

```
In [1]: import igraph as ig
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
from sklearn.linear_model import LinearRegression
from sklearn.cluster import KMeans
from collections import Counter
import os
import umap
import pickle
import partition_igraph
import subprocess
from sklearn.metrics import adjusted_mutual_info_score as AMI
from sklearn.metrics.cluster import adjusted_rand_score as ARI
from itertools import combinations
import time
from math import sqrt, ceil
from geopy.distance import geodesic
from geopy.point import Point
import networkx as nx

import scipy.sparse.linalg as lg
```

```
In [2]: ## the data directory
datadir = '../Datasets/'

## location of the GED code
## use the '-S' option to use split JS divergence
GED = '../GED/GED'

## location of the node2vec code
# n2v = '~/Tools/node2vec/node2vec'
n2v = 'python /Users/hoangnguyen/Downloads/node2vec-master/src/main.py'
```

```
In [3]: ## 'N2K' mapping is used to map between node name and key value in graph when reading re
def readEmbedding(fn="_embed", N2K=None):
    D = pd.read_csv(fn, sep=' ', skiprows=1, header=None)
    D = D.dropna(axis=1)
    if N2K!=None:
        x = [N2K[i] for i in D[0]]
        D[0] = x
        D = D.sort_values(by=0)
    Y = np.array(D.iloc[:,1:])
    return Y

## Read embedding from file in node2vec format
## Map to layout format
## for visualization, we use UMAP if dim > 2
def embed2layout(fn="_embed"):
    D = pd.read_csv(fn, sep=' ', skiprows=1, header=None)
    D = D.dropna(axis=1)
    D = D.sort_values(by=0)
    Y = np.array(D.iloc[:,1:])
    if Y.shape[1]>2:
        Y = umap.UMAP().fit_transform(Y)
    ly = []
    for v in range(Y.shape[0]):
        ly.append((Y[v][0],Y[v][1]))
```

```
return ly
```

```
## Computing JS divergence with GED code given edgelist, communities and embedding
```

```
def JS(edge_file, comm_file, embed_file, entropy=False):  
    if entropy:  
        x = GED+' -E -g '+edge_file+' -c '+comm_file+' -e '+embed_file  
    else:  
        x = GED+' -g '+edge_file+' -c '+comm_file+' -e '+embed_file  
    s = subprocess.run(x, shell=True, stdout=subprocess.PIPE)  
    x = s.stdout.decode().split(' ')  
    div = float(x[1])  
    return(div)
```

```
## Hope embedding with various similarity functions
```

```
def Hope(g, sim='katz', dim=2, verbose=False, beta=.01, alpha=.5):  
    ## For undirected graphs, embedding as source and target are identical  
    if g.is_directed() == False:  
        dim = dim*2  
    A = np.array(g.get_adjacency().data)  
    beta = beta  
    alpha = alpha  
    n = g.vcount()  
    ## Katz  
    if sim == 'katz':  
        M_g = np.eye(n) - beta * A  
        M_l = beta * A  
    ## Adamic-Adar  
    if sim == 'aa':  
        M_g = np.eye(n)  
        ## fix bug 1/x and take log();  
        D = np.diag([1/np.log(x) if x>1 else 0 for x in g.degree()])  
        # D = np.diag([1/np.log(max(2,x)) for x in g.degree()])  
        M_l = np.dot(np.dot(A,D),A)  
        np.fill_diagonal(M_l,0)  
    ## Common neighbors  
    if sim == 'cn':  
        M_g = np.eye(n)  
        M_l = np.dot(A,A)  
    ## personalized page rank  
    if sim == 'ppr':  
        P = []  
        for i in range(n):  
            s = np.sum(A[i])  
            if s>0:  
                P.append([x/s for x in A[i]])  
            else:  
                P.append([1/n for x in A[i]])  
        P = np.transpose(np.array(P)) ## fix bug - take transpose  
        M_g = np.eye(n)-alpha*P  
        M_l = (1-alpha)*np.eye(n)  
    S = np.dot(np.linalg.inv(M_g), M_l)  
    u, s, vt = lg.svds(S, k=dim // 2)  
    X1 = np.dot(u, np.diag(np.sqrt(s)))  
    X2 = np.dot(vt.T, np.diag(np.sqrt(s)))  
    X = np.concatenate((X1, X2), axis=1)  
    p_d_p_t = np.dot(u, np.dot(np.diag(s), vt))  
    eig_err = np.linalg.norm(p_d_p_t - S)  
    if verbose:  
        print('SVD error (low rank): %f' % eig_err)  
    ## undirected graphs have identical source and target embeddings
```

```

    if g.is_directed() == False:
        d = dim//2
        return X[:, :d]
    else:
        return X

## save to disk to compute divergence
def saveEmbedding(X, g, fn='_embed'):
    with open(fn, 'w') as f:
        f.write(str(X.shape[0]) + " " + str(X.shape[1]) + '\n')
        for i in range(X.shape[0]):
            f.write(str(g.vs[i]['name']) + ' ')
            for j in range(X.shape[1]):
                f.write(str(X[i][j]) + ' ')
            f.write('\n')

## Laplacian eigenmaps embedding
def LE(g, dim=2):
    L_sym = np.array(g.laplacian(normalized=True))
    w, v = lg.eigs(L_sym, k=dim + 1, which='SM')
    idx = np.argsort(w) # sort eigenvalues
    w = w[idx]
    v = v[:, idx]
    X = v[:, 1:]
    return X.real

```

Problem 1

Generate ABCD graph

```

In [4]: abcd_path = '../Datasets/ABCDGraphGenerator.jl-master/utils/'
        julia = '/Applications/Julia-1.8.app/Contents/Resources/julia/bin/julia'

```

```

In [5]: node_count = 1000
        gamma = 2.5
        beta = 1.5
        xi = 0.2

        os.system(f"rm -r {str(node_count)}")
        os.system(f"mkdir {str(node_count)}")

        deg_path = f'{node_count}/deg.dat'
        cmd = f'{julia} {abcd_path}/deg_sampler.jl {deg_path} {gamma} 10 50 {node_count} 1000'
        os.system(cmd)

        cs_path = f'{node_count}/cs.dat'
        cmd = f'{julia} {abcd_path}/com_sampler.jl {cs_path} {beta} 50 100 {node_count} 1000'
        os.system(cmd)

        net_path = f'{node_count}/net.dat'
        comm_path = f'{node_count}/comm.dat'
        cmd = f'{julia} {abcd_path}/graph_sampler.jl {net_path} {comm_path} {deg_path} {cs_path}'
        os.system(cmd)

```

```
[ Info: Usage: julia deg_sampler.jl filename  $\tau_1$  d_min d_max n max_iter [seed]
[ Info: Example: julia deg_sampler.jl degrees.dat 3 5 50 10000 1000 42
[ Info: Expected value of degree: 17.59492981753638
[ Info: Usage: julia com_sampler.jl filename  $\tau_2$  c_min c_max n max_iter [seed] [nout]
[ Info: Example: julia com_sampler.jl community_sizes.dat 2 50 1000 10000 1000 42 100
[ Info: Expected value of community size: 70.53394879444838
[ Info: Usage: julia graph_sampler.jl networkfile communityfile degreefile communitysize
sfile  $\mu$ | $\xi$  fraction isCL islocal [seed] [nout]
[ Info: Example: julia graph_sampler.jl network.dat community.dat degrees.dat community_
sizes.dat  $\xi$  0.2 true true 42 100
```

Out[5]: 0

Read ABCD graph

```
In [9]: abcd_datadir = '1000/'
abcd_net_file = abcd_datadir+'net.dat'
abcd_comm_file = abcd_datadir+'comm.dat'
```

```
In [10]: ## read graph and communities
ABCD = ig.Graph.Read_Ncol(abcd_net_file,directed=False)
c = np.loadtxt(abcd_comm_file,dtype='uint16',usecols=(1))
ABCD.vs['comm'] = [c[int(x['name'])]-1 for x in ABCD.vs]

## print a few stats
print(ABCD.vcount(),'vertices,',ABCD.ecount(),'edges,', 'avg degreee',np.mean(ABCD.degree
'communities',max(ABCD.vs['comm'])))

## ground truth communities
GT = {k:(v-1) for k,v in enumerate(ABCD.vs['comm'])}

## map between int(name) to key
N2K = {int(v):k for k,v in enumerate(ABCD.vs['name'])}

## define the colors and node sizes here
## node colors refer to communities
cls_edges = 'gainsboro'
ABCD.vs['size'] = 5
ABCD.es['color'] = cls_edges
pal = ig.RainbowPalette(n=max(ABCD.vs['comm'])+1)
ABCD.vs['color'] = [pal.get(int(i)) for i in ABCD.vs['comm']]
#ABCD.vs['color'] = 'black'

ig.plot(ABCD, bbox=(0,0,400,300)) ## communities are far from obvious in 2d layout!

1000 vertices, 8701 edges, avg degreee 17.402 communities 14
```

Out [10]:

b'

\n'

Run embedding algorithms

```
In [12]: # save ecg community result to file
abcd_ecg_label_ls = ABCD.community_ecg().membership
abcd_ecg_file = abcd_datadir+'abcd.ecg'
with open(abcd_ecg_file, 'w') as fp:
    fp.write("\n".join(str(label) for label in abcd_ecg_label_ls))
```

```
In [13]: def compute_JS_divergence(
    best_jsd, worst_jsd,
    net_file,
    ecg_file,
    _embed_fn='_embed', _embed_best_fn='_embed_best', _embed_worst_fn='_embed_worst'
):
    (best_jsd_, worst_jsd_) = (best_jsd, worst_jsd)

    jsd = JS(net_file, ecg_file, _embed_fn)
    ## keep track of best and worst
    if jsd < best_jsd:
        os.system(f'cp {_embed_fn} {_embed_best_fn}')
        best_jsd_ = jsd
    if jsd > worst_jsd:
        os.system(f'cp {_embed_fn} {_embed_worst_fn}')
        worst_jsd_ = jsd
    return (best_jsd_, worst_jsd_, jsd)

def run_hope(
    embedding_count,
    g, best_jsd, worst_jsd, L, DIM, net_file, ecg_file,
    _embed_fn_prefix='', _embed_best_fn='_embed_best', _embed_worst_fn='_embed_worst'
):
    for i in range(embedding_count):
        print('Running Hope...')
        ## Hope with different choices for the similarity
        for dim in DIM:
```

```

#         for sim in ['katz', 'aa', 'cn', 'ppr']:
            for sim in ['ppr']:
                print(f'Running Hope run={i} dim={dim} sim={sim}...')
                X = Hope(g, sim=sim, dim=dim)
                _embed_fn = f'{_embed_fn_prefix}_Hope_run={i}_dim={dim}_sim={sim}_embed'
                saveEmbedding(X, g, fn=_embed_fn)
                (best_jsd, worst_jsd, jsd) = compute_JS_divergence(
                    best_jsd, worst_jsd,
                    net_file, ecg_file, _embed_fn, _embed_best_fn, _embed_worst_fn
                )
                L.append([dim, 'hope', sim, jsd, i])
    return best_jsd, worst_jsd

def run_le(
    embedding_count,
    g, best_jsd, worst_jsd, L, DIM, net_file, ecg_file,
    _embed_fn_prefix='', _embed_best_fn='_embed_best', _embed_worst_fn='_embed_worst'
):
    for i in range(embedding_count):
        print('Running LE...')
        ## Laplacian Eigenmap
        for dim in DIM:
            print(f'Running LE run={i} dim={dim}...')
            X = LE(g, dim=dim)
            _embed_fn = f'{_embed_fn_prefix}_LE_run={i}_dim={dim}_embed'
            saveEmbedding(X, g, fn=_embed_fn)
            (best_jsd, worst_jsd, jsd) = compute_JS_divergence(
                best_jsd, worst_jsd,
                net_file, ecg_file, _embed_fn, _embed_best_fn, _embed_worst_fn
            )
            L.append([dim, 'le', ' ', jsd, i])
    return best_jsd, worst_jsd

def run_node2vec(
    embedding_count,
    g, best_jsd, worst_jsd, L, DIM, net_file, ecg_file,
    _embed_fn_prefix='', _embed_best_fn='_embed_best', _embed_worst_fn='_embed_worst'
):
    for i in range(embedding_count):
        print('Running node2vec...')
        ## node2vec
        ## we try a few choices for p and q, parameters for the random walks
        ## on some platforms, we got better results with longer random walks (code comme
        for dim in DIM:
            # for (p,q) in [(1,0.1),(1,.5),(0.1,1),(0.5,1),(1,1)]:
            for (p,q) in [(1,0.1)]:
                print(f'Running node2vec run={i} dim={dim} p={p} q={q}...')
                _embed_fn = f'{_embed_fn_prefix}_node2vec_run={i}_dim={dim}_p={p}_q={q}_
                ## long walks:
                # x = n2v + ' -i:'+net_file+' -o:_embed -d:'+str(dim)+' -p:'+str(p)+' -q
                ## short walks:
                # x = f'{n2v} -l:15 -i:{net_file} -o:{_embed_fn} -d:{str(dim)} -p:{str(p)}
                x = f'{n2v} --walk-length 15 --input {net_file} --output {_embed_fn} --d

                print(x)
                r = os.system(x+' >/dev/null')
                print(r)
                (best_jsd, worst_jsd, jsd) = compute_JS_divergence(
                    best_jsd, worst_jsd,
                    net_file, ecg_file, _embed_fn, _embed_best_fn, _embed_worst_fn
                )
                L.append([dim, 'n2v', str(p)+' '+str(q), jsd, i])
    return best_jsd, worst_jsd

```

```

In [14]: def run_exp(g, net_file, ecg_file, prefix, DIM=[4, 8, 16, 32, 64, 128], embedding_count
          L = []
          # DIM = [2, 4, 5]
          best_jsd = 1          ## keep track of best result
          worst_jsd = 0         ## and worst

          _embed_fn_prefix = prefix
          _embed_best_fn = f'{prefix}_embed_best'
          _embed_worst_fn = f'{prefix}_embed_worst'

          # (best_jsd, worst_jsd) = run_le(
          #     embedding_count,
          #     g, best_jsd, worst_jsd, L, DIM, net_file, ecg_file,
          #     _embed_fn_prefix, _embed_best_fn, _embed_worst_fn
          # )
          (best_jsd, worst_jsd) = run_hope(
              embedding_count,
              g, best_jsd, worst_jsd, L, DIM, net_file, ecg_file,
              _embed_fn_prefix, _embed_best_fn, _embed_worst_fn
          )
          (best_jsd, worst_jsd) = run_node2vec(
              embedding_count,
              g, best_jsd, worst_jsd, L, DIM, net_file, ecg_file,
              _embed_fn_prefix, _embed_best_fn, _embed_worst_fn
          )

          ## store in dataframe and show best results
          D = pd.DataFrame(L, columns=['dim', 'algo', 'param', 'jsd', 'run_id'])
          D = D.sort_values(by='jsd', axis=0)
          return D, best_jsd, worst_jsd

```

```

In [24]: (ABCD_D, ABCD_best_jsd, ABCD_worst_jsd) = run_exp(ABCD, abcd_net_file, abcd_ecg_file, "A
print(ABCD_best_jsd, ABCD_worst_jsd)

```

Running Hope...
Running Hope run=0 dim=4 sim=ppr...
Running Hope run=0 dim=8 sim=ppr...
Running Hope run=0 dim=16 sim=ppr...
Running Hope run=0 dim=32 sim=ppr...
Running Hope run=0 dim=64 sim=ppr...
Running Hope run=0 dim=128 sim=ppr...
Running Hope...
Running Hope run=1 dim=4 sim=ppr...
Running Hope run=1 dim=8 sim=ppr...
Running Hope run=1 dim=16 sim=ppr...
Running Hope run=1 dim=32 sim=ppr...
Running Hope run=1 dim=64 sim=ppr...
Running Hope run=1 dim=128 sim=ppr...
Running Hope...
Running Hope run=2 dim=4 sim=ppr...
Running Hope run=2 dim=8 sim=ppr...
Running Hope run=2 dim=16 sim=ppr...
Running Hope run=2 dim=32 sim=ppr...
Running Hope run=2 dim=64 sim=ppr...
Running Hope run=2 dim=128 sim=ppr...
Running Hope...
Running Hope run=3 dim=4 sim=ppr...
Running Hope run=3 dim=8 sim=ppr...
Running Hope run=3 dim=16 sim=ppr...
Running Hope run=3 dim=32 sim=ppr...
Running Hope run=3 dim=64 sim=ppr...
Running Hope run=3 dim=128 sim=ppr...
Running Hope...
Running Hope run=4 dim=4 sim=ppr...
Running Hope run=4 dim=8 sim=ppr...
Running Hope run=4 dim=16 sim=ppr...
Running Hope run=4 dim=32 sim=ppr...
Running Hope run=4 dim=64 sim=ppr...
Running Hope run=4 dim=128 sim=ppr...
Running Hope...
Running Hope run=5 dim=4 sim=ppr...
Running Hope run=5 dim=8 sim=ppr...
Running Hope run=5 dim=16 sim=ppr...
Running Hope run=5 dim=32 sim=ppr...
Running Hope run=5 dim=64 sim=ppr...
Running Hope run=5 dim=128 sim=ppr...
Running Hope...
Running Hope run=6 dim=4 sim=ppr...
Running Hope run=6 dim=8 sim=ppr...
Running Hope run=6 dim=16 sim=ppr...
Running Hope run=6 dim=32 sim=ppr...
Running Hope run=6 dim=64 sim=ppr...
Running Hope run=6 dim=128 sim=ppr...
Running Hope...
Running Hope run=7 dim=4 sim=ppr...
Running Hope run=7 dim=8 sim=ppr...
Running Hope run=7 dim=16 sim=ppr...
Running Hope run=7 dim=32 sim=ppr...
Running Hope run=7 dim=64 sim=ppr...
Running Hope run=7 dim=128 sim=ppr...
Running Hope...
Running Hope run=8 dim=4 sim=ppr...
Running Hope run=8 dim=8 sim=ppr...
Running Hope run=8 dim=16 sim=ppr...
Running Hope run=8 dim=32 sim=ppr...
Running Hope run=8 dim=64 sim=ppr...

Running Hope run=8 dim=128 sim=ppr...
Running Hope...
Running Hope run=9 dim=4 sim=ppr...
Running Hope run=9 dim=8 sim=ppr...
Running Hope run=9 dim=16 sim=ppr...
Running Hope run=9 dim=32 sim=ppr...
Running Hope run=9 dim=64 sim=ppr...
Running Hope run=9 dim=128 sim=ppr...
Running Hope...
Running Hope run=10 dim=4 sim=ppr...
Running Hope run=10 dim=8 sim=ppr...
Running Hope run=10 dim=16 sim=ppr...
Running Hope run=10 dim=32 sim=ppr...
Running Hope run=10 dim=64 sim=ppr...
Running Hope run=10 dim=128 sim=ppr...
Running Hope...
Running Hope run=11 dim=4 sim=ppr...
Running Hope run=11 dim=8 sim=ppr...
Running Hope run=11 dim=16 sim=ppr...
Running Hope run=11 dim=32 sim=ppr...
Running Hope run=11 dim=64 sim=ppr...
Running Hope run=11 dim=128 sim=ppr...
Running Hope...
Running Hope run=12 dim=4 sim=ppr...
Running Hope run=12 dim=8 sim=ppr...
Running Hope run=12 dim=16 sim=ppr...
Running Hope run=12 dim=32 sim=ppr...
Running Hope run=12 dim=64 sim=ppr...
Running Hope run=12 dim=128 sim=ppr...
Running Hope...
Running Hope run=13 dim=4 sim=ppr...
Running Hope run=13 dim=8 sim=ppr...
Running Hope run=13 dim=16 sim=ppr...
Running Hope run=13 dim=32 sim=ppr...
Running Hope run=13 dim=64 sim=ppr...
Running Hope run=13 dim=128 sim=ppr...
Running Hope...
Running Hope run=14 dim=4 sim=ppr...
Running Hope run=14 dim=8 sim=ppr...
Running Hope run=14 dim=16 sim=ppr...
Running Hope run=14 dim=32 sim=ppr...
Running Hope run=14 dim=64 sim=ppr...
Running Hope run=14 dim=128 sim=ppr...
Running Hope...
Running Hope run=15 dim=4 sim=ppr...
Running Hope run=15 dim=8 sim=ppr...
Running Hope run=15 dim=16 sim=ppr...
Running Hope run=15 dim=32 sim=ppr...
Running Hope run=15 dim=64 sim=ppr...
Running Hope run=15 dim=128 sim=ppr...
Running Hope...
Running Hope run=16 dim=4 sim=ppr...
Running Hope run=16 dim=8 sim=ppr...
Running Hope run=16 dim=16 sim=ppr...
Running Hope run=16 dim=32 sim=ppr...
Running Hope run=16 dim=64 sim=ppr...
Running Hope run=16 dim=128 sim=ppr...
Running Hope...
Running Hope run=17 dim=4 sim=ppr...
Running Hope run=17 dim=8 sim=ppr...
Running Hope run=17 dim=16 sim=ppr...
Running Hope run=17 dim=32 sim=ppr...

Running Hope run=17 dim=64 sim=ppr...
Running Hope run=17 dim=128 sim=ppr...
Running Hope...
Running Hope run=18 dim=4 sim=ppr...
Running Hope run=18 dim=8 sim=ppr...
Running Hope run=18 dim=16 sim=ppr...
Running Hope run=18 dim=32 sim=ppr...
Running Hope run=18 dim=64 sim=ppr...
Running Hope run=18 dim=128 sim=ppr...
Running Hope...
Running Hope run=19 dim=4 sim=ppr...
Running Hope run=19 dim=8 sim=ppr...
Running Hope run=19 dim=16 sim=ppr...
Running Hope run=19 dim=32 sim=ppr...
Running Hope run=19 dim=64 sim=ppr...
Running Hope run=19 dim=128 sim=ppr...
Running Hope...
Running Hope run=20 dim=4 sim=ppr...
Running Hope run=20 dim=8 sim=ppr...
Running Hope run=20 dim=16 sim=ppr...
Running Hope run=20 dim=32 sim=ppr...
Running Hope run=20 dim=64 sim=ppr...
Running Hope run=20 dim=128 sim=ppr...
Running Hope...
Running Hope run=21 dim=4 sim=ppr...
Running Hope run=21 dim=8 sim=ppr...
Running Hope run=21 dim=16 sim=ppr...
Running Hope run=21 dim=32 sim=ppr...
Running Hope run=21 dim=64 sim=ppr...
Running Hope run=21 dim=128 sim=ppr...
Running Hope...
Running Hope run=22 dim=4 sim=ppr...
Running Hope run=22 dim=8 sim=ppr...
Running Hope run=22 dim=16 sim=ppr...
Running Hope run=22 dim=32 sim=ppr...
Running Hope run=22 dim=64 sim=ppr...
Running Hope run=22 dim=128 sim=ppr...
Running Hope...
Running Hope run=23 dim=4 sim=ppr...
Running Hope run=23 dim=8 sim=ppr...
Running Hope run=23 dim=16 sim=ppr...
Running Hope run=23 dim=32 sim=ppr...
Running Hope run=23 dim=64 sim=ppr...
Running Hope run=23 dim=128 sim=ppr...
Running Hope...
Running Hope run=24 dim=4 sim=ppr...
Running Hope run=24 dim=8 sim=ppr...
Running Hope run=24 dim=16 sim=ppr...
Running Hope run=24 dim=32 sim=ppr...
Running Hope run=24 dim=64 sim=ppr...
Running Hope run=24 dim=128 sim=ppr...
Running Hope...
Running Hope run=25 dim=4 sim=ppr...
Running Hope run=25 dim=8 sim=ppr...
Running Hope run=25 dim=16 sim=ppr...
Running Hope run=25 dim=32 sim=ppr...
Running Hope run=25 dim=64 sim=ppr...
Running Hope run=25 dim=128 sim=ppr...
Running Hope...
Running Hope run=26 dim=4 sim=ppr...
Running Hope run=26 dim=8 sim=ppr...
Running Hope run=26 dim=16 sim=ppr...

```

Running Hope run=26 dim=32 sim=ppr...
Running Hope run=26 dim=64 sim=ppr...
Running Hope run=26 dim=128 sim=ppr...
Running Hope...
Running Hope run=27 dim=4 sim=ppr...
Running Hope run=27 dim=8 sim=ppr...
Running Hope run=27 dim=16 sim=ppr...
Running Hope run=27 dim=32 sim=ppr...
Running Hope run=27 dim=64 sim=ppr...
Running Hope run=27 dim=128 sim=ppr...
Running Hope...
Running Hope run=28 dim=4 sim=ppr...
Running Hope run=28 dim=8 sim=ppr...
Running Hope run=28 dim=16 sim=ppr...
Running Hope run=28 dim=32 sim=ppr...
Running Hope run=28 dim=64 sim=ppr...
Running Hope run=28 dim=128 sim=ppr...
Running Hope...
Running Hope run=29 dim=4 sim=ppr...
Running Hope run=29 dim=8 sim=ppr...
Running Hope run=29 dim=16 sim=ppr...
Running Hope run=29 dim=32 sim=ppr...
Running Hope run=29 dim=64 sim=ppr...
Running Hope run=29 dim=128 sim=ppr...
Running node2vec...
Running node2vec run=0 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=0_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=0 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=0_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=0 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=0_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=0 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=0_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=0 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=0_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=0 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=0_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=1 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=1_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=1 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=1_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=1 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=1_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=1 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=1_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=1 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=1_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=1 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=1_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=2 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=2_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=2 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=2_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=2 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=2_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=2 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=2_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=2 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=2_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=2 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=2_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=3 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=3_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=3 dim=8 p=1 q=0.1...
```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=3_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=3 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=3_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=3 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=3_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=3 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=3_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=3 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=3_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=4 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=4_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=4 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=4_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=4 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=4_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=4 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=4_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=4 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=4_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=4 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=4_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=5 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=5_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=5 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=5_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=5 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=5_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=5 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=5_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=5 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=5_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=5 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=5_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=6 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=6_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=6 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=6_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=6 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=6_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=6 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=6_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=6 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=6_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=6 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=6_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=7 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=7_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=7 dim=8 p=1 q=0.1...
```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=7_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=7 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=7_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=7 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=7_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=7 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=7_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=7 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=7_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=8 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=8_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=8 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=8_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=8 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=8_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=8 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=8_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=8 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=8_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=8 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=8_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=9 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=9_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=9 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=9_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=9 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=9_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=9 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=9_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=9 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=9_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=9 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=9_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=10 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=10_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=10 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=10_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=10 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=10_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=10 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=10_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=10 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=10_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=10 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=10_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=11 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=11_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=11 dim=8 p=1 q=0.1...

```



```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=11_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=11 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=11_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=11 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=11_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=11 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=11_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=11 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=11_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=12 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=12_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=12 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=12_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=12 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=12_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=12 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=12_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=12 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=12_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=12 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=12_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=13 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=13_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=13 dim=8 p=1 q=0.1...
```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=13_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=13 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=13_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=13 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=13_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=13 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=13_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=13 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=13_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=14 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=14_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=14 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=14_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=14 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=14_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=14 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=14_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=14 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=14_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=14 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=14_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=15 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=15_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=15 dim=8 p=1 q=0.1...
```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=15_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=15 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=15_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=15 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=15_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=15 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=15_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=15 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=15_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=16 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=16_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=16 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=16_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=16 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=16_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=16 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=16_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=16 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=16_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=16 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=16_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=17 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=17_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=17 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=17_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=17 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=17_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=17 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=17_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=17 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=17_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=17 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=17_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=18 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=18_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=18 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=18_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=18 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=18_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=18 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=18_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=18 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=18_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=18 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=18_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=19 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=19_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=19 dim=8 p=1 q=0.1...
```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=19_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=19 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=19_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=19 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=19_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=19 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=19_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=19 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=19_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=20 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=20_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=20 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=20_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=20 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=20_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=20 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=20_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=20 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=20_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=20 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=20_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=21 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=21_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=21 dim=8 p=1 q=0.1...
```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=21_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=21 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=21_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=21 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=21_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=21 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=21_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=21 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=21_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=22 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=22_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=22 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=22_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=22 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=22_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=22 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=22_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=22 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=22_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=22 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=22_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=23 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=23_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=23 dim=8 p=1 q=0.1...
```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=23_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=23 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=23_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=23 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=23_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=23 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=23_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=23 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=23_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=24 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=24_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=24 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=24_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=24 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=24_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=24 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=24_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=24 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=24_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=24 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=24_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=25 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=25_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=25 dim=8 p=1 q=0.1...
```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=25_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=25 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=25_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=25 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=25_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=25 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=25_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=25 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=25_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=26 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=26_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=26 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=26_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=26 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=26_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=26 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=26_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=26 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=26_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=26 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=26_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=27 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=27_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=27 dim=8 p=1 q=0.1...

```



```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=27_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=27 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=27_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=27 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=27_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=27 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=27_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=27 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=27_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=28 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=28_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=28 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=28_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=28 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=28_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=28 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=28_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=28 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=28_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=28 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=28_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=29 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=29_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=29 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=29_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=29 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=29_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=29 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=29_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=29 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=29_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=29 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input 1000/net.dat --output ABCD_node2vec_run=29_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
0.00105436 0.001376821
```

In [25]: `display(ABCD_D.head())`

	dim	algo	param	jsd	run_id
179	128	hope	ppr	0.001054	29
53	128	hope	ppr	0.001054	8
23	128	hope	ppr	0.001054	3
155	128	hope	ppr	0.001054	25
149	128	hope	ppr	0.001054	24

In [26]: `ABCD_D_ = ABCD_D.groupby(by=["dim"], as_index=False).agg({"jsd": ["mean", np.std]})`
`ABCD_D_`

Out[26]:

	dim	jsd	
		mean	std
0	4	0.001370	0.000014
1	8	0.001365	0.000027
2	16	0.001371	0.000010
3	32	0.001350	0.000021
4	64	0.001331	0.000040
5	128	0.001206	0.000154

In [27]: `best_emd = ABCD_D_[['jsd', 'mean']].idxmax()`
`most_stable = ABCD_D_[['jsd', 'std']].idxmax()`

`print('Best embedding dim:', ABCD_D_.loc[best_emd]['dim'][0])`
`print('Most stable dim:', ABCD_D_.loc[most_stable]['dim'][0])`

Best embedding dim: 16.0
Most stable dim: 128.0

Problem 2

```
In [ ]: # Reload ABCD graph
abcd_datadir = '1000/'
abcd_net_file = abcd_datadir+'net.dat'
abcd_comm_file = abcd_datadir+'comm.dat'

## read graph and communities
ABCD = ig.Graph.Read_Ncol(abcd_net_file,directed=False)
c = np.loadtxt(abcd_comm_file,dtype='uint16',usecols=(1))
ABCD.vs['comm'] = [c[int(x['name'])-1] for x in ABCD.vs]

## print a few stats
print(ABCD.vcount(),'vertices','ABCD.ecount(),'edges','avg degreee',np.mean(ABCD.degree
    'communities',max(ABCD.vs['comm'])))

## ground truth communities
GT = {k:(v-1) for k,v in enumerate(ABCD.vs['comm'])}

## map between int(name) to key
N2K = {int(v):k for k,v in enumerate(ABCD.vs['name'])}

## define the colors and node sizes here
## node colors refer to communities
cls_edges = 'gainsboro'
ABCD.vs['size'] = 5
ABCD.es['color'] = cls_edges
pal = ig.RainbowPalette(n=max(ABCD.vs['comm'])+1)
ABCD.vs['color'] = [pal.get(int(i)) for i in ABCD.vs['comm']]
#ABCD.vs['color'] = 'black'

ig.plot(ABCD, bbox=(0,0,400,300)) ## communities are far from obvious in 2d layout!
```

```
In [15]: def run_kmeans_compute_scores(X, g, GT, random_state=0):
    cl = KMeans(n_clusters=len(set(GT.values())), random_state=random_state).fit(X)
    d = {k:v for k,v in enumerate(cl.labels_)}
    ami = AMI(list(GT.values()),list(d.values()))
    ari = ARI(list(GT.values()),list(d.values()))
    agri = ABCD.gam(d,GT)

    print("AMI:", ami)
    print("ARI:", ari)
    print("AGRI:", agri)
    return ami, ari, agri
```

```
In [16]: best_nodes_vectors = readEmbedding(fn="abcd_embed_best")
(best_embedding_ami, best_embedding_ari, best_embedding_agri) = run_kmeans_compute_score
    best_nodes_vectors, ABCD, GT)
```

AMI: 0.1687057402453275
ARI: 0.0809958930579529
AGRI: 0.05023912041818268

```
In [17]: worst_nodes_vectors = readEmbedding(fn="abcd_embed_worst")
(worst_embedding_ami, worst_embedding_ari, worst_embedding_agri) = run_kmeans_compute_sc
    worst_nodes_vectors, ABCD, GT)
```

AMI: 0.13125996426928777
ARI: 0.04723810420402105
AGRI: 0.03167618963894593

Problem 3

```
In [31]: # https://networkx.org/documentation/stable/reference/generated/networkx.generators.comm  
# A ring of cliques is a graph that consists of  $l$  complete subgraphs (cliques) of size  $s$   
#  $s = 3$  and  $3 \leq l \leq 48$   
#  $l = 10$ 
```

```
In [33]: # Generate a ring of cliques  
num_cliques = 20  
clique_size = 3  
nx_ring_of_cliques = nx.ring_of_cliques(num_cliques, clique_size)  
nx_ring_of_cliques
```

Out[33]: <networkx.classes.graph.Graph at 0x15a41ed90>

```
In [34]: ring_of_cliques = ig.Graph.TupleList(nx_ring_of_cliques.edges(), directed=False)  
ring_of_cliques
```

Out[34]: <igraph.Graph at 0x15a4a9040>

```
In [35]: ig.plot(ring_of_cliques)
```

Out [35]: b'

\n'

```
In [36]: ring_net_data = [[e.source, e.target] for e in list(ring_of_cliques.es())]
ring_net_file = 'ring_net.dat'
with open(ring_net_file, 'w') as testfile:
    for row in ring_net_data:
        testfile.write(' '.join([str(a) for a in row]) + '\n')
```

```
In [37]: ring_ecg_file = 'ring.ecg'
ring_ecg_label_ls = ring_of_cliques.community_ecg().membership
with open(ring_ecg_file, 'w') as fp:
    fp.write("\n".join(str(label) for label in ring_ecg_label_ls))
```

```
In [38]: ring_of_cliques.vs['comm'] = [ring_ecg_label_ls[int(x.index)] for x in ring_of_cliques.v
pal = ig.RainbowPalette(n=max(ring_of_cliques.vs['comm'])+1)
ring_of_cliques.vs['color'] = [pal.get(int(i)) for i in ring_of_cliques.vs['comm']]
ig.plot(ring_of_cliques)
```

Out [38]: b'

\n'

```
In [39]: (ring_D, ring_best_jsd, ring_worst_jsd) = run_exp(ring_of_cliques, ring_net_file, ring_e
print(ring_best_jsd, ring_worst_jsd)
```

Running Hope...
Running Hope run=0 dim=4 sim=ppr...
Running Hope run=0 dim=8 sim=ppr...
Running Hope run=0 dim=16 sim=ppr...
Running Hope run=0 dim=32 sim=ppr...
Running Hope...
Running Hope run=1 dim=4 sim=ppr...
Running Hope run=1 dim=8 sim=ppr...
Running Hope run=1 dim=16 sim=ppr...
Running Hope run=1 dim=32 sim=ppr...
Running Hope...
Running Hope run=2 dim=4 sim=ppr...
Running Hope run=2 dim=8 sim=ppr...
Running Hope run=2 dim=16 sim=ppr...
Running Hope run=2 dim=32 sim=ppr...
Running Hope...
Running Hope run=3 dim=4 sim=ppr...
Running Hope run=3 dim=8 sim=ppr...
Running Hope run=3 dim=16 sim=ppr...
Running Hope run=3 dim=32 sim=ppr...
Running Hope...
Running Hope run=4 dim=4 sim=ppr...
Running Hope run=4 dim=8 sim=ppr...
Running Hope run=4 dim=16 sim=ppr...
Running Hope run=4 dim=32 sim=ppr...
Running Hope...
Running Hope run=5 dim=4 sim=ppr...
Running Hope run=5 dim=8 sim=ppr...
Running Hope run=5 dim=16 sim=ppr...
Running Hope run=5 dim=32 sim=ppr...
Running Hope...
Running Hope run=6 dim=4 sim=ppr...
Running Hope run=6 dim=8 sim=ppr...
Running Hope run=6 dim=16 sim=ppr...
Running Hope run=6 dim=32 sim=ppr...
Running Hope...
Running Hope run=7 dim=4 sim=ppr...
Running Hope run=7 dim=8 sim=ppr...
Running Hope run=7 dim=16 sim=ppr...
Running Hope run=7 dim=32 sim=ppr...
Running Hope...
Running Hope run=8 dim=4 sim=ppr...
Running Hope run=8 dim=8 sim=ppr...
Running Hope run=8 dim=16 sim=ppr...
Running Hope run=8 dim=32 sim=ppr...
Running Hope...
Running Hope run=9 dim=4 sim=ppr...
Running Hope run=9 dim=8 sim=ppr...
Running Hope run=9 dim=16 sim=ppr...
Running Hope run=9 dim=32 sim=ppr...
Running Hope...
Running Hope run=10 dim=4 sim=ppr...
Running Hope run=10 dim=8 sim=ppr...
Running Hope run=10 dim=16 sim=ppr...
Running Hope run=10 dim=32 sim=ppr...
Running Hope...
Running Hope run=11 dim=4 sim=ppr...
Running Hope run=11 dim=8 sim=ppr...
Running Hope run=11 dim=16 sim=ppr...
Running Hope run=11 dim=32 sim=ppr...
Running Hope...
Running Hope run=12 dim=4 sim=ppr...

Running Hope run=12 dim=8 sim=ppr...
Running Hope run=12 dim=16 sim=ppr...
Running Hope run=12 dim=32 sim=ppr...
Running Hope...
Running Hope run=13 dim=4 sim=ppr...
Running Hope run=13 dim=8 sim=ppr...
Running Hope run=13 dim=16 sim=ppr...
Running Hope run=13 dim=32 sim=ppr...
Running Hope...
Running Hope run=14 dim=4 sim=ppr...
Running Hope run=14 dim=8 sim=ppr...
Running Hope run=14 dim=16 sim=ppr...
Running Hope run=14 dim=32 sim=ppr...
Running Hope...
Running Hope run=15 dim=4 sim=ppr...
Running Hope run=15 dim=8 sim=ppr...
Running Hope run=15 dim=16 sim=ppr...
Running Hope run=15 dim=32 sim=ppr...
Running Hope...
Running Hope run=16 dim=4 sim=ppr...
Running Hope run=16 dim=8 sim=ppr...
Running Hope run=16 dim=16 sim=ppr...
Running Hope run=16 dim=32 sim=ppr...
Running Hope...
Running Hope run=17 dim=4 sim=ppr...
Running Hope run=17 dim=8 sim=ppr...
Running Hope run=17 dim=16 sim=ppr...
Running Hope run=17 dim=32 sim=ppr...
Running Hope...
Running Hope run=18 dim=4 sim=ppr...
Running Hope run=18 dim=8 sim=ppr...
Running Hope run=18 dim=16 sim=ppr...
Running Hope run=18 dim=32 sim=ppr...
Running Hope...
Running Hope run=19 dim=4 sim=ppr...
Running Hope run=19 dim=8 sim=ppr...
Running Hope run=19 dim=16 sim=ppr...
Running Hope run=19 dim=32 sim=ppr...
Running Hope...
Running Hope run=20 dim=4 sim=ppr...
Running Hope run=20 dim=8 sim=ppr...
Running Hope run=20 dim=16 sim=ppr...
Running Hope run=20 dim=32 sim=ppr...
Running Hope...
Running Hope run=21 dim=4 sim=ppr...
Running Hope run=21 dim=8 sim=ppr...
Running Hope run=21 dim=16 sim=ppr...
Running Hope run=21 dim=32 sim=ppr...
Running Hope...
Running Hope run=22 dim=4 sim=ppr...
Running Hope run=22 dim=8 sim=ppr...
Running Hope run=22 dim=16 sim=ppr...
Running Hope run=22 dim=32 sim=ppr...
Running Hope...
Running Hope run=23 dim=4 sim=ppr...
Running Hope run=23 dim=8 sim=ppr...
Running Hope run=23 dim=16 sim=ppr...
Running Hope run=23 dim=32 sim=ppr...
Running Hope...
Running Hope run=24 dim=4 sim=ppr...
Running Hope run=24 dim=8 sim=ppr...
Running Hope run=24 dim=16 sim=ppr...


```
Running Hope run=24 dim=32 sim=ppr...
Running Hope...
Running Hope run=25 dim=4 sim=ppr...
Running Hope run=25 dim=8 sim=ppr...
Running Hope run=25 dim=16 sim=ppr...
Running Hope run=25 dim=32 sim=ppr...
Running Hope...
Running Hope run=26 dim=4 sim=ppr...
Running Hope run=26 dim=8 sim=ppr...
Running Hope run=26 dim=16 sim=ppr...
Running Hope run=26 dim=32 sim=ppr...
Running Hope...
Running Hope run=27 dim=4 sim=ppr...
Running Hope run=27 dim=8 sim=ppr...
Running Hope run=27 dim=16 sim=ppr...
Running Hope run=27 dim=32 sim=ppr...
Running Hope...
Running Hope run=28 dim=4 sim=ppr...
Running Hope run=28 dim=8 sim=ppr...
Running Hope run=28 dim=16 sim=ppr...
Running Hope run=28 dim=32 sim=ppr...
Running Hope...
Running Hope run=29 dim=4 sim=ppr...
Running Hope run=29 dim=8 sim=ppr...
Running Hope run=29 dim=16 sim=ppr...
Running Hope run=29 dim=32 sim=ppr...
Running node2vec...
Running node2vec run=0 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=0_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=0 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=0_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=0 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=0_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=0 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=0_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=1 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=1_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=1 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=1_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=1 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=1_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
```

```
0
Running node2vec run=1 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=1_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=2 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=2_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=2 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=2_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=2 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=2_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=2 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=2_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=3 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=3_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=3 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=3_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=3 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=3_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=3 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=3_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=4 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=4_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=4 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=4_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=4 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=4_dim=16_p=1_q=0.1_embed --dimensions 16 --p
```

```
1 --q 0.1
0
Running node2vec run=4 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=4_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=5 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=5_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=5 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=5_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=5 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=5_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=5 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=5_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=6 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=6_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=6 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=6_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=6 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=6_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=6 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=6_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=7 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=7_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=7 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=7_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=7 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
```

```

ut ring_net.dat --output ring_node2vec_run=7_dim=16_p=1_q=0.1_embed --dimensions 16 --p
1 --q 0.1
0
Running node2vec run=7 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=7_dim=32_p=1_q=0.1_embed --dimensions 32 --p
1 --q 0.1
0
Running node2vec...
Running node2vec run=8 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=8_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1
--q 0.1
0
Running node2vec run=8 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=8_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1
--q 0.1
0
Running node2vec run=8 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=8_dim=16_p=1_q=0.1_embed --dimensions 16 --p
1 --q 0.1
0
Running node2vec run=8 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=8_dim=32_p=1_q=0.1_embed --dimensions 32 --p
1 --q 0.1
0
Running node2vec...
Running node2vec run=9 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=9_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1
--q 0.1
0
Running node2vec run=9 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=9_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1
--q 0.1
0
Running node2vec run=9 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=9_dim=16_p=1_q=0.1_embed --dimensions 16 --p
1 --q 0.1
0
Running node2vec run=9 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=9_dim=32_p=1_q=0.1_embed --dimensions 32 --p
1 --q 0.1
0
Running node2vec...
Running node2vec run=10 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=10_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1
--q 0.1
0
Running node2vec run=10 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=10_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1
--q 0.1
0
Running node2vec run=10 dim=16 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=10_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=10 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=10_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=11 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=11_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=11 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=11_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=11 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=11_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=11 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=11_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=12 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=12_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=12 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=12_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=12 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=12_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=12 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=12_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=13 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=13_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=13 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=13_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
```

```
Running node2vec run=13 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=13_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=13 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=13_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=14 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=14_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=14 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=14_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=14 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=14_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=14 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=14_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=15 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=15_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=15 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=15_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=15 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=15_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=15 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=15_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=16 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=16_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=16 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=16_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
```

```
0
Running node2vec run=16 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=16_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=16 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=16_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=17 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=17_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=17 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=17_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=17 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=17_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=17 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=17_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=18 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=18_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=18 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=18_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=18 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=18_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=18 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=18_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=19 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=19_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=19 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=19_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1
```

```
--q 0.1
0
Running node2vec run=19 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=19_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=19 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=19_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=20 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=20_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=20 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=20_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=20 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=20_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=20 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=20_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=21 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=21_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=21 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=21_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=21 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=21_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=21 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=21_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=22 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=22_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=22 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
```



```

ut ring_net.dat --output ring_node2vec_run=22_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1
--q 0.1
0
Running node2vec run=22 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=22_dim=16_p=1_q=0.1_embed --dimensions 16 --p
1 --q 0.1
0
Running node2vec run=22 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=22_dim=32_p=1_q=0.1_embed --dimensions 32 --p
1 --q 0.1
0
Running node2vec...
Running node2vec run=23 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=23_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1
--q 0.1
0
Running node2vec run=23 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=23_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1
--q 0.1
0
Running node2vec run=23 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=23_dim=16_p=1_q=0.1_embed --dimensions 16 --p
1 --q 0.1
0
Running node2vec run=23 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=23_dim=32_p=1_q=0.1_embed --dimensions 32 --p
1 --q 0.1
0
Running node2vec...
Running node2vec run=24 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=24_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1
--q 0.1
0
Running node2vec run=24 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=24_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1
--q 0.1
0
Running node2vec run=24 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=24_dim=16_p=1_q=0.1_embed --dimensions 16 --p
1 --q 0.1
0
Running node2vec run=24 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=24_dim=32_p=1_q=0.1_embed --dimensions 32 --p
1 --q 0.1
0
Running node2vec...
Running node2vec run=25 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=25_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1
--q 0.1
0
Running node2vec run=25 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=25_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=25 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=25_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=25 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=25_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=26 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=26_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=26 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=26_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=26 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=26_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=26 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=26_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=27 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=27_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=27 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=27_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=27 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=27_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=27 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=27_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=28 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=28_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
```

```

Running node2vec run=28 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=28_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=28 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=28_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=28 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=28_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=29 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=29_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=29 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=29_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=29 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=29_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=29 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input ring_net.dat --output ring_node2vec_run=29_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
0.002057906 0.0411705

```

```

In [40]: ## plot result with lowest JS divergence
os.system('cp ring_embed_best _embed')
l = embed2layout()
ring_of_cliques.vs['ly'] = [l[int(v['name'])-1] for v in ring_of_cliques.vs]
ig.plot(ring_of_cliques, layout=ring_of_cliques.vs['ly'], bbox=(0,0,400,300))

```

Out [40]:

b' \n'

```
In [41]: ## plot result with high divergence
os.system('cp ring_embed_worst_embed')
l = embed2layout()
ring_of_cliques.vs['ly'] = [l[int(v['name'])-1] for v in ring_of_cliques.vs]
ig.plot(ring_of_cliques, layout=ring_of_cliques.vs['ly'], bbox=(0,0,300,200))
```

Out [41]:

b' \n'

Problem 4

```
In [86]: ## read edge list for the grid network and build undirected graph
gr = ig.Graph.Read_Ncol(datadir+'GridEurope/gridkit_europe-highvoltage.edges', directed=
gr = gr.simplify()

## read the vertices along with some of the attributes
X = pd.read_csv(datadir+'GridEurope/gridkit_europe-highvoltage.vertices')
idx = [int(i) for i in gr.vs['name']]
sorterIndex = dict(zip(idx, range(len(idx))))
X['Rank'] = X['v_id'].map(sorterIndex)
X.sort_values(['Rank'], ascending=[True], inplace=True)
```

```

X.dropna(inplace=True)
gr.vs['longitude'] = list(X['lon'])
gr.vs['latitude'] = list(X['lat'])
gr.vs['type'] = list(X['typ'])
gr.vs['layout'] = [(v['longitude'],v['latitude']) for v in gr.vs()] ## tuples with lat/lon
gr.vs['size'] = 3
gr.es['color'] = 'grey'
gr.vs['color'] = 'black'

```

```

In [87]: ## subgraph of Grid -- Iberic peninsula
V = [v for v in gr.vs() if v['latitude']>36 and v['latitude']<44 and v['longitude']>-10]
gr_spain = gr.subgraph(V)
ly = ig.Layout(gr_spain.vs['layout'])
ly.mirror(1)
print(gr_spain.vcount(), 'nodes')
#ig.plot(gr_spain, 'grid_sg.eps', layout=ly, bbox=(0,0,300,300))
ig.plot(gr_spain, layout=ly, bbox=(0,0,300,300))

```

1562 nodes

Out[87]:

b' \n'

```

In [88]: gr_spain_giant = gr_spain.connected_components().giant()
gr_spain_giant.vcount()

```

Out[88]: 1537

```

In [89]: for v in list(gr_spain_giant.vs()):
v['name'] = str(v.index)

```

```

In [90]: spain_ecg_file = 'spain.ecg'
spain_ecg_label_ls = gr_spain_giant.community_ecg().membership
with open(spain_ecg_file, 'w') as fp:
    fp.write("\n".join(str(label) for label in spain_ecg_label_ls))

```

```

In [91]: spain_net_data = [[e.source, e.target] for e in list(gr_spain_giant.es())]
spain_net_file = 'spain_net.dat'
with open(spain_net_file, 'w') as testfile:

```

```
for row in spain_net_data:  
    testfile.write(' '.join([str(a) for a in row]) + '\n')
```

```
In [106... (spain_D, spain_best_jsd, spain_worst_jsd) = run_exp(gr_spain_giant, spain_net_file, spa  
print(spain_best_jsd, spain_worst_jsd)  
spain_D
```

Running Hope...
Running Hope run=0 dim=4 sim=ppr...
Running Hope run=0 dim=8 sim=ppr...
Running Hope run=0 dim=16 sim=ppr...
Running Hope run=0 dim=32 sim=ppr...
Running Hope run=0 dim=64 sim=ppr...
Running Hope run=0 dim=128 sim=ppr...
Running Hope...
Running Hope run=1 dim=4 sim=ppr...
Running Hope run=1 dim=8 sim=ppr...
Running Hope run=1 dim=16 sim=ppr...
Running Hope run=1 dim=32 sim=ppr...
Running Hope run=1 dim=64 sim=ppr...
Running Hope run=1 dim=128 sim=ppr...
Running Hope...
Running Hope run=2 dim=4 sim=ppr...
Running Hope run=2 dim=8 sim=ppr...
Running Hope run=2 dim=16 sim=ppr...
Running Hope run=2 dim=32 sim=ppr...
Running Hope run=2 dim=64 sim=ppr...
Running Hope run=2 dim=128 sim=ppr...
Running Hope...
Running Hope run=3 dim=4 sim=ppr...
Running Hope run=3 dim=8 sim=ppr...
Running Hope run=3 dim=16 sim=ppr...
Running Hope run=3 dim=32 sim=ppr...
Running Hope run=3 dim=64 sim=ppr...
Running Hope run=3 dim=128 sim=ppr...
Running Hope...
Running Hope run=4 dim=4 sim=ppr...
Running Hope run=4 dim=8 sim=ppr...
Running Hope run=4 dim=16 sim=ppr...
Running Hope run=4 dim=32 sim=ppr...
Running Hope run=4 dim=64 sim=ppr...
Running Hope run=4 dim=128 sim=ppr...
Running Hope...
Running Hope run=5 dim=4 sim=ppr...
Running Hope run=5 dim=8 sim=ppr...
Running Hope run=5 dim=16 sim=ppr...
Running Hope run=5 dim=32 sim=ppr...
Running Hope run=5 dim=64 sim=ppr...
Running Hope run=5 dim=128 sim=ppr...
Running Hope...
Running Hope run=6 dim=4 sim=ppr...
Running Hope run=6 dim=8 sim=ppr...
Running Hope run=6 dim=16 sim=ppr...
Running Hope run=6 dim=32 sim=ppr...
Running Hope run=6 dim=64 sim=ppr...
Running Hope run=6 dim=128 sim=ppr...
Running Hope...
Running Hope run=7 dim=4 sim=ppr...
Running Hope run=7 dim=8 sim=ppr...
Running Hope run=7 dim=16 sim=ppr...
Running Hope run=7 dim=32 sim=ppr...
Running Hope run=7 dim=64 sim=ppr...
Running Hope run=7 dim=128 sim=ppr...
Running Hope...
Running Hope run=8 dim=4 sim=ppr...
Running Hope run=8 dim=8 sim=ppr...
Running Hope run=8 dim=16 sim=ppr...
Running Hope run=8 dim=32 sim=ppr...
Running Hope run=8 dim=64 sim=ppr...

Running Hope run=8 dim=128 sim=ppr...
Running Hope...
Running Hope run=9 dim=4 sim=ppr...
Running Hope run=9 dim=8 sim=ppr...
Running Hope run=9 dim=16 sim=ppr...
Running Hope run=9 dim=32 sim=ppr...
Running Hope run=9 dim=64 sim=ppr...
Running Hope run=9 dim=128 sim=ppr...
Running Hope...
Running Hope run=10 dim=4 sim=ppr...
Running Hope run=10 dim=8 sim=ppr...
Running Hope run=10 dim=16 sim=ppr...
Running Hope run=10 dim=32 sim=ppr...
Running Hope run=10 dim=64 sim=ppr...
Running Hope run=10 dim=128 sim=ppr...
Running Hope...
Running Hope run=11 dim=4 sim=ppr...
Running Hope run=11 dim=8 sim=ppr...
Running Hope run=11 dim=16 sim=ppr...
Running Hope run=11 dim=32 sim=ppr...
Running Hope run=11 dim=64 sim=ppr...
Running Hope run=11 dim=128 sim=ppr...
Running Hope...
Running Hope run=12 dim=4 sim=ppr...
Running Hope run=12 dim=8 sim=ppr...
Running Hope run=12 dim=16 sim=ppr...
Running Hope run=12 dim=32 sim=ppr...
Running Hope run=12 dim=64 sim=ppr...
Running Hope run=12 dim=128 sim=ppr...
Running Hope...
Running Hope run=13 dim=4 sim=ppr...
Running Hope run=13 dim=8 sim=ppr...
Running Hope run=13 dim=16 sim=ppr...
Running Hope run=13 dim=32 sim=ppr...
Running Hope run=13 dim=64 sim=ppr...
Running Hope run=13 dim=128 sim=ppr...
Running Hope...
Running Hope run=14 dim=4 sim=ppr...
Running Hope run=14 dim=8 sim=ppr...
Running Hope run=14 dim=16 sim=ppr...
Running Hope run=14 dim=32 sim=ppr...
Running Hope run=14 dim=64 sim=ppr...
Running Hope run=14 dim=128 sim=ppr...
Running Hope...
Running Hope run=15 dim=4 sim=ppr...
Running Hope run=15 dim=8 sim=ppr...
Running Hope run=15 dim=16 sim=ppr...
Running Hope run=15 dim=32 sim=ppr...
Running Hope run=15 dim=64 sim=ppr...
Running Hope run=15 dim=128 sim=ppr...
Running Hope...
Running Hope run=16 dim=4 sim=ppr...
Running Hope run=16 dim=8 sim=ppr...
Running Hope run=16 dim=16 sim=ppr...
Running Hope run=16 dim=32 sim=ppr...
Running Hope run=16 dim=64 sim=ppr...
Running Hope run=16 dim=128 sim=ppr...
Running Hope...
Running Hope run=17 dim=4 sim=ppr...
Running Hope run=17 dim=8 sim=ppr...
Running Hope run=17 dim=16 sim=ppr...
Running Hope run=17 dim=32 sim=ppr...

Running Hope run=17 dim=64 sim=ppr...
Running Hope run=17 dim=128 sim=ppr...
Running Hope...
Running Hope run=18 dim=4 sim=ppr...
Running Hope run=18 dim=8 sim=ppr...
Running Hope run=18 dim=16 sim=ppr...
Running Hope run=18 dim=32 sim=ppr...
Running Hope run=18 dim=64 sim=ppr...
Running Hope run=18 dim=128 sim=ppr...
Running Hope...
Running Hope run=19 dim=4 sim=ppr...
Running Hope run=19 dim=8 sim=ppr...
Running Hope run=19 dim=16 sim=ppr...
Running Hope run=19 dim=32 sim=ppr...
Running Hope run=19 dim=64 sim=ppr...
Running Hope run=19 dim=128 sim=ppr...
Running Hope...
Running Hope run=20 dim=4 sim=ppr...
Running Hope run=20 dim=8 sim=ppr...
Running Hope run=20 dim=16 sim=ppr...
Running Hope run=20 dim=32 sim=ppr...
Running Hope run=20 dim=64 sim=ppr...
Running Hope run=20 dim=128 sim=ppr...
Running Hope...
Running Hope run=21 dim=4 sim=ppr...
Running Hope run=21 dim=8 sim=ppr...
Running Hope run=21 dim=16 sim=ppr...
Running Hope run=21 dim=32 sim=ppr...
Running Hope run=21 dim=64 sim=ppr...
Running Hope run=21 dim=128 sim=ppr...
Running Hope...
Running Hope run=22 dim=4 sim=ppr...
Running Hope run=22 dim=8 sim=ppr...
Running Hope run=22 dim=16 sim=ppr...
Running Hope run=22 dim=32 sim=ppr...
Running Hope run=22 dim=64 sim=ppr...
Running Hope run=22 dim=128 sim=ppr...
Running Hope...
Running Hope run=23 dim=4 sim=ppr...
Running Hope run=23 dim=8 sim=ppr...
Running Hope run=23 dim=16 sim=ppr...
Running Hope run=23 dim=32 sim=ppr...
Running Hope run=23 dim=64 sim=ppr...
Running Hope run=23 dim=128 sim=ppr...
Running Hope...
Running Hope run=24 dim=4 sim=ppr...
Running Hope run=24 dim=8 sim=ppr...
Running Hope run=24 dim=16 sim=ppr...
Running Hope run=24 dim=32 sim=ppr...
Running Hope run=24 dim=64 sim=ppr...
Running Hope run=24 dim=128 sim=ppr...
Running Hope...
Running Hope run=25 dim=4 sim=ppr...
Running Hope run=25 dim=8 sim=ppr...
Running Hope run=25 dim=16 sim=ppr...
Running Hope run=25 dim=32 sim=ppr...
Running Hope run=25 dim=64 sim=ppr...
Running Hope run=25 dim=128 sim=ppr...
Running Hope...
Running Hope run=26 dim=4 sim=ppr...
Running Hope run=26 dim=8 sim=ppr...
Running Hope run=26 dim=16 sim=ppr...

```

Running Hope run=26 dim=32 sim=ppr...
Running Hope run=26 dim=64 sim=ppr...
Running Hope run=26 dim=128 sim=ppr...
Running Hope...
Running Hope run=27 dim=4 sim=ppr...
Running Hope run=27 dim=8 sim=ppr...
Running Hope run=27 dim=16 sim=ppr...
Running Hope run=27 dim=32 sim=ppr...
Running Hope run=27 dim=64 sim=ppr...
Running Hope run=27 dim=128 sim=ppr...
Running Hope...
Running Hope run=28 dim=4 sim=ppr...
Running Hope run=28 dim=8 sim=ppr...
Running Hope run=28 dim=16 sim=ppr...
Running Hope run=28 dim=32 sim=ppr...
Running Hope run=28 dim=64 sim=ppr...
Running Hope run=28 dim=128 sim=ppr...
Running Hope...
Running Hope run=29 dim=4 sim=ppr...
Running Hope run=29 dim=8 sim=ppr...
Running Hope run=29 dim=16 sim=ppr...
Running Hope run=29 dim=32 sim=ppr...
Running Hope run=29 dim=64 sim=ppr...
Running Hope run=29 dim=128 sim=ppr...
Running node2vec...
Running node2vec run=0 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=0_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=0 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=0_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=0 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=0_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=0 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=0_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=0 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=0_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=0 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=0_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=1 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=1_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=1 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
spain_net.dat --output spain_node2vec_run=1_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=1 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=1_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=1 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=1_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=1 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=1_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=1 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=1_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=2 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=2_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=2 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=2_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=2 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=2_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=2 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=2_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=2 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=2_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=2 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=2_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=3 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=3_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=3 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
spain_net.dat --output spain_node2vec_run=3_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=3 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=3_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=3 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=3_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=3 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=3_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=3 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=3_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=4 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=4_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=4 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=4_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=4 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=4_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=4 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=4_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=4 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=4_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=4 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=4_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=5 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=5_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=5 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
ut spain_net.dat --output spain_node2vec_run=5_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=5 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=5_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=5 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=5_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=5 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=5_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=5 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=5_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=6 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=6_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=6 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=6_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=6 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=6_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=6 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=6_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=6 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=6_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=6 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=6_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=7 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=7_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=7 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
spain_net.dat --output spain_node2vec_run=7_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=7 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=7_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=7 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=7_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=7 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=7_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=7 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=7_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=8 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=8_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=8 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=8_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=8 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=8_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=8 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=8_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=8 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=8_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=8 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=8_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=9 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=9_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=9 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
spain_net.dat --output spain_node2vec_run=9_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=9 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=9_dim=16_p=1_q=0.1_embed --dimensions 16 --
p 1 --q 0.1
0
Running node2vec run=9 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=9_dim=32_p=1_q=0.1_embed --dimensions 32 --
p 1 --q 0.1
0
Running node2vec run=9 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=9_dim=64_p=1_q=0.1_embed --dimensions 64 --
p 1 --q 0.1
0
Running node2vec run=9 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=9_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=10 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=10_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=10 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=10_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=10 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=10_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=10 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=10_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=10 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=10_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=10 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=10_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=11 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=11_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=11 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
spain_net.dat --output spain_node2vec_run=11_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=11 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=11_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=11 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=11_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=11 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=11_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=11 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=11_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=12 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=12_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=12 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=12_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=12 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=12_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=12 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=12_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=12 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=12_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=12 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=12_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=13 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=13_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=13 dim=8 p=1 q=0.1...
```



```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
ut spain_net.dat --output spain_node2vec_run=13_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=13 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=13_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=13 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=13_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=13 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=13_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=13 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=13_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=14 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=14_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=14 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=14_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=14 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=14_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=14 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=14_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=14 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=14_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=14 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=14_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=15 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=15_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=15 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=15_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=15 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=15_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=15 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=15_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=15 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=15_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=15 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=15_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=16 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=16_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=16 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=16_dim=8_p=1_q=0.1_embed --dimensions 8 --p 1 --q 0.1
0
Running node2vec run=16 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=16_dim=16_p=1_q=0.1_embed --dimensions 16 --p 1 --q 0.1
0
Running node2vec run=16 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=16_dim=32_p=1_q=0.1_embed --dimensions 32 --p 1 --q 0.1
0
Running node2vec run=16 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=16_dim=64_p=1_q=0.1_embed --dimensions 64 --p 1 --q 0.1
0
Running node2vec run=16 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=16_dim=128_p=1_q=0.1_embed --dimensions 128 --p 1 --q 0.1
0
Running node2vec...
Running node2vec run=17 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input spain_net.dat --output spain_node2vec_run=17_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1 --q 0.1
0
Running node2vec run=17 dim=8 p=1 q=0.1...
```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
ut spain_net.dat --output spain_node2vec_run=17_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=17 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=17_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=17 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=17_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=17 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=17_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=17 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=17_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=18 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=18_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=18 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=18_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=18 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=18_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=18 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=18_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=18 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=18_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=18 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=18_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=19 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=19_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=19 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
ut spain_net.dat --output spain_node2vec_run=19_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=19 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=19_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=19 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=19_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=19 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=19_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=19 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=19_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=20 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=20_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=20 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=20_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=20 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=20_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=20 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=20_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=20 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=20_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=20 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=20_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=21 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=21_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=21 dim=8 p=1 q=0.1...

```

```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
spain_net.dat --output spain_node2vec_run=21_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=21 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=21_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=21 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=21_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=21 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=21_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=21 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=21_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=22 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=22_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=22 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=22_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=22 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=22_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=22 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=22_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=22 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=22_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=22 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=22_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=23 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=23_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=23 dim=8 p=1 q=0.1...
```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
ut spain_net.dat --output spain_node2vec_run=23_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=23 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=23_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=23 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=23_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=23 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=23_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=23 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=23_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=24 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=24_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=24 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=24_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=24 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=24_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=24 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=24_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=24 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=24_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=24 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=24_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=25 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=25_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=25 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
ut spain_net.dat --output spain_node2vec_run=25_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=25 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=25_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=25 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=25_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=25 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=25_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=25 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=25_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=26 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=26_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=26 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=26_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=26 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=26_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=26 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=26_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=26 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=26_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=26 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=26_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=27 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=27_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=27 dim=8 p=1 q=0.1...

```

```

python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
ut spain_net.dat --output spain_node2vec_run=27_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=27 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=27_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=27 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=27_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=27 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=27_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=27 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=27_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=28 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=28_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=28 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=28_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=28 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=28_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=28 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=28_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=28 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=28_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=28 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=28_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
Running node2vec...
Running node2vec run=29 dim=4 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=29_dim=4_p=1_q=0.1_embed --dimensions 4 --p
1 --q 0.1
0
Running node2vec run=29 dim=8 p=1 q=0.1...

```



```
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --input
spain_net.dat --output spain_node2vec_run=29_dim=8_p=1_q=0.1_embed --dimensions 8 --p
1 --q 0.1
0
Running node2vec run=29 dim=16 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=29_dim=16_p=1_q=0.1_embed --dimensions 16 -
-p 1 --q 0.1
0
Running node2vec run=29 dim=32 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=29_dim=32_p=1_q=0.1_embed --dimensions 32 -
-p 1 --q 0.1
0
Running node2vec run=29 dim=64 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=29_dim=64_p=1_q=0.1_embed --dimensions 64 -
-p 1 --q 0.1
0
Running node2vec run=29 dim=128 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut spain_net.dat --output spain_node2vec_run=29_dim=128_p=1_q=0.1_embed --dimensions 128
--p 1 --q 0.1
0
0.06850165 0.1367341
```

Out[106]:

	dim	algo	param	jsd	run_id
179	128	hope	ppr	0.068502	29
95	128	hope	ppr	0.068502	15
77	128	hope	ppr	0.068502	12
101	128	hope	ppr	0.068502	16
47	128	hope	ppr	0.068502	7
...
265	8	n2v	1 0.1	0.136734	14
297	32	n2v	1 0.1	0.136734	19
232	64	n2v	1 0.1	0.136734	8
262	64	n2v	1 0.1	0.136734	13
359	128	n2v	1 0.1	0.136734	29

360 rows × 5 columns

In [107...

```
## plot result with lowest JS divergence
os.system('cp spain_embed_best _embed')
l = embed2layout()
gr_spain_giant.vs['ly'] = [l[int(v['name'])-1] for v in gr_spain_giant.vs]
ig.plot(gr_spain_giant, layout=gr_spain_giant.vs['ly'], bbox=(0,0,400,300))
```

Out[107]:

b'

\n'

```
In [108... ## plot result with lowest JS divergence
os.system('cp spain_embed_worst _embed')
l = embed2layout()
gr_spain_giant.vs['ly'] = [l[int(v['name'])-1] for v in gr_spain_giant.vs]
ig.plot(gr_spain_giant, layout=gr_spain_giant.vs['ly'], bbox=(0,0,400,300))
```

Out[108]:

b'

\n'

a

```
In [109... gr_spain_giant_ecg = gr_spain_giant.community_ecg().membership
```

```
In [110... pal = ig.RainbowPalette(n=max(gr_spain_giant_ecg)+1)
```

```
gr_spain_giant.vs['color'] = [pal.get(int(i)) for i in gr_spain_giant_ecg]
```

```
In [111... ig.plot(gr_spain_giant, bbox=(0,0,400,300))
plt.show()
```

b

```
In [112... def get_embedding_distance(v1, v2, embeddings):
    i1 = int(v1["name"])
    i2 = int(v2["name"])
    e1 = embeddings[i1]
    e2 = embeddings[i2]
    dist = np.linalg.norm(e1-e2)
    return dist

def get_geographical_distance(from_v, to_v):
    from_loc = Point(
        latitude=from_v['latitude'],
        longitude=from_v['longitude'])
    to_loc = Point(
        latitude=to_v['latitude'],
        longitude=to_v['longitude'])
    geographical_distance = geodesic(from_loc, to_loc).kilometers
    return geographical_distance
```

```
In [113... spain_best_nodes_vectors = readEmbedding(fn="spain_embed_best")
spain_best_nodes_vectors
```

```
Out[113]: array([[ -4.80503732e-03, -1.05667275e-02,  2.26243147e-03, ...,
        6.15870627e-05, -2.02512444e-04, -5.77876895e-03],
       [-9.09014660e-03, -2.00519253e-02,  4.29600148e-03, ...,
        1.32402045e-04, -4.36785787e-04, -1.25832156e-02],
       [-3.32022986e-03, -5.40395270e-04, -2.05061457e-05, ...,
        8.73522673e-03, -6.09304213e-03, -1.90261239e-06],
       ...,
       [ 2.53723898e-02, -7.83159447e-04, -4.55231251e-04, ...,
        4.16046597e-03, -2.30084554e-02, -1.05006023e-04],
       [-7.96424212e-04, -2.31709265e-03,  6.93081087e-04, ...,
        2.61729924e-04, -6.31397461e-04, -4.02620619e-02],
       [-1.00521944e-02,  3.49843782e-04,  9.59512637e-05, ...,
        3.10682213e-03, -2.35344928e-02, -7.81853855e-05]])
```

```
In [114... comb = list(combinations(list(gr_spain_giant.vs()), 2))
len(comb)
```

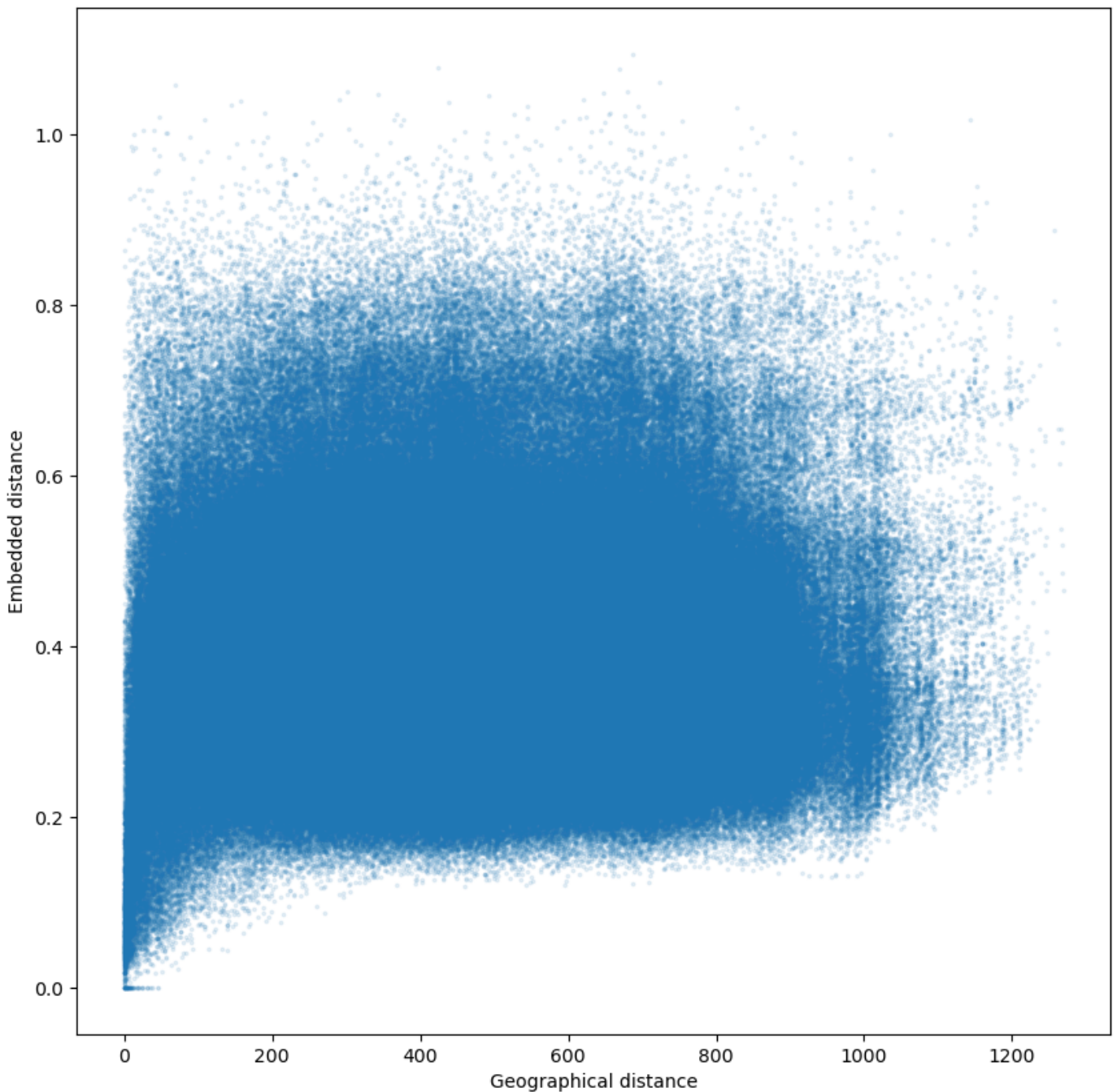
```
Out[114]: 1180416
```

```
In [115... dist_dict = {}
geo_ls = []
embedding_ls = []
for i, (v1, v2) in enumerate(comb):
    if i%100000 == 0:
        print(i)
    geo_dist = get_geographical_distance(v1, v2)
    geo_ls.append(geo_dist)
    embedding_dist = get_embedding_distance(v1, v2, spain_best_nodes_vectors)
    embedding_ls.append(embedding_dist)
    dist_dict[(v1["name"], v2["name"])] = embedding_dist
```

```
0
100000
200000
300000
400000
500000
600000
700000
800000
900000
1000000
1100000
```

```
In [116... plt.figure(figsize=(10,10))
geos = np.array(gео_ls)
embs = np.array(embedding_ls)

plt.scatter(geos, embs, s=3, alpha=0.1)
plt.xlabel('Geographical distance')
plt.ylabel('Embedded distance')
plt.show()
```



C

```
In [117... BUCKET_COUNT = 10
dist_dict_sorted = {k: v for k, v in sorted(dist_dict.items(), key=lambda item: item[1])}
buckets = np.array_split(np.array(list(dist_dict_sorted.keys())), BUCKET_COUNT)
```

```
In [118... bucket_dict = {}
for i, bucket in enumerate(buckets):
    count = 0
    for pair in bucket:
        if gr_spain_giant.are_connected(pair[0], pair[1]):
            count += 1
    bucket_dict[i] = count
```

```
In [119... bucket_dict
```

```
Out[119]: {0: 1640, 1: 99, 2: 66, 3: 49, 4: 43, 5: 30, 6: 17, 7: 9, 8: 7, 9: 2}
```

```
In [ ]: # Bucket containing closer pairs has more edges in the graph
```