other.