复杂网络之四大基本网络图

规则图，ER随机图，WS小世界网络和BA无标度网络。

1. 规则图

生成一个含有n个节点，每个节点有d个邻居节点的规则图

import networkx as nx

import matplotlib.pyplot as plt

# regular graphy

# generate a regular graph which has 20 nodes & each node has 3 neghbour nodes.

RG = nx.random\_graphs.random\_regular\_graph(3, 20)

# the spectral layout

pos = nx.spectral\_layout(RG)

# draw the regular graphy

nx.draw(RG, pos, with\_labels = False, node\_size = 30)

plt.show()

1. ER随机图

模型的基本思想是以概率p连接n个节点中的每一对节点

import networkx as nx

import matplotlib.pyplot as plt

# erdos renyi graph

# generate a graph which has n=20 nodes, probablity p = 0.2.

ER = nx.random\_graphs.erdos\_renyi\_graph(20, 0.2)

# the shell layout

pos = nx.shell\_layout(ER)

nx.draw(ER, pos, with\_labels = False, node\_size = 30)

plt.show()

1. WS小世界网络

过程：a、建立一个n个节点的网络，每个节点与相邻的m个节点相连，形成一个规则网络（即上述的第一种规则图）；b、每一条连边以概率p断开，在剩下的节点中随机找一个节点相连，形成一个随机网络。

import networkx as nx

import matplotlib.pyplot as plt

# WS network

# generate a WS network which has 20 nodes,

# each node has 4 neighbour nodes,

# random reconnection probability was 0.3.

WS = nx.random\_graphs.watts\_strogatz\_graph(20, 4, 0.3)

# circular layout

pos = nx.circular\_layout(WS)

nx.draw(WS, pos, with\_labels = False, node\_size = 30)

plt.show()

1. BA无标度网络

过程：a、初始时具有m个节点，两两互连；b、每过一个时间单位增加一个新节点。新节点从当前网络中选择(m<=m0)个节点与之相连，网络中某节点vi被选中的概率p(vi)与其节点度di的大小成正比，即p(vi)=di/sum(dj)；c、直至网络中节点增加至n，形成无标度网络。

import networkx as nx

import matplotlib.pyplot as plt

# BA scale-free degree network

# generalize BA network which has 20 nodes, m = 1

BA = nx.random\_graphs.barabasi\_albert\_graph(20, 1)

# spring layout

pos = nx.spring\_layout(BA)

nx.draw(BA, pos, with\_labels = False, node\_size = 30)

plt.show()

网络中的度分布和簇系数

ws=网络，ne=包简称，也可以使用其他API

print(ws.degree())   
print(ne.clustering(ws))