

```
In [3]: 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
from IPython.core.display import display, SVG, Image

import scipy.sparse.linalg as lg
```

```
/var/folders/w4/3znqz2dx1s3121nykvjzztwm0000gn/T/ipykernel_68072/1340680109.py:22: DeprecationWarning: Importing display from IPython.core.display is deprecated since IPython 7.14, please import from IPython display
from IPython.core.display import display, SVG, Image
```

```
In [4]: def plot_igraph(g_plot):
g_plot.save('temporary.png')
display(Image(filename='temporary.png'))
os.remove('temporary.png')
```

```
In [5]: ## 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 = 'python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py'
# n2v = '/Users/navervietnam/Downloads/snap-master/examples/node2vec'
```

```
In [6]: ## '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 τ1 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 r2 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 [7]: abcd_datadir = '1000/'
abcd_net_file = abcd_datadir+'net.dat'
abcd_comm_file = abcd_datadir+'comm.dat'
```

```
In [8]: ## 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'])))

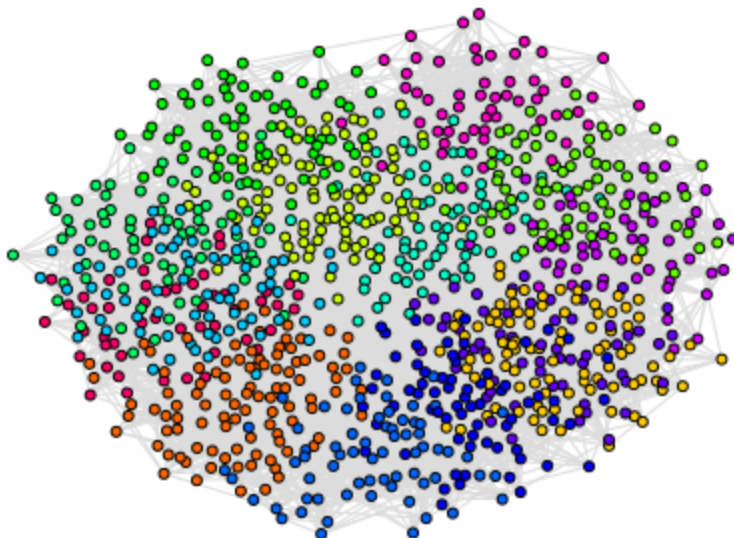
## ground truth communities
GT = {k:(v-1) for k,v in enumerate(ABCD.vs['comm'])}

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

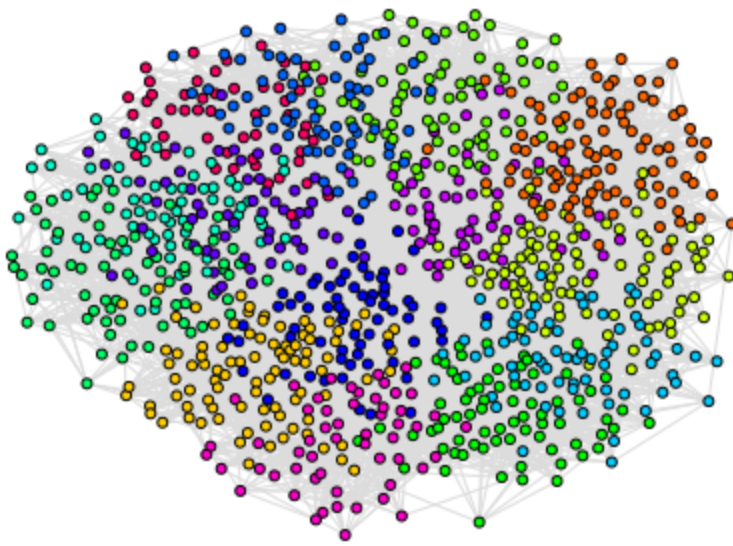
## define the colors and node sizes here
## node colors refer to communities
cls_edges = 'gainsboro'
ABCD.vs['size'] = 5
ABCD.es['color'] = cls_edges
pal = ig.RainbowPalette(n=max(ABCD.vs['comm'])+1)
ABCD.vs['color'] = [pal.get(int(i)) for i in ABCD.vs['comm']]
#ABCD.vs['color'] = 'black'

plot_igraph(ig.plot(ABCD, bbox=(0,0,400,300)))
```

1000 vertices, 8701 edges, avg degreee 17.402 communities 14



```
In [9]: plot_igraph(ig.plot(ABCD, bbox=(0,0,400,300)))
```



Run embedding algorithms

```
In [10]: # 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 [11]: 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(
    load_existing_embedding,
    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}...')
                _embed_fn = f'{_embed_fn_prefix}_Hope_run={i}_dim={dim}_sim={sim}_embed'
                if not load_existing_embedding:
                    X = Hope(g, sim=sim, dim=dim)
                    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(
    load_existing_embedding,
    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}...')
            _embed_fn = f'{_embed_fn_prefix}_LE_run={i}_dim={dim}_embed'
            if not load_existing_embedding:
                X = LE(g, dim=dim)
                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(
    load_existing_embedding,
    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), (.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}_
                if not load_existing_embedding:
                    ## long walks:
                    # x = n2v + ' -i:'+net_file+' -o:_embed -d:'+str(dim)+' -p:'+str(p)+
                    ## short walks:
                    # x = f'{n2v} -l:15 -i:{net_file} -o:{_embed_fn} -d:{str(dim)} -p:{s
                    x = f'{n2v} --walk-length 15 --input {net_file} --output {_embed_fn}

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

```

```

embedding_count = 2

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

# (best_jsd, worst_jsd) = run_le(
#     load_existing_embedding,
#     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(
    load_existing_embedding,
    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(
    load_existing_embedding,
    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...

[illegible]

```
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
```

```
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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

```



```

ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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

```

```

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 [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

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

AMI: 0.13125996426928777
ARI: 0.04723810420402105
AGRI: 0.03167618963894593
```

Problem 3

```
In [31]: # https://networkx.org/documentation/stable/reference/generated/networkx.generators.commm
```

```
In [32]: # A ring of cliques is a graph that consists of l complete subgraphs (cliques) of size s
# s = 3 and 3 ≤ l ≤ 48
# l = 10
```

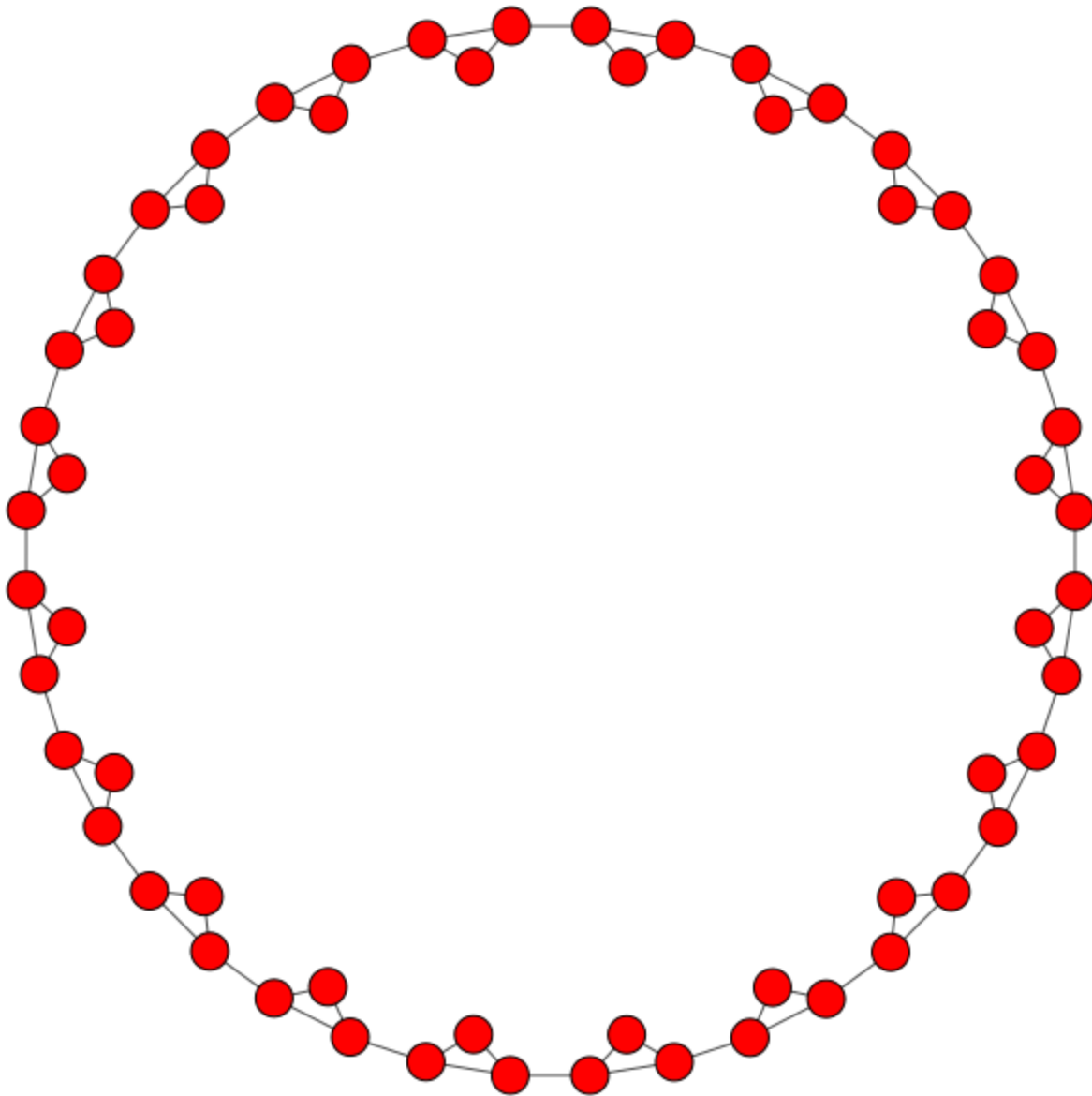
```
In [13]: num_cliques = 20
clique_size = 3
nx_ring_of_cliques = nx.ring_of_cliques(num_cliques, clique_size)
nx_ring_of_cliques
```

```
Out[13]: <networkx.classes.graph.Graph at 0x12fe1c970>
```

```
In [14]: ring_of_cliques = ig.Graph.TupleList(nx_ring_of_cliques.edges(), directed=False)
ring_of_cliques
```

```
Out[14]: <igraph.Graph at 0x12fdfea40>
```

```
In [15]: plot_igraph(ig.plot(ring_of_cliques))
```

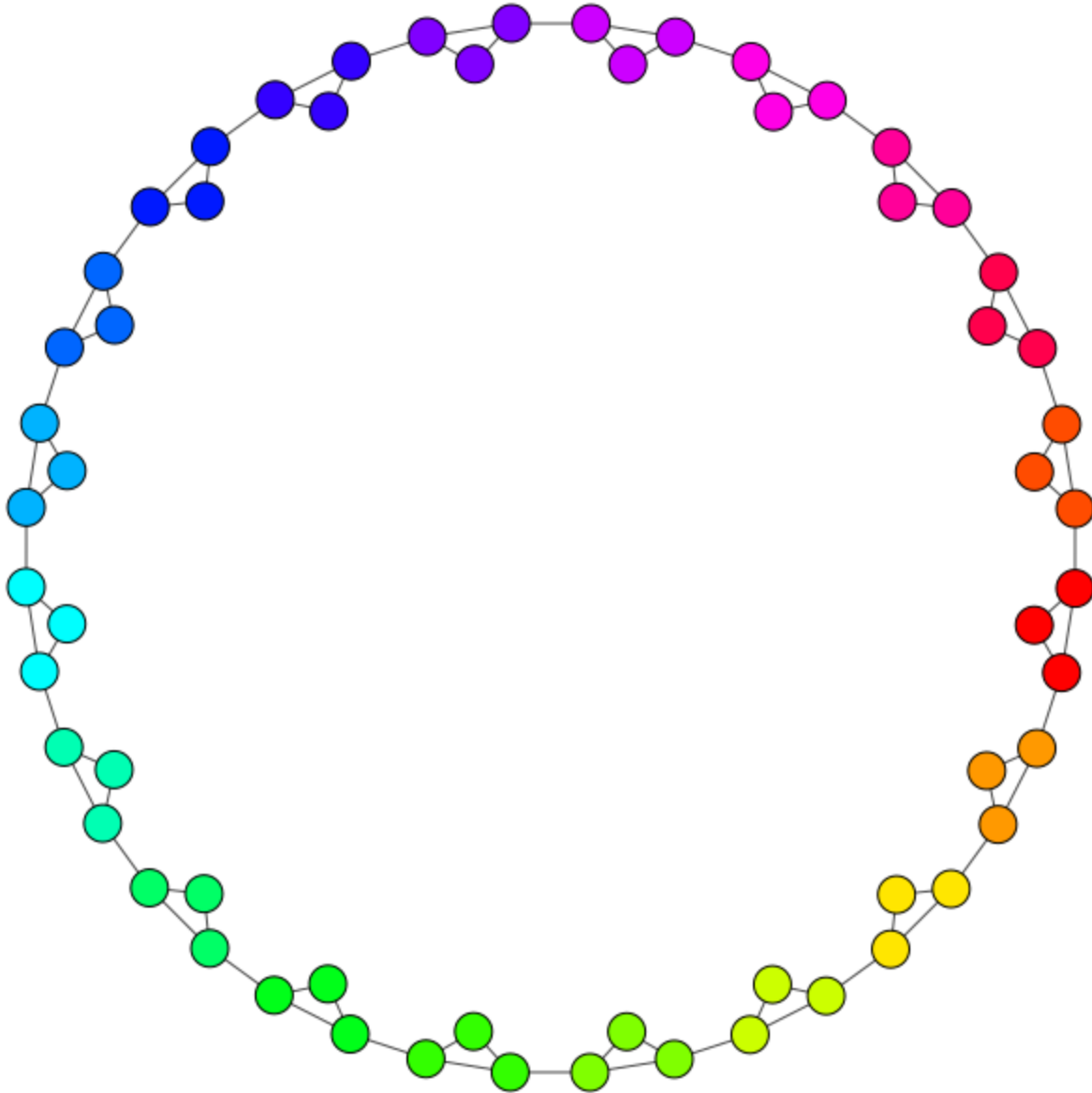


```
In [16]: ring_net_data = [[e.source, e.target] for e in list(ring_of_cliques.es())]
ring_net_file = 'ring_net.dat'
with open(ring_net_file, 'w') as testfile:
    for row in ring_net_data:
        testfile.write(' '.join([str(a) for a in row]) + '\n')
```

```
In [17]: 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 [18]: 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']]
plot_igraph(ig.plot(ring_of_cliques))
```



```
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...

[illegible]

```
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
```

```

ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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
```

```

ut 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 --inp
ut 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 --inp
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 --input 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
```

```

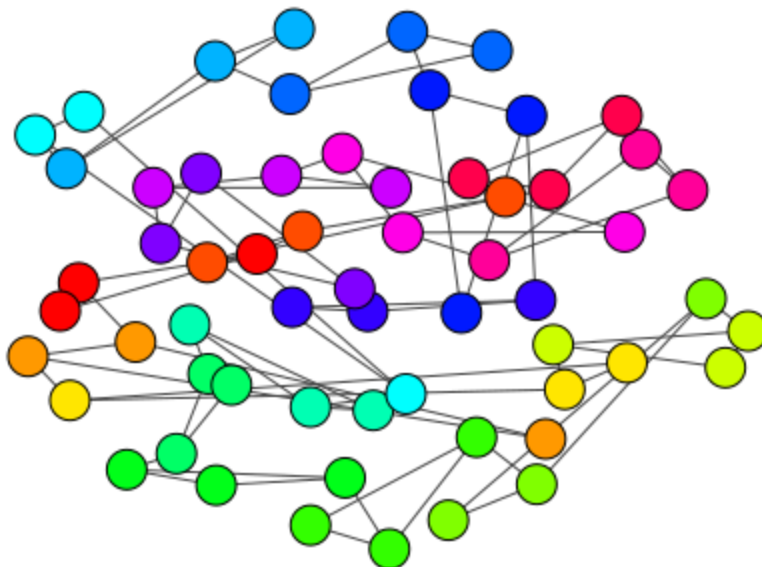
ut ring_net.dat --output ring_node2vec_run=28_dim=4_p=1_q=0.1_embed --dimensions 4 --p 1
--q 0.1
0
Running node2vec run=28 dim=8 p=1 q=0.1...
python3 /Users/navervietnam/Downloads/node2vec-master/src/main.py --walk-length 15 --inp
ut ring_net.dat --output ring_node2vec_run=28_dim=8_p=1_q=0.1_embed --dimensions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

```

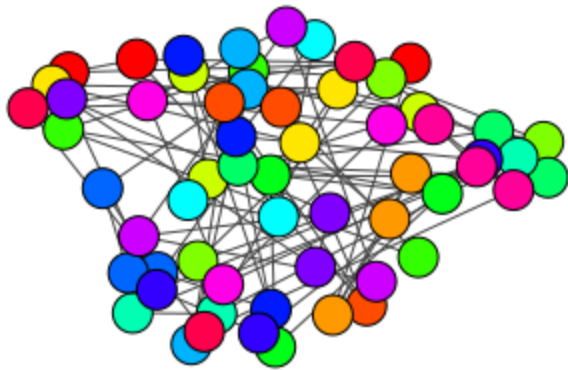
```

In [19]: ## 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]
plot_igraph(ig.plot(ring_of_cliques, layout=ring_of_cliques.vs['ly'], bbox=(0,0,400,300))

```



```
In [20]: ## 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]
plot_igraph(ig.plot(ring_of_cliques, layout=ring_of_cliques.vs['ly'], bbox=(0,0,300,200))
```



Problem 4

```
In [21]: ## read edge list for the grid network and build undirected graph
gr = ig.Graph.Read_Ncol(datadir+'GridEurope/gridkit_europe-highvoltage.edges', directed=False)
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 [22]: ## 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')
#plot_igraph(ig.plot(gr_spain, 'grid_sg.eps', layout=ly, bbox=(0,0,300,300)))
plot_igraph(ig.plot(gr_spain, layout=ly, bbox=(0,0,300,300)))
```

1562 nodes



```
In [23]: gr_spain_giant = gr_spain.connected_components().giant()
gr_spain_giant.vcount()
```

```
Out[23]: 1537
```

```
In [24]: for v in list(gr_spain_giant.vs()):
v['name'] = str(v.index)
```

```
In [25]: 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 [26]: 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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
```

```
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 --inp
ut 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 --input
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 --input
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 --input
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 --input
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
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --inp
ut 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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --input
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 --inp
ut 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 --input 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 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 --input 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 --input 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 --input 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 --input 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 --input 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 --input 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 --input 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 --input 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 --input 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 --input 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 --input 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
ut 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 --inp
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 --inp
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 --input
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 --inp
ut 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 --inp
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 --input
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 --inp
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 --inp
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 --input
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 --inp
ut 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
--	-----	------	-------	-----	--------

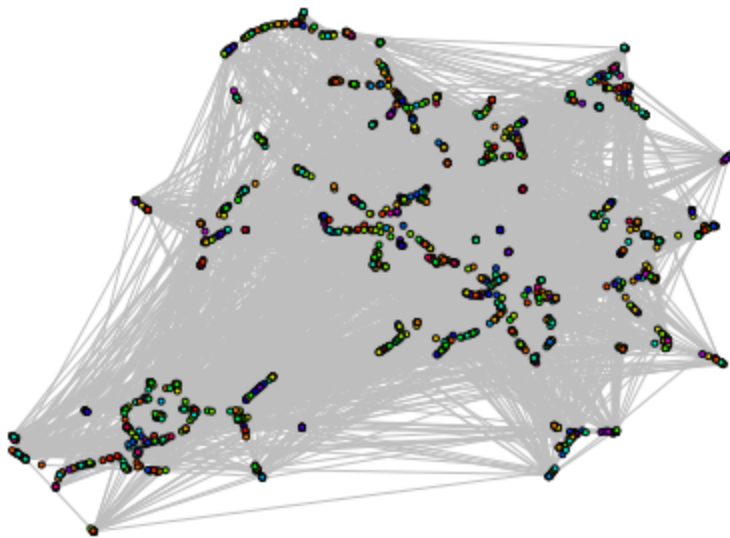
179	128	hope	ppr	0.068502	29
95	128	hope	ppr	0.068502	15
77	128	hope	ppr	0.068502	12
101	128	hope	ppr	0.068502	16
47	128	hope	ppr	0.068502	7
...
265	8	n2v	1 0.1	0.136734	14
297	32	n2v	1 0.1	0.136734	19
232	64	n2v	1 0.1	0.136734	8
262	64	n2v	1 0.1	0.136734	13
359	128	n2v	1 0.1	0.136734	29

360 rows × 5 columns

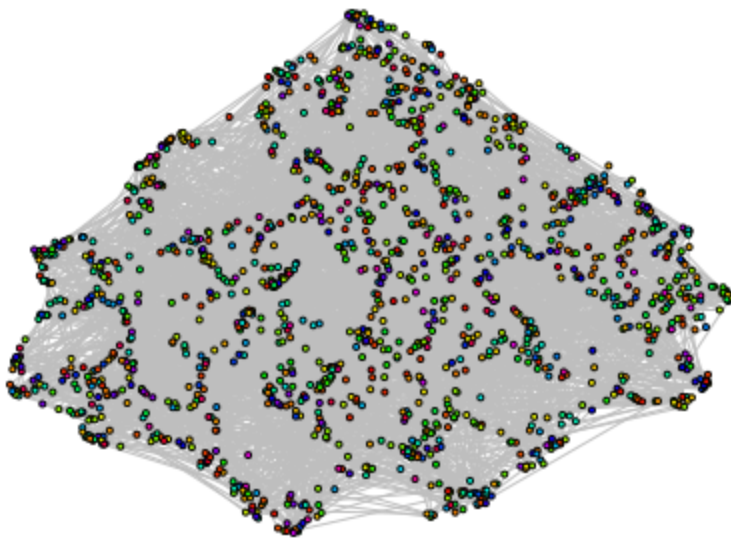
```
In [34]: gr_spain_giant_ecg = gr_spain_giant.community_ecg().membership
```

```
In [35]: 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 [36]: ## 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]
plot_igraph(ig.plot(gr_spain_giant, layout=gr_spain_giant.vs['ly'], bbox=(0,0,400,300)))
```

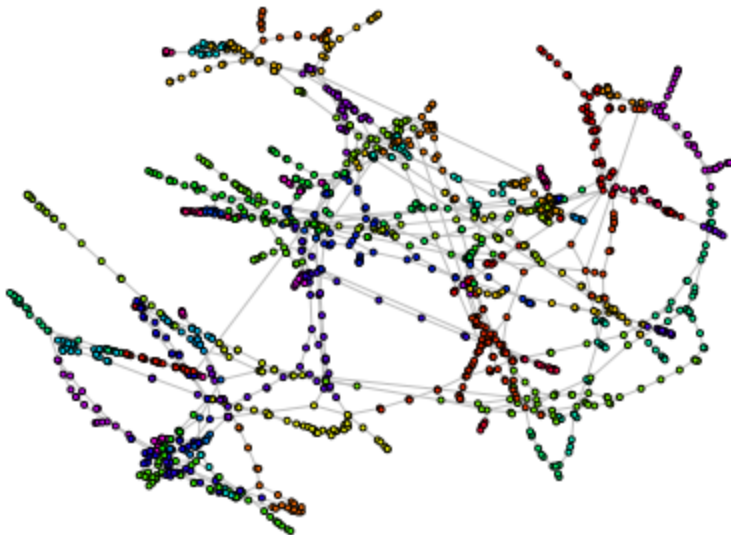


```
In [37]: ## plot result with lowest JS divergence
os.system('cp spain_embed_worst_embed')
l = embed2layout()
gr_spain_giant.vs['ly'] = [l[int(v['name'])-1] for v in gr_spain_giant.vs]
plot_igraph(ig.plot(gr_spain_giant, layout=gr_spain_giant.vs['ly'], bbox=(0,0,400,300)))
```



a

```
In [31]: plot_igraph(ig.plot(gr_spain_giant, bbox=(0,0,400,300)))
plt.show()
```



b

```
In [32]: 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)
```

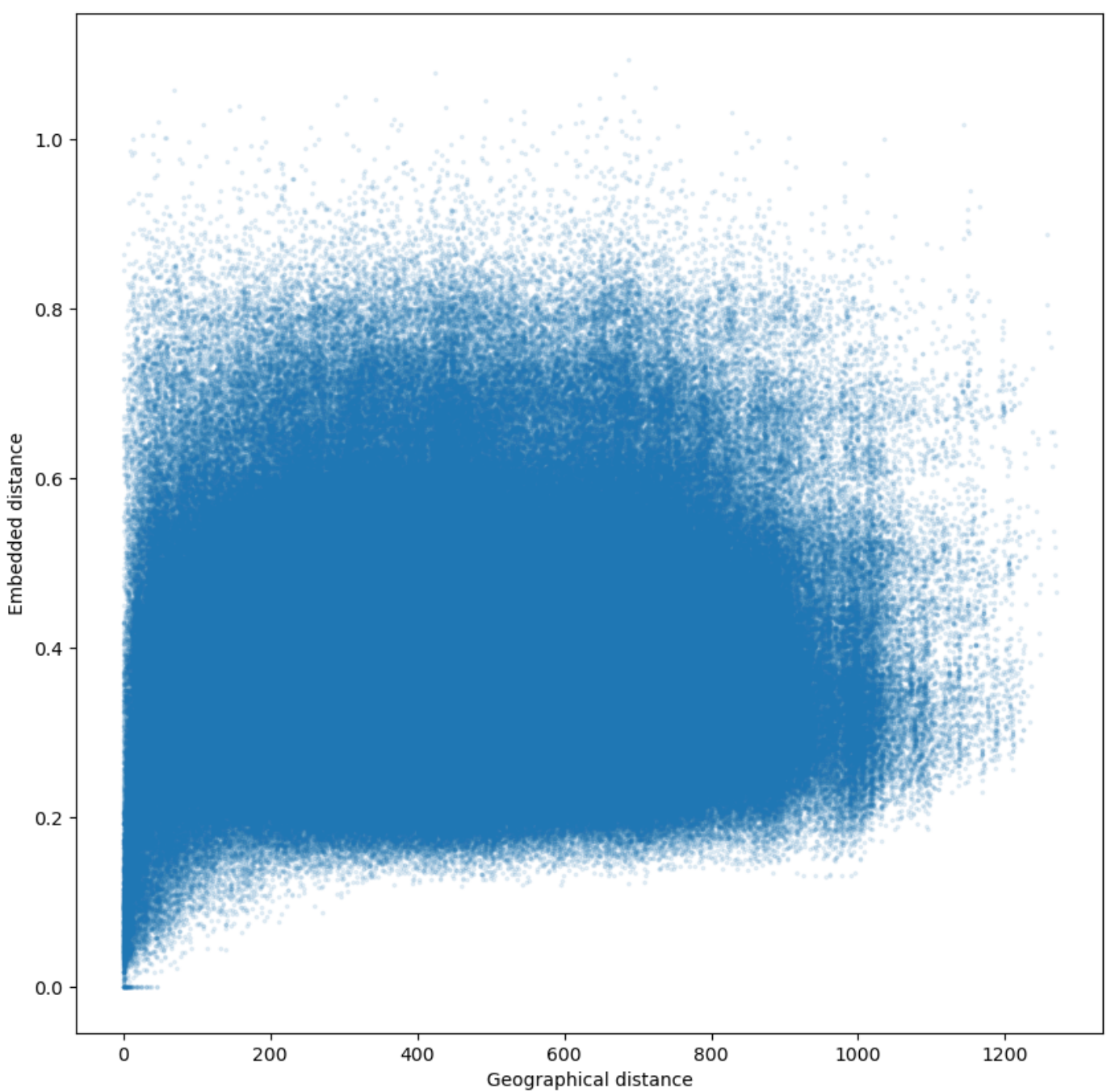
```
Out[114]: 1180416
```

```
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(geo_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}
```

```
# Bucket containing closer pairs has more edges in the graph
```

