from scipy.integrate import odeint # 导入 scipy.integrate 模块

import numpy as np # 导入 numpy包

import matplotlib.pyplot as plt # 导入 matplotlib包

def dyLV(y, t, r,mu): # SIR 模型，导数函数

u, v = y

du\_dt = r \* (u- u\*v) # du/dt = r\*(u-uv)

dv\_dt = (u\*v-v) / r # dv/dt = (uv-v)/r

return np.array([du\_dt,dv\_dt])

# 设置模型参数

r = [0.25, 0.5, 1.0, 2.0, 4.0]

mu = 1.0

colorlist = ['green','cyan','blue','orange','red']

tEnd = 20 # 预测日期长度

t = np.arange(0.0, tEnd, 1) # (start,stop,step)

u0 = 1.0 # 初值

v0 = 1.2 # 初值

Y0 = (u0, v0) # 微分方程组的初值

plt.figure(figsize=(10, 4))

for k in range(len(r)):

yt = odeint(dyLV, Y0, t, args=(r[k],mu)) # SIS 模型

plt.plot(t, yt[:, 0], color=colorlist[k], label=r"r = {}".format(r[k]))

plt.title('u(r)')

plt.xlabel('t')

plt.legend(loc='best') # youcans

plt.show()

plt.figure(figsize=(10, 4))

for k in range(len(r)):

yt = odeint(dyLV, Y0, t, args=(r[k],mu)) # SIS 模型

plt.plot(t, yt[:, 1], '--', color=colorlist[k], label="r = {}".format(r[k]))

plt.title('v(r)')

plt.xlabel('t')

plt.legend(loc='best') # youcans

plt.show()