Atividade_6

October 7, 2021

[1]:
```python
import numpy as np
import seaborn as sns
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib as plt2
import igraph as ig
import networkx as nx
import itertools
import math
import random
from scipy.stats import kde
from networkx.algorithms import bipartite
from sklearn import preprocessing
from sklearn.preprocessing import normalize, MinMaxScaler
```

[2]:
```python
#generating Barabasi network

g = ig.Graph.Barabasi(1000, 3)
```

[3]:
```python
#setting nodes' labels

g.vs['label'] = [i for i in range(g.vcount())]
```

[4]:
```python
#creating array with [(label1, degree node1), (label2, degree node2)...]

labels_deg = [(g.vs['label'][i], float(g.degree(i))) for i in range(g.vcount())]
```

[5]:
```python
#sorting in descendent order

labels_deg.sort(key=lambda x: x[1], reverse=True)
```

[6]:
```python
#calculating the robustness

def robustness_stats_node_component(g, stat_array):
        # Make a copy of the network
        g_copy = g.copy()

        N = g_copy.vcount()
```

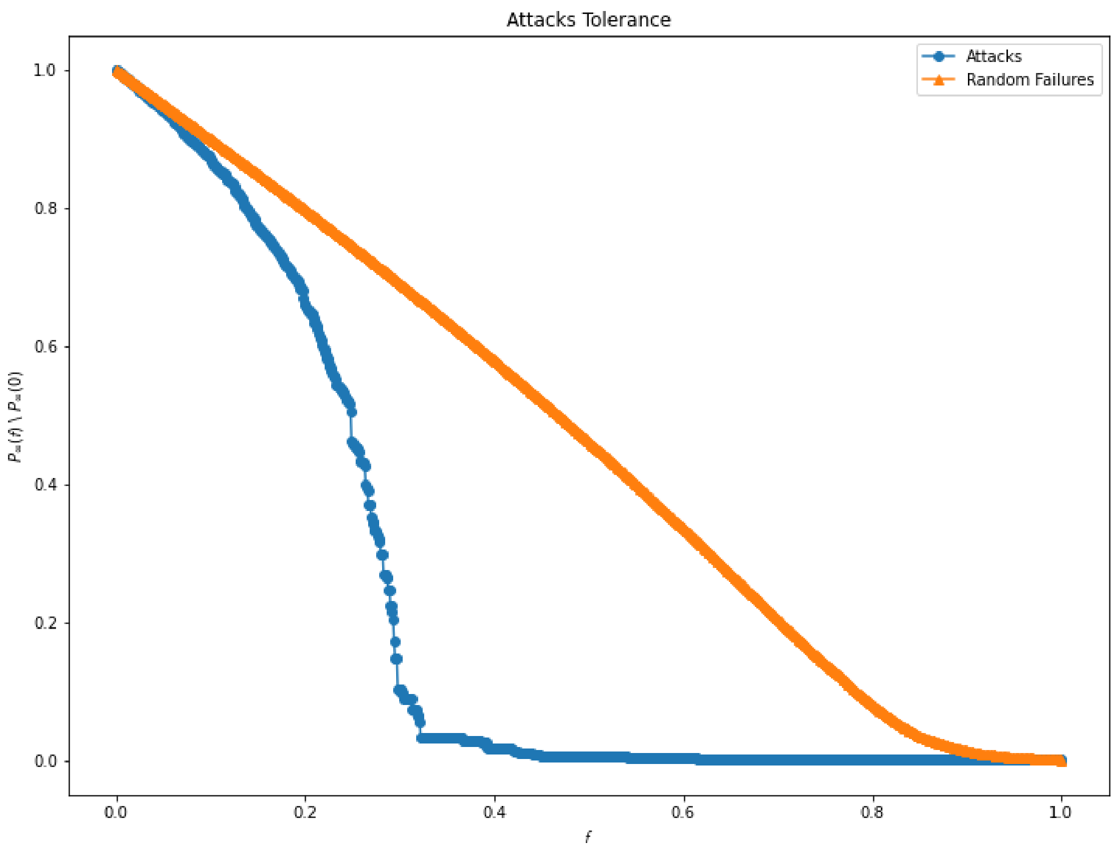
```
        number_removed = np.zeros(N+1)

        for i in range(g.vcount()):
                number_removed[i] = i / float(N)

        number_removed[N] = 1.0


        P_infty = np.zeros(N+1)

        # Find larger component
        cl = g_copy.components()
        P_infty_baseline = float(max(cl.sizes()))

        P_infty[0] = 1.0

        count = 1
        while(g_copy.vcount() > 0 and count < len(stat_array)):
                index = g_copy.vs.find(label=stat_array[count-1][0]).index

                g_copy.delete_vertices(index)

                cl = g_copy.components()

                if(len(cl) > 0):
                        P_infty[count] += float(max(cl.sizes())) /␣
 ↪P_infty_baseline
                else:
                        P_infty[count] += 0.0

                count = count + 1

        if(count < g.vcount()):
                number_removed = number_removed[0:count]
                P_infty = P_infty[0:count]

        return number_removed,P_infty
```

[7]:
```
#calculating the robustness

def robustness_failure_node(g, simulations=50):
        N = g.vcount()

        number_removed = np.zeros(N+1)

        for i in range(g.vcount()):
```

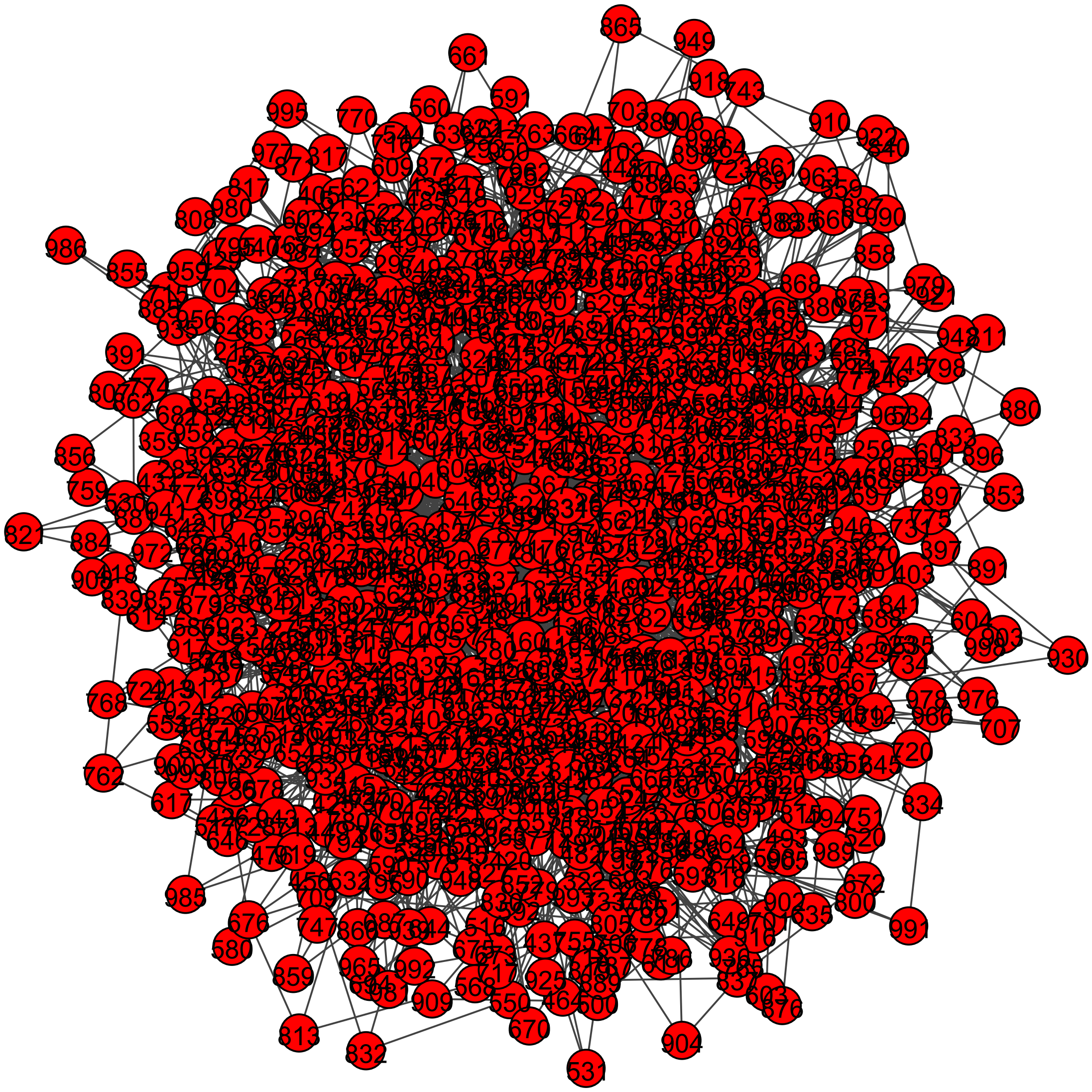
```
                number_removed[i] = i / float(N)
        number_removed[N] = 1.0

        P_infty = np.zeros(N+1)

        # Find larger component
        cl = g.components()
        P_infty_baseline = float(max(cl.sizes()))

        for _ in range(simulations):
                g_copy = g.copy()
                P_infty[0] += 1.0

                count = 1
                while(g_copy.vcount() > 0):
                        index = int(np.random.random() * g_copy.vcount())
                        g_copy.delete_vertices(index)

                        cl = g_copy.components()
                        if(len(cl) > 0):
                                P_infty[count] += float(max(cl.sizes())) /␣
 ↪P_infty_baseline
                        else:
                                P_infty[count] += 0.0

                        count = count + 1

        # Compute the average
        P_infty = P_infty / float(simulations)

        return number_removed,P_infty
```

[9]:
```
number_removed_comp, P_infinity_comp = robustness_stats_node_component(g,␣
 ↪labels_deg)
number_removed_random, P_infinity_random = robustness_failure_node(g, 100)
```

[10]:
```
plt.figure(figsize=(12,9))

plt.plot(number_removed_comp, P_infinity_comp, marker='o', label='Attacks')
plt.plot(number_removed_random, P_infinity_random, marker='^', label='Random␣
 ↪Failures')
plt.title('Attacks Tolerance')
plt.xlabel('$\mathcal{f}$')
plt.ylabel('$P_\infty (\mathcal{f})$ \ $P_\infty (0)$')
plt.legend()
plt.savefig('Attacks_tolerance.pdf', dpi=600)
```



[11]:
```
ig.plot(g)
```
[11]:



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[ ]:
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