Report

December 22, 2017

1 Report

```
In [77]: #imports
         import matplotlib.pyplot as plt
         import networkx as nx
         import seaborn as sns
         import heapq
         from heapq import heappush, heappop
         import itertools
         import datetime as d
         import Modules
```

```
In [21]: #Open file
         fo = open('D:/Università/Data Science/ADM/HW4/full_dblp.json', 'r')
         data = fo.read()
         fo.close()
         import json
         dataset = json.loads(data)
```

```
In [24]: #Create dictionaries
         authors_dict, authors_dict_reference, publications_dict, conferences_dict=Modules.crea
```

```
In [25]: #Create the graph and the dictionary with similar nodes
         G, similar=Modules.createGraph(authors_dict, publications_dict)
```

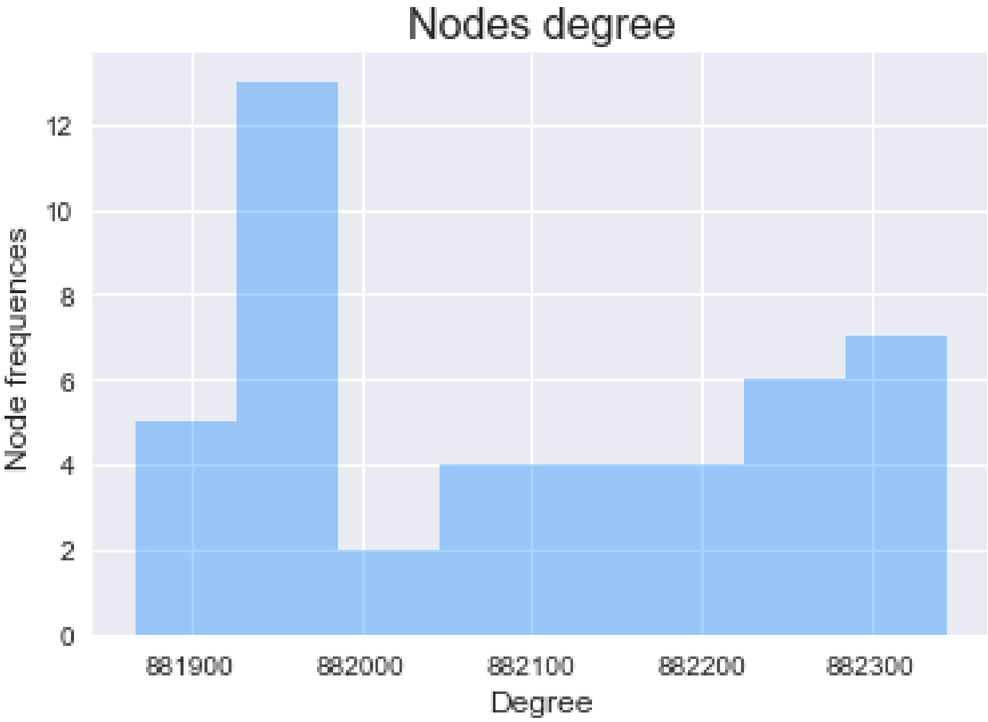
```
In [26]: nx.info(G)
```

```
Out[26]: 'Name: \nType: Graph\nNumber of nodes: 851248\nNumber of edges: 3278279\nAverage degre
```

```
In [ ]: '''Nodes: 851248, Edges: 3278279, Ave degree: 7.7023'''
```

1.1 2a.

```
In [27]: #Starting from the original graph, create the subgraph for the conference in input
         G2a = G.copy()
         conf = input("Insert a conference name: ")
         for node in nx.nodes(G):
             for tup in G.node[node]['conferences']:
                try:
                    if tup[0] != conf:
                        G2a.remove_node(node)
                except:
                    continue
            print("Done!")

Insert a conference name: conf/atal/2015
Done!


In [28]: nx.info(G2a)

Out[28]: 'Name: \nType: Graph\nNumber of nodes: 45\nNumber of edges: 13\nAverage degree:   0.57

In [ ]: '''Nodes: 45, Edges: 13, Ave degree: 0.5778'''

In [41]: '''Compute the degree for nodes which is the number of edges each node has.'''
         dg_values=list(nx.degree(G2a))

In [55]: print(min(dg_values))
         print(max(dg_values))

881867
882344


In [44]: #Degree histogram
         sns.set_style("darkgrid")
         sns.set_context({"figure.figsize": (6, 4)})
         fig, ax = plt.subplots()
         sns.distplot(dg_values,  color="dodgerblue", bins=8, hist=True, kde=False)
         plt.xlabel("Degree", fontsize=12)
         plt.ylabel("Node frequences", fontsize=12)
         plt.legend(prop={'size':16})
         plt.title("Nodes degree", fontsize = 16)

         plt.show()

C:\Users\eleon\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:545: UserWarning: No labell
  warnings.warn("No labelled objects found. "
```

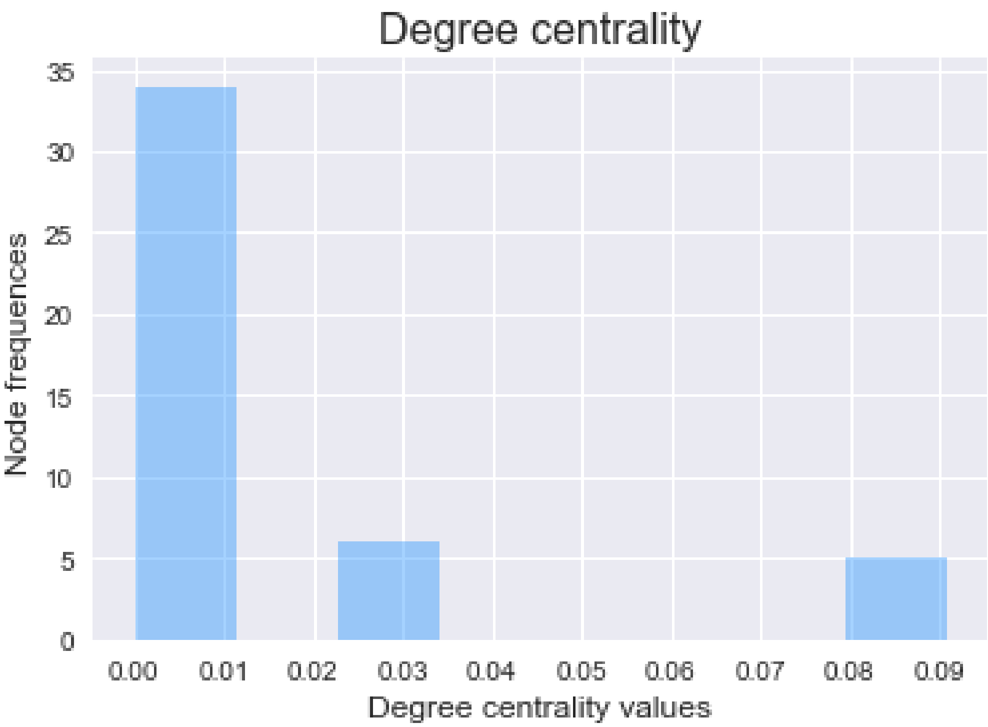


```
In [ ]: '''Looking at the histogram above, we can see that
        the minimum degree is 881867 and the maximum is 88234.
        It means that the authors in this conference (given in input)
        are extremely connected to the others.'''
```

```
In [42]: '''Compute the degree centrality for nodes.
         The degree centrality for a node v is the fraction of nodes it is connected to.'''
         dvalues=list(nx.degree_centrality(G2a).values())
```

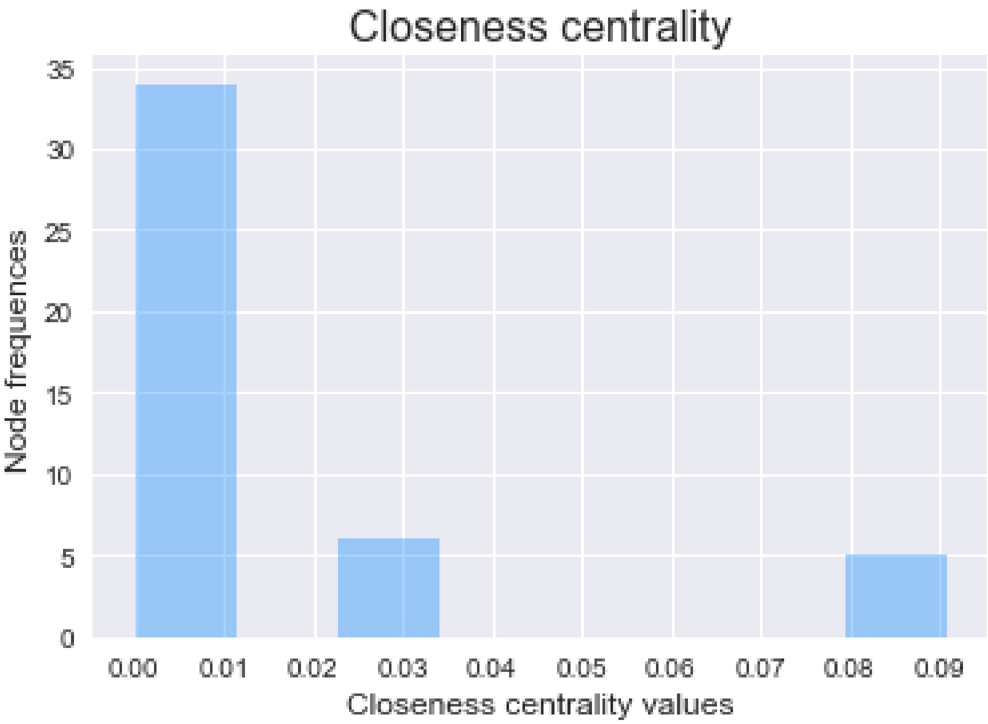
```
In [45]: #Degree centrality histogram
         sns.set_style("darkgrid")
         sns.set_context({"figure.figsize": (6, 4)})
         fig, ax = plt.subplots()
         sns.distplot(dvalues,  color="dodgerblue", bins=8, hist=True, kde=False)
         plt.xlabel("Degree centrality values", fontsize=12)
         plt.ylabel("Node frequences", fontsize=12)
         plt.legend(prop={'size':16})
         plt.title("Degree centrality", fontsize = 16)
         plt.xticks((0.00, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09))

         plt.show()
```

```
C:\Users\eleon\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:545: UserWarning: No labell
  warnings.warn("No labelled objects found. "
```



```
In [18]: '''As we can see from the plot, we got high frequences
         for low values of the centrality.'''

Out[18]: 'As we can see from the plot, we got high frequences for low values of the centrality

In [34]: '''Compute the closeness centrality for nodes in a bipartite network.
         The closeness of a node is the distance to all other nodes in the graph
         or in the case that the graph is not connected
         to all other nodes in the connected component containing that node.'''
         cvalues=list(nx.closeness_centrality(G2a).values())

In [35]: #Closeness centrality histogram
         sns.set_style("darkgrid")
         sns.set_context({"figure.figsize": (6, 4)})
         fig, ax = plt.subplots()
         sns.distplot(cvalues,  color="dodgerblue", bins=8, hist=True, kde=False)
         plt.xlabel("Closeness centrality values", fontsize=12)
         plt.ylabel("Node frequences", fontsize=12)
         plt.legend(prop={'size':16})
         plt.title("Closeness centrality", fontsize = 16)
         plt.xticks((0.00, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09))

         plt.show()
```

```
C:\Users\eleon\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:545: UserWarning: No labell
  warnings.warn("No labelled objects found. "
```

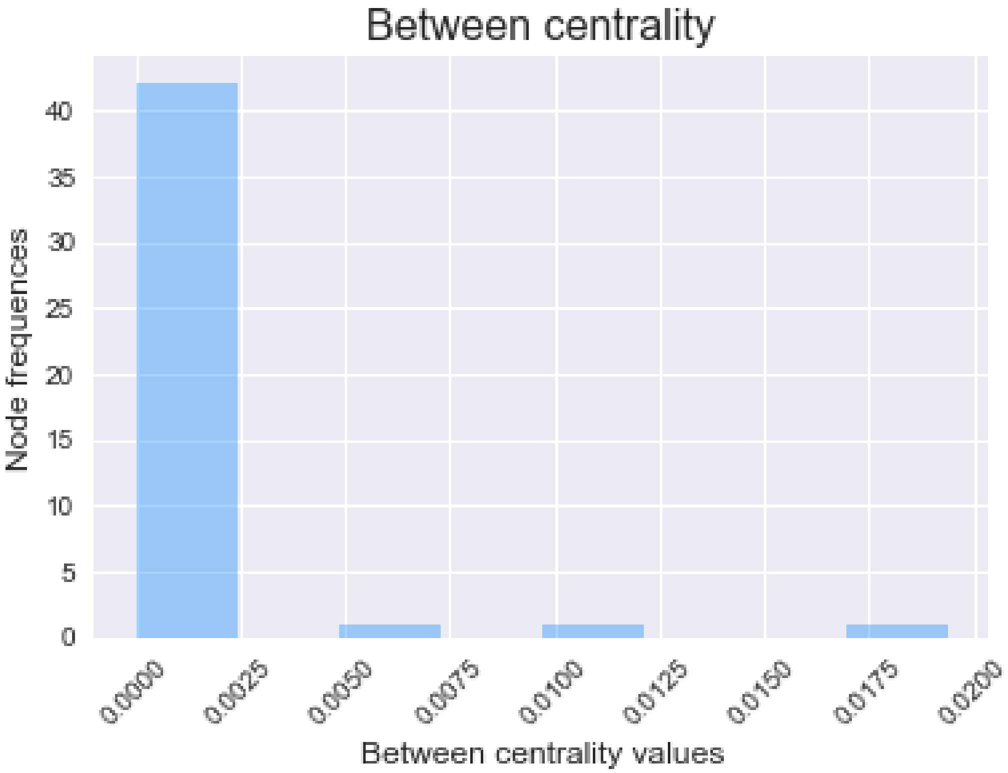


```
In [ ]: '''As we can see from the plot, even for Closeness centrality,
        we got high frequences for values of the centrality
        between 0.00 and 0.01 and low frequences for other values.'''
```

```
In [36]: '''Compute the shortest-path betweenness centrality for nodes.
         Betweenness centrality of a node vv is the sum of the fraction
         of all-pairs shortest paths that pass through v.'''
         bvalues=list(nx.betweenness_centrality(G2a, weight="weight").values())
```

```
In [37]: sns.set_style("darkgrid")
         sns.set_context({"figure.figsize": (6, 4)})

         fig, ax = plt.subplots()
         sns.distplot(bvalues,  color="dodgerblue", bins=8, hist=True, kde=False)
         plt.xlabel("Between centrality values", fontsize=12)
         plt.ylabel("Node frequences", fontsize=12)
         plt.legend(prop={'size':16})
         plt.title("Between centrality", fontsize = 16)
         plt.xticks(rotation=45)

         plt.show()
```

```
C:\Users\eleon\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:545: UserWarning: No labell
  warnings.warn("No labelled objects found. "
```



```
In [ ]: '''In this plot we can see that values which are different
        from 0.00 have low frequences,
        even lower than in the other plots.'''
```

1.2 2b.

```
In [56]: #Create the sub graph for the author in input at maximum hop distance given in input.
         G2b = nx.Graph()
         a = int(input("Enter an author id: "))
         dist=int(input("Enter max hop distance: "))
         G2b = G.subgraph(Modules.neighbors(G, a, dist))
         print("Done!")
         #256176 aris
```

```
Enter an author id: 256176
Enter max hop distance: 2
Done!
```

```
In [57]: nx.info(G2b)
```

```
Out[57]: 'Name: \nType: Graph\nNumber of nodes: 656\nNumber of edges: 2584\nAverage degree:
```

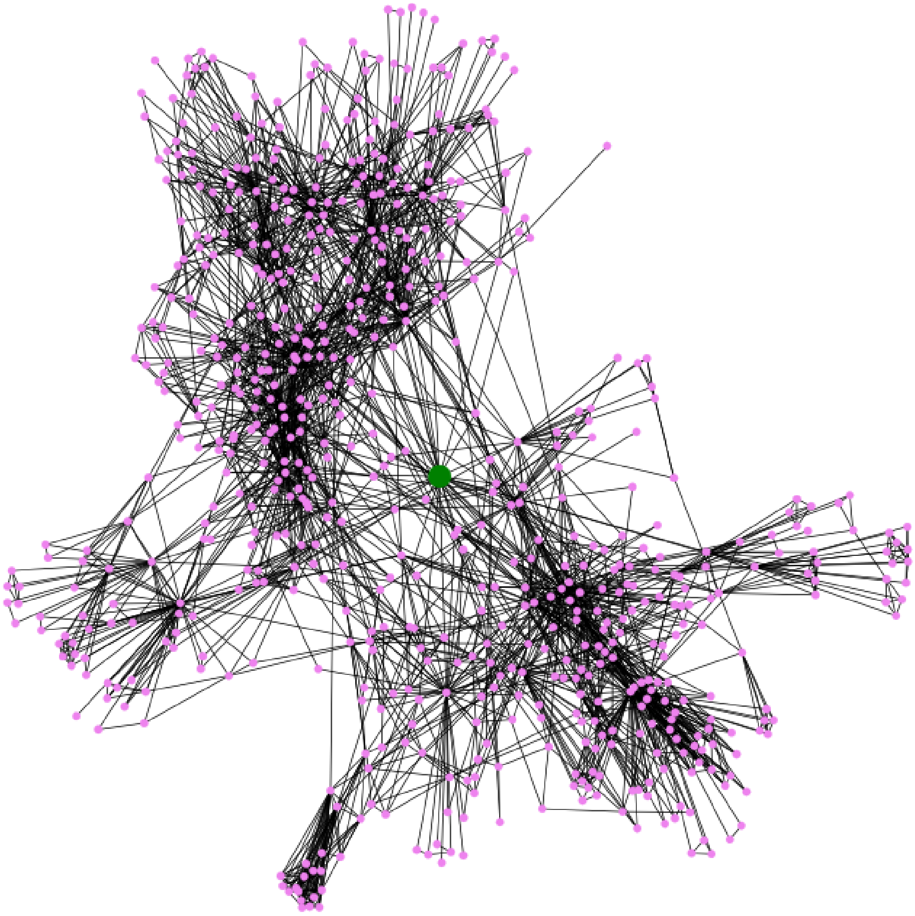
```
In [ ]: '''Nodes: 656, Edges: 2584, Ave degree: 7.8780'''
```

```
In [73]: #here we assign the color "blue" to aris' node and "red" to others
         for node in G2b.nodes():
             if (node == a):
                 color = 'green'
                 node_size=2000
             else:
                 color = 'violet'
                 node_size=250
             G2b.node[node]['color'] = color
             G2b.node[node]['node_size']= node_size
```

```
In [74]: #plot of the subgraph
         plt.clf()
         plt.figure(num=None, figsize=(15,15), dpi=50)
         nx.draw(G2b, node_shape= '.', node_size=list(nx.get_node_attributes(G2b,'node_size').
         #nx.draw_networkx_edges(G2b, alpha=.5)
         plt.show()
```

```
C:\Users\eleon\Anaconda3\lib\site-packages\networkx\drawing\nx_pylab.py:126: MatplotlibDeprecat
    Future behavior will be consistent with the long-time default:
    plot commands add elements without first clearing the
    Axes and/or Figure.
  b = plt.ishold()
C:\Users\eleon\Anaconda3\lib\site-packages\networkx\drawing\nx_pylab.py:138: MatplotlibDeprecat
    Future behavior will be consistent with the long-time default:
    plot commands add elements without first clearing the
    Axes and/or Figure.
  plt.hold(b)
C:\Users\eleon\Anaconda3\lib\site-packages\matplotlib\__init__.py:917: UserWarning: axes.hold i
  warnings.warn(self.msg_depr_set % key)
C:\Users\eleon\Anaconda3\lib\site-packages\matplotlib\rcsetup.py:152: UserWarning: axes.hold is
  warnings.warn("axes.hold is deprecated, will be removed in 3.0")
```

```
<matplotlib.figure.Figure at 0x24b05f7e2b0>
```



```
In [ ]: '''This is the subgraph for Aris (green node)
        at hop-distance 2 (given in input)'''
```

```
In [63]: #Create the graph removing similar nodes
         Gcon=Modules.removeNodes(G, similar)
```

```
In [64]: nx.info(Gcon)
```

```
Out[64]: 'Name: \nType: Graph\nNumber of nodes: 652901\nNumber of edges: 2523824\nAverage degre
```

```
In [ ]: '''Nodes: 652901, Edges: 2523824, Ave degree: 7.7311'''
```

1.3 3a.

```
In [75]: p=Modules.aris_subgraph(Gcon, similar)
```

```
In [76]: Modules.distances_aris(p, similar)
```

```
Enter Author id: 16837
2.8776876177538426
```

1.4 3b.

```
In [80]: st=d.datetime.now()
         groupnumber=Modules.groupNumber(G, Gcon, similar)
         print("Execution time: "+str(d.datetime.now()-st))
```

```
Insert author id or enter to stop: 264678 17002 15858 16438 16830 271768 17206 271791 271792 11
Execution time: 0:07:48.654791
```

```
In [ ]: '''input list: 264678 17002 15858 16438 16830 271768 17206
        271791 271792 111329 271793 271797 271798 271799 271800
        271801 271802 21484 271681 271811 271819'''
```

```
In [89]: #Print the output just for the first ten nodes.
         i=0
         for k,v in groupnumber.items():
             if i <= 10:
                 print("Node "+str(k)+":", v)
             else:
                 break
             i+=1
```

```
Node 1: (15858, 4.638938484764257)
Node 2: (15858, 3.8889384847642563)
Node 4: (111329, 3.824770286165978)
Node 5: (17002, 3.629759584145549)
Node 6: (271819, 3.792214175480484)
Node 7: (271819, 4.292214175480484)
Node 8: (271819, 4.292214175480484)
Node 9: (17002, 3.7315062388591804)
Node 10: (16830, 2.8485105982691583)
Node 11: (264678, 2.903743961352657)
Node 13: (16830, 4.403113245298119)
```