

HW2

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Q1

Community detection wrapper

iii. Running the functions on 'Les Miserables' network:

Girvan Newman(without edge_selector_optimizer):

Number of partitions: 11

Modularity: 0.47769110648423646

Partitions:

Community 0 - ['Champtercier', 'Count', 'CountessDeLo', 'Cravatte', 'Geborand', 'MlleBaptistine', 'MmeMagloire', 'Myriel', 'Napoleon', 'OldMan']

Community 1 - ['Bamatabois', 'Brevet', 'Champmathieu', 'Chenildieu', 'Cocheapille', 'Gervais', 'Isabeau', 'Judge', 'Labarre', 'MmeDeR', 'Scaufflaire', 'Simplice', 'Valjean', 'Woman1']

Community 2 - ['Blacheville', 'Dahlia', 'Fameuil', 'Fantine', 'Favourite', 'Listolier', 'Marguerite', 'Perpetue', 'Tholomyes', 'Zephine']

Community 3 - ['Anzelma', 'Babet', 'Brujon', 'Claquesous', 'Eponine', 'Gueulemer', 'Javert', 'MmeThenardier', 'Montparnasse', 'Pontmercy', 'Thenardier']

Community 4 - ['BaronessT', 'Cosette', 'Gillenormand', 'LtGillenormand', 'Magnon', 'MlleGillenormand', 'MlleVaubois', 'MmePontmercy', 'Toussaint', 'Woman2']

Community 5 - ['Fauchelevant', 'Gribier', 'MotherInnocent']

Community 6 - ['Boulatruelle']

Community 7 - ['Jondrette', 'MmeBurgon']

Community 8 - ['Bahorel', 'Bossuet', 'Combeferre', 'Courfeyrac', 'Enjolras', 'Feuilly', 'Gavroche', 'Grantaire', 'Joly', 'Mabeuf', 'Marius', 'MmeHucheloup', 'Prouvaire']

Community 9 - ['MotherPlutarch']

Community 10 - ['Child1', 'Child2']

Girvan Newman(with edge_selector_optimizer):

Number of partitions: 8

Modularity: 0.522930547293279

Partitions:

Community 0 - ['Champtercier', 'Count', 'CountessDeLo', 'Cravatte', 'Geborand', 'MlleBaptistine', 'MmeMagloire', 'Myriel', 'Napoleon', 'OldMan']

Community 1 - ['Bamatabois', 'Brevet', 'Champmathieu', 'Chenildieu', 'Cocheapaille', 'Gervais', 'Isabeau', 'Judge', 'Labarre', 'MmeDeR', 'Scaufflaire', 'Valjean', 'Woman1']

Community 2 - ['Blacheville', 'Dahlia', 'Fameuil', 'Fantine', 'Favourite', 'Listolier', 'Marguerite', 'Perpetue', 'Simplice', 'Tholomyes', 'Zephine']

Community 3 - ['Anzelma', 'Babet', 'Boulatruelle', 'Brujon', 'Claquesous', 'Eponine', 'Gueulemer', 'Javert', 'MmeThenardier', 'Montparnasse', 'Thenardier']

Community 4 - ['BaronessT', 'Cosette', 'Gillenormand', 'LtGillenormand', 'Magnon', 'Marius', 'MlleGillenormand', 'MlleVaubois', 'MmePontmercy', 'Pontmercy', 'Toussaint', 'Woman2']

Community 5 - ['Fauchelevent', 'Gribier', 'MotherInnocent']

Community 6 - ['Jondrette', 'MmeBurgon']

Community 7 - ['Bahorel', 'Bossuet', 'Child1', 'Child2', 'Combeferre', 'Courfeyrac', 'Enjolras', 'Feuilly', 'Gavroche', 'Grantaire', 'Joly', 'Mabeuf', 'MmeHucheloup', 'MotherPlutarch', 'Prouvaire']

Louvain:

Number of partitions: 6

Modularity: 0.5666879833432481

Partitions:

Community 0 - ['Napoleon', 'Myriel', 'MlleBaptistine', 'MmeMagloire', 'CountessDeLo', 'Geborand', 'Champtercier', 'Cravatte', 'Count', 'OldMan']

Community 1 - ['Valjean', 'Labarre', 'MmeDeR', 'Isabeau', 'Gervais', 'Cosette', 'Javert', 'Fauchelevent', 'Scaufflaire', 'Woman1', 'Pontmercy', 'Woman2', 'MotherInnocent', 'Gribier', 'Gillenormand', 'MlleGillenormand', 'MmePontmercy', 'MlleVaubois', 'LtGillenormand', 'Marius', 'BaronessT', 'Toussaint']

Community 2 - ['Marguerite', 'Listolier', 'Tholomyes', 'Fameuil', 'Blacheville', 'Favourite', 'Dahlia', 'Zephine', 'Fantine', 'Perpetue', 'Simplice']

Community 3 - ['MmeThenardier', 'Thenardier', 'Boulatruelle', 'Eponine', 'Anzelma', 'Magnon', 'Gueulemer', 'Babet', 'Claquesous', 'Montparnasse', 'Brujon']

Community 4 - ['Bamatabois', 'Judge', 'Champmathieu', 'Brevet', 'Chenildieu', 'Cocheapaille']

Community 5 - ['MmeBurgon', 'Jondrette', 'Gavroche', 'Mabeuf', 'Enjolras', 'Combeferre', 'Prouvaire', 'Feuilly', 'Courfeyrac', 'Bahorel', 'Bossuet', 'Joly', 'Grantaire', 'MotherPlutarch', 'Child1', 'Child2', 'MmeHucheloup']

clique percolation:

Number of partitions: 5

Modularity: 0.4349999999999966

Partitions:

Community 0 - ['Grantaire', 'Mabeuf', 'Gavroche', 'Joly', 'Bossuet', 'Bahorel', 'Feuilly', 'MmeHucheloup', 'Marius', 'Prouvaire', 'Courfeyrac', 'Enjolras', 'Combeferre', 'Valjean']

Community 1 - ['Fantine', 'Zephine', 'Blacheville', 'Dahlia', 'Listolier', 'Fameuil', 'Tholomyes', 'Favourite']

Community 2 - ['Marius', 'Valjean', 'Cosette', 'LtGillenormand', 'MlleGillenormand', 'Gillenormand']

Community 3 - ['Champmathieu', 'Valjean', 'Chenildieu', 'Cocheapaille', 'Judge', 'Brevet', 'Bamatabois']

Community 4 - ['Fantine', 'Montparnasse', 'Babet', 'Gavroche', 'MmeThenardier', 'Gueulemer', 'Javert', 'Brujon', 'Thenardier', 'Claquesous', 'Cosette', 'Valjean', 'Eponine']

Results:

As we can see, the algorithm that yields the best modularity value is “Louvain”.

When I used the clique percolation algorithm the partition of the network didn't include all the nodes in the graph. This happened because this algorithm builds k cliques communities, and in some graphs there can be nodes that does not connect to any of those communities, because they are not part of any k clique.

The edge_selector_optimizer function did improved the modularity but didn't result the best modularity of the three algorithms.

After a lot of experiments the best modularity I resulted was when I calculated the betweenness of the nodes by second order centrality and communicability betweenness centrality.

Q2

Community detection - Twitter data

iv. applying “Girvan Newman” algorithm over the network I built:

Applying with only central political players:

Number of partitions: 14

Modularity: 0.8266699244284988

Partitions:

Community 0 - ['Asaf Zamir', 'Benny Gantz', 'Blue White', 'Bogie Yaalon', 'Eitan Ginzburg', 'Gadeer Mreeh', 'Idan Roll', 'Izhar Shay', 'Kachol Lavan', 'Karine Elharrar', 'Meirav Cohen', 'Miki Haimovich', 'Ofer Shelah', 'Orit Farkash Hacohen', 'Orna Barbivay', 'Pnina Tamano', 'Yair Lapid', 'Yoaz Hendel', 'Zvi Hauser']

Community 1 - ['Baruch Marzel', 'Bezalel Smotrich', 'Itamar Ben Gvir', 'May Golan', 'Michael Ben Ari', 'Moti Yogev']

Community 2 - ['Eli Cohen', 'Haim Jelin', 'Kulanu', 'Merav Ben Ari', 'Moshe Kahlon', 'Roy Folkman', 'Tali Ploskov', 'Yifat Shasha-Biton']

Community 3 - ['Ayelet Nahmias Verbin', 'Dov Khenin', 'Esawi Frej', 'Eyal Ben-Reuven', 'Michal Rozin', 'Mossi Raz', 'Nitzan Horowitz', 'Tamar Zandberg', 'Tzipi Livni', 'Yoel Hasson', 'Zehava Gal-On']

Community 4 - ['Erel Margalit', 'Ksenia Svetlova', 'Merav Michaeli', 'Ram Ben Barak']

Community 5 - ['Aliza Lavie', 'Amir Ohana', 'Benjamin Netanyahu', 'Dudi Amsalem', 'Gilad Erdan', 'Israel Katz', 'Likud Party', 'Ofir Katz', 'PM Of Israel', 'Sharren Haskel', 'Yehudah Glick', 'Yoav Galant']

Community 6 - ['Biran Michal', 'Havoda', 'Itzik Shmuli', 'Omer Bar-Lev', 'Revital Swid', 'Shelly Yachimovich', 'Stav Shaffir', 'Yael Cohen Paran']

Community 7 - ['Alex Fridman', 'Avigdor Lieberman', 'Eli Avidar', 'Israel Beytenu', 'Oded Forer']

Community 8 - ['Alona Barkat', 'Ayelet Shaked', 'Matan Kahana', 'Naftali Bennett', 'New Right', 'Shirly Pinto', 'Shuli Mualem']

Community 9 - ['Amir Peretz']

Community 10 - ['Aida Touma-Sliman', 'Ayman Odeh', 'Hadash Party', 'Ofar Cassif']

Community 11 - ['Balad', 'Haneen Zoabi', 'Mtanes Shihadeh']

Community 12 - ['Moshe Feiglin', 'Refael Minnes', 'Zehut']

Community 13 - ['Yuli Edelstein']

Applying with 200 extra non parliamentarians nodes:

Number of partitions: 15

Modularity: 0.5146776289657061

Partitions:

Community 0 - ['53366898', '714789486', '742066914764152832', '789049562212204544', 'Ayelet Nahmias Verbin', 'Biran Michal', 'Dov Khenin', 'Eli Cohen', 'Esawi Frej', 'Eyal Ben-Reuven', 'Haim Jelin', 'Havoda', 'Itzik Shmuli', 'Kulanu', 'Merav Ben Ari', 'Michal Rozin', 'Moshe Kahlon', 'Mossi Raz', 'Nitzan Horowitz', 'Omer Bar-Lev', 'Revital Swid', 'Roy Folkman', 'Shelly Yachimovich', 'Stav Shaffir', 'Tali Ploskov', 'Tamar Zandberg', 'Tzipi Livni', 'Yael Cohen Paran', 'Yifat Shasha-Biton', 'Yoel Hasson', 'Zehava Gal-On']

Community 1 - ['1067862538220695552', '1082615607802167297', '1085993731160006656', '1095084695182807040', '1475972148', '18758614', '2305656327', '2730725598', '2736979741', '2833152462', '2943216314', '2944419884', '299567758', '3103731014', '315324345', '31875851', '3197046540', '32378883', '347291858', '392973048', '4252949559', '49436658', '49976341', '532882285', '711806075901779968', '783920156842098690', '802194425543884805', '822860028893954049', '890607822399995904', '894211032243109888', '921780490058727424', '92628670', '943054006053720064', '959021685461700608', '991176511955890176', 'Aliza Lavie', 'Asaf Zamir', 'Benny Gantz', 'Blue White', 'Bogie Yaalon', 'Eitan Ginzburg', 'Gadeer Mreeh', 'Idan Roll', 'Izhar Shay', 'Kachol Lavan', 'Karine Elharrar', 'Meirav Cohen', 'Miki Haimovich', 'Ofar Shelah', 'Orit Farkash Hacohen', 'Orna Barbivay', 'Pnina Tamano', 'Yair Lapid', 'Yehudah Glick', 'Yoaz Hendel', 'Zvi Hauser']

Community 2 - ['1073935713442455557', '1091358519389937664', '42618323', '900239881699569664', '934884109264084992', 'Alona Barkat', 'Ayelet Shaked', 'Matan Kahana', 'Naftali Bennett', 'New Right', 'Shirly Pinto', 'Shuli Mualem']

Community 3 - ['2256455062', '243170052', '2969637076', '779581020265910272', 'Amir Ohana', 'Likud Party', 'Sharren Haskel']

Community 4 - ['1007342417828343808', '1008116138767773696', '1010145587629559810', '1010154616091267073', '1013378623066083328', '1026770927743205376', '1032214232077660160', '1035301073840418817', '1037742936501440512', '1044498125187108864', '1045611822722748416', '1049955158195666944', '1052597164826865664', '1053723092256804866', '1054146620328210433', '1059783522284519425', '1060181786309861376', '1060510851889750022', '1069790294185529344', '1073935118509723654', '1074144832967331840', '1076121369727942656', '1076736915062353920', '1082394812400222214', '109166604', '1097067775640682496', '1099696691870019584', '1099781751247908866', '1100084581905190914', '1102287988933963776', '1106183947346722816', '1113165876889616386', '1495217348', '1528650636', '1616499505', '183166373', '187147504', '1872223814', '2168032683', '230832125', '2372162220', '24005777', '2429713430', '248202917', '2572775376', '25741722', '260803172', '2769701894', '2779958916', '2833210069', '2943350389', '2955268177', '3063522862', '311265104', '3163287318', '3221238691', '3233491494', '325221033', '3271154412', '3280419312', '368555136', '371291223', '375424272', '390571920', '391225620', '403802054', '40515159', '430703520', '4342659921', '4846961452', '4892732933', '491813894', '500444558', '54882415', '565373789', '59549458', '712258693765734404', '720116425852108800', '762381852128796672', '774133248586715136', '781838159134896128', '802147544386142208', '802161985299234817', '808265609125523456', '813323412185710592', '826425481549451264', '826511990294269952', '830458633066524674', '831883240407437314', '835359701667840001', '838592179262144512', '841372125432827905', '84472630', '846277479463575552', '853466688926261248', '85904700', '876408437814558724', '889076352', '899795804797501441', '901376636964265986', '904333846874869763', '907274972992868353', '912104208446443521', '917103871830515714', '917615649387671552', '932340825492557825', '937288679311249408', '960267569054838786', '963090269259358208', '963336078248873984', '963863522978525184', '967123451629666306',

'970418196825214977', '972482610868948994', '975357046236250113', '991062235706548231', '998492708', 'Benjamin Netanyahu', 'Ofir Katz', 'PM Of Israel']

Community 5 - ['1034846556241965057', '1332367405', '3187032164', '549446238', '828594000726724608', '871722917670903813', '885789567470751746', '926226860727468032', '942062274524729345', 'Baruch Marzel', 'Bezalel Smotrich', 'Gilad Erdan', 'Israel Katz', 'Itamar Ben Gvir', 'May Golan', 'Michael Ben Ari', 'Moti Yogev']

Community 6 - ['Alex Fridman', 'Avigdor Lieberman', 'Eli Avidar', 'Israel Beytenu', 'Oded Forer']

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Community 11 - ['Balad', 'Haneen Zoabi', 'Mtanes Shihadeh']

Community 12 - ['Amir Peretz']

Community 13 - ['Yuli Edelstein']

Community 14 - ['1078307019252289536', '1096495627603755008', '863147867640406017', 'Orly Levi Abekasis']

Results:

The adding order of the nodes I choose, that I think will add value to the network is:

Firstly, adding the non political nodes that political nodes have retweeted with the strongest edges.

Secondly , adding the non political nodes that retweeted the political nodes with the strongest edges.

Lastly, adding non political nodes that retweeted not political nodes with the strongest edges.

I choose this order because I think that non political nodes that political nodes retweeted them will probably be important to understand the political map, than after adding the non political that retweets the political nodes will give added value, but less than the political nodes that retweeted the non political nodes.

And if there aren't political nodes that retweeted non political or non political that retweets the political nodes I will add the non political that retweeted the non political.

The order I choose reduces the modularity of the partition, because I inserted to the network powerful nodes that pulled other nodes to them and sometimes created communities around them.

By the central political players partition we can clearly identify the political blocks.

We can identify the right block with communities 1,2,5,8,12 central blocks in communities 0,7 and left block in communities 3,4,6,10,11

In the partition with the non political nodes its harder to identify the blocks, as some of the non political nodes creating communities with political nodes and changing the previous order of the partition. We can see that in community 4 where a lot of non political nodes have created a community with 'Benjamin Netanyahu' and 'Ofir Katz'. Probably because they are retweeting them a lot.

I can assume that in the second partition of the non political and the political nodes some communities was build by the ideology of the players. This resulted players from the same party to end in communities with some players from other parties. In this partition where central political nodes are in communities that does not represent their parties, i believe some of them can desert their party and find themselves in different ones.

I think allowing extra nodes, not listed in the predefined list did proved useful, because we can analysis the new partition and calculate the probability of certain players to desert their party, or act in a way that can change the political map, although this partition resulted modularity not as good as the only political players partition's modularity.