

CPDB Project - Checkpoint 04

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Data Science 339

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Q.1: Does this code compile and run without significant effort on the part of the reviewer?

Ans.1: Yes, please refer to the README file and the Google Colab URLs attached in the submission folder.

Q.2: Quantitative Analysis. Does the code answer the questions from the proposal?

Ans.2: Yes, our code answers both the questions from the proposal:

1. Can we examine an officer's misconduct network based on the seniority of the officers they are involved in uses of force with?

For this graph we have the officers as the nodes (represented by officer ID), with the officer rank as an attribute. The edges represent TRRs that officers have been involved in together where force was used.

2. Using TRR records that officers are involved in together, can we examine the types of force officers use?

For this graph we have the officers as the nodes (represented by officer ID), with the force type that an officer has used the most in general as an attribute (represented by a column with the force type an officer has used the most and another column with the number of times an officer has used that type of force). The edges represent the TRRs that officers have been involved in together where force was used

We want to note that we use degrees and the number of TRRs that officers are involved in together for our analysis. We are defining co-offenders as officers who were involved in a TRR with at least one other officer and used some type of force in those TRRs. When analyzing the graphframes and dataframes created to answer both questions, we found a series of interesting results as shown in the figures explained.

Co-offenses are not uniformly distributed across all the officers we look at. We have a small percentage of officers co-offending between 15 and 22 times with the same officer, while most officers (~19,600) only co-offend once with the same officer. Looking

src	dst	
31795	32105	22
2798	31576	18
17634	29992	17
1444	29209	16
7195	11634	15
8628	18384	15
15273	22392	14
8428	26304	13
27669	29670	13
31898	32428	12
27222	29008	12
61	972	12
13143	26941	12
4484	22216	12
4078	24736	12
10291	15845	11
32141	32291	11
26018	29454	11
22709	26435	11
3305	31782	11
10135	15873	11
464	5501	10
dtype: int64		

Figure 1: Officers and the number of times they co-offend with a particular officer

at the number of TRRs officers are involved in together, we see that ~2800 officers were involved in more than one TRR with other officers. When we look at the top 1% of officers that had multiple co-offenses, we see each officer in the top 5 pairs shares a unit with their co-offender. For the officers that had the 5th highest count of co-offenses, it is interesting to note that both the officers transferred between 3 units (units 9, 173 and 174) and co-offended together 15 times in their career. A lot of these officers in general were also part of Unit 30 which is the training unit and so we chose to ignore that in our analysis. Even by removing unit 30 from analysis, the number of co-offenses only go down marginally.

To validate our findings, we also performed a dynamic PageRank algorithm on the graphframe and found that it shows a similar distribution amongst co-offending officers. We found that the top 1% of officers with co-offenses

using the value counts were also ranked in the top 1% by the PageRank algorithm.

We analyzed the ranks of the officers that were involved in TRRs together. The police ranks for the top 1% of co-offending officer pairs are either Police Officers or Field Training Officers. The officers in the bottom 1% of co-offending officer pairs with only one co-offense connecting them were Sergeants, Lieutenants, and some Police Officers or Field Training Officers.

id	force_type	max_count	id	force_type	max_count
18269	31795 Physical Force - Holding	85	18653	32105 Physical Force - Holding	79
id	force_type	max_count	id	force_type	max_count
18131	31576 Physical Force - Holding	56	1661	2798 Verbal Commands	42
id	force_type	max_count	id	force_type	max_count
17281	29992 Member Presence	37	10047	17634 Member Presence	26
17282	29992 Verbal Commands	37	10048	17634 Verbal Commands	26

Figure 2 (a-c): The Most Used Force For The Top 3 Pairs of Co-offending Officers

Figure 2 above is an example that shows the top 3 pairs of co-offending officers and the use of force each of them most frequently employs. We see that their most common force types range from less severe (such as verbal commands) to something moderately severe such as physical force, but they don't extend to the use of guns or tasers. This is a similar trend seen across the top 5% of officers in our sample. However, a point of interest is the fact that the top pair with the most number of co-offenses is made up of officers that use physical force in the form of holding the most through their individual TRRs.

Q.3: Qualitative Analysis: Does the analysis described in the write-up adequately analyze the problem we are investigating? Was it thoughtful and thorough? Does it reveal interesting open questions (optional)?

Ans.3: A key feature of TRR records is that they provide self-reported details of all officers involved in an incident. This allows us to examine each officer's misconduct network across their history of TRRs. An officer's misconduct network includes all officers who were named in the same TRR with the focal officer, creating a network in which officers are linked to each other through TRRs. These misconduct networks represent a particular type of social network more accurately described as "behavioral networks".

One of the interesting things we found in our analysis was the fact that the occurrence of co-offenses was not uniformly distributed among officers that do co-offend. We noted, not surprisingly, that a lot of officers involved in TRRs together come from the same unit. However, we see that some officers move through units and still co-

offend with the same officers. This is interesting to us because these officers choose to co-offend together, and based on Andrew Papachristos' paper, we know that this could be because of other factors such as geographical distance between where offices are located.

We analyzed the types of force officers are most likely to use in TRRs in general, and we hypothesize that some officers learn to use a certain type of force because they use it more with a certain officer that they are involved in TRRs with. We also found that officers that co-offend the most number of times are police officers or officers in field training. This makes sense because police officers are often first responders to crime scenes, however we find that the officers that co-offend a lot use mild to moderate force ranging from verbal commands to physical force. This can be due to the nature of incidents they are involved with, and we could see certain outliers, but we think they learn to use certain tactics as response to situations based on officers they respond to incidents with, and this goes with our theme to suggest that officers do learn to use force while on the job.

We recognize that networks based on TRR reports represent only a fraction of the social ties between officers, so we are likely underestimating the true network and emphasizing only self-reported relationships with a potentially negative influence. A key limitation of our graphical analysis is that we only take into account co-offenses that use the same type of force. As such, we believe that we are underestimating the true number of co-offenses that may be extracted from the TRR records. However, we believe that our analysis remains complete in its core sense as it does indicate that a large proportion of the co-offending officers are likely to use that same type of force in other TRR incidents, as indicated by their max counts.