

Open Source Spatial Social Network Diffusion Simulation Platform

Kent State University

The Objectives of the platform

- Develop a toolkit for simulating information diffusion on social network over time
- Design an open platform for network analysis and information diffusion simulation

design principles

- **Multi-layers**

- Data → Functions → Algorithm → Module → UI

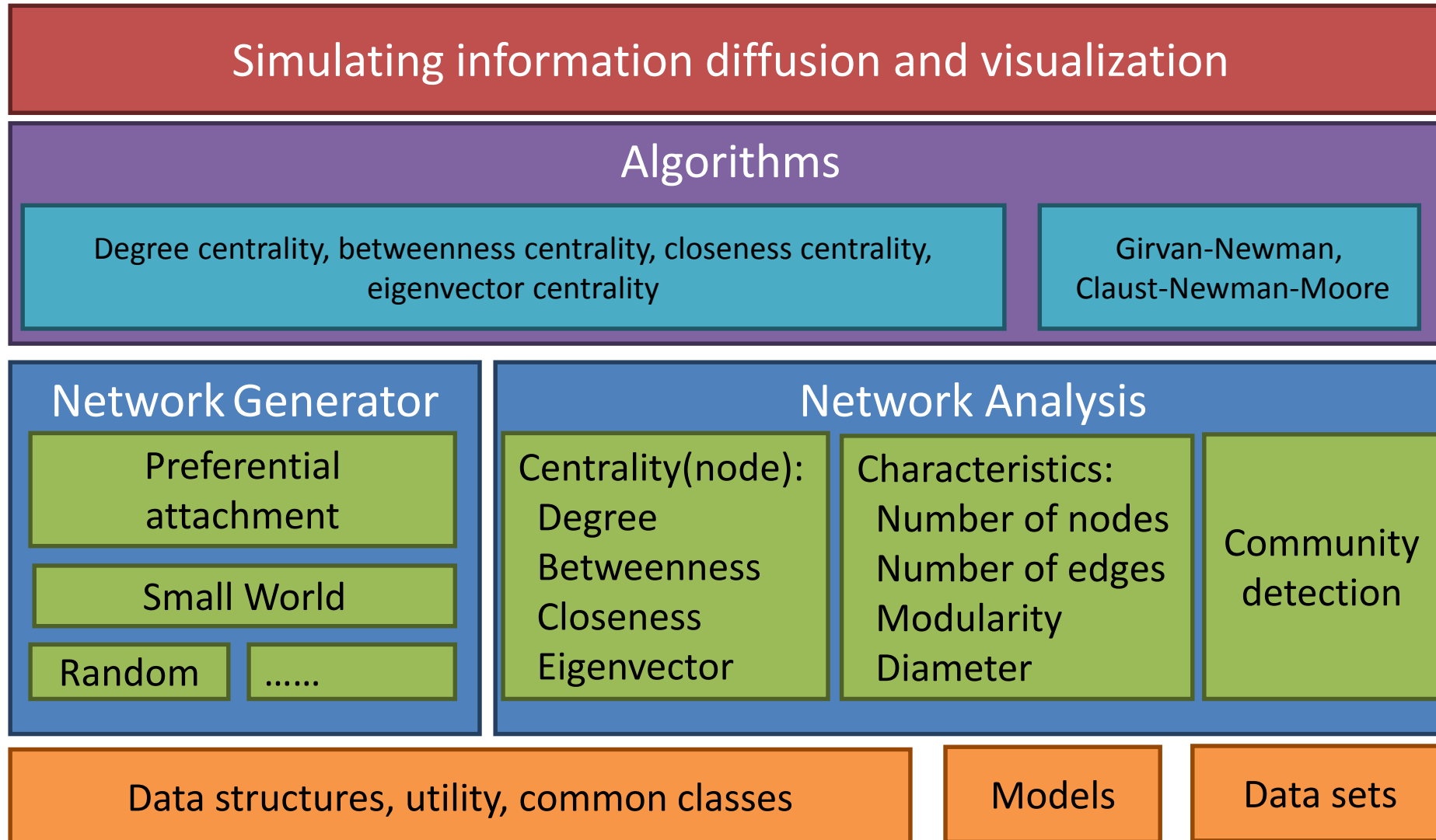
- **Integrated**

- Packages can be integrated in the platform for reuse

- **Extensible**

- It is easy for developers to add new models, algorithms and functions.

Platform Structure



Current Modules

Module	Function description
Network Generator	This module provides functions to generate network with different structures
Network Analysis	Characteristics of a network or characteristics of a node are examined in this module
Community Detection	Includes three methods developed for detecting communities in a network
Information Diffusion	demonstrate information diffusion over network in the models

User's control panel

File Network Analysis Community Simulator Case Data Help

Network Generator

Network Type: Small World

Please Configure Parameter (s)

Parameter	Value
1 Nodes(int)	
2 OutDeg(int)	
3 RewireProb(float)	
4 Rnd	Random number

Base Map

Please Select Base Map File

Select

View

Show Edge Generate Network

Reset Network

Network Analysis

Network Characteristics

Character	Value
1 # Nodes	
2 # Edges	
3 Modularity	
4 Diameter	

Run

Nodes Characteristics

Degree Centrality

Betweenness Centrality

Closeness Centrality

Eigenvector Centrality

Information Diffusion

Seed Nodes

Number:

Algorithm :

Generate Seed Nodes

Opinion Leaders

Whole Network

Each Community

Proportion : %

Generate Opinion Leaders

Linear Threshold Model

Threshold:

Independent Cascade Model

Popagate Probability(Opinion Node)

0.3

Popagate Probability(Normal Node)

0.2

Network

Please Select Base Map File

Select

Load Network File

Load Weight Matrix File

Source City

Termination

The number of steps

Percentage of coverage(%)

Event Urgency

Variable temporal weights Clear

Fixed temporal weights Setting

Urgency Value

Spatial Weight

Fixed

Decaying

Decayed radius(mile)

Decayed ratio(%)

Diffusion

Network Generator

Network Simulator

File Network Analysis Community Simulator Case Data Help

Network Generator

Network Type: PrefAttach

Please Configure Parameter (s)

Parameter	Value
1 Nodes(int)	50
2 OutDeg(int)	2
3 Rnd	Random number

Base Map

Please Select Base Map File

SRATiger2010.shp

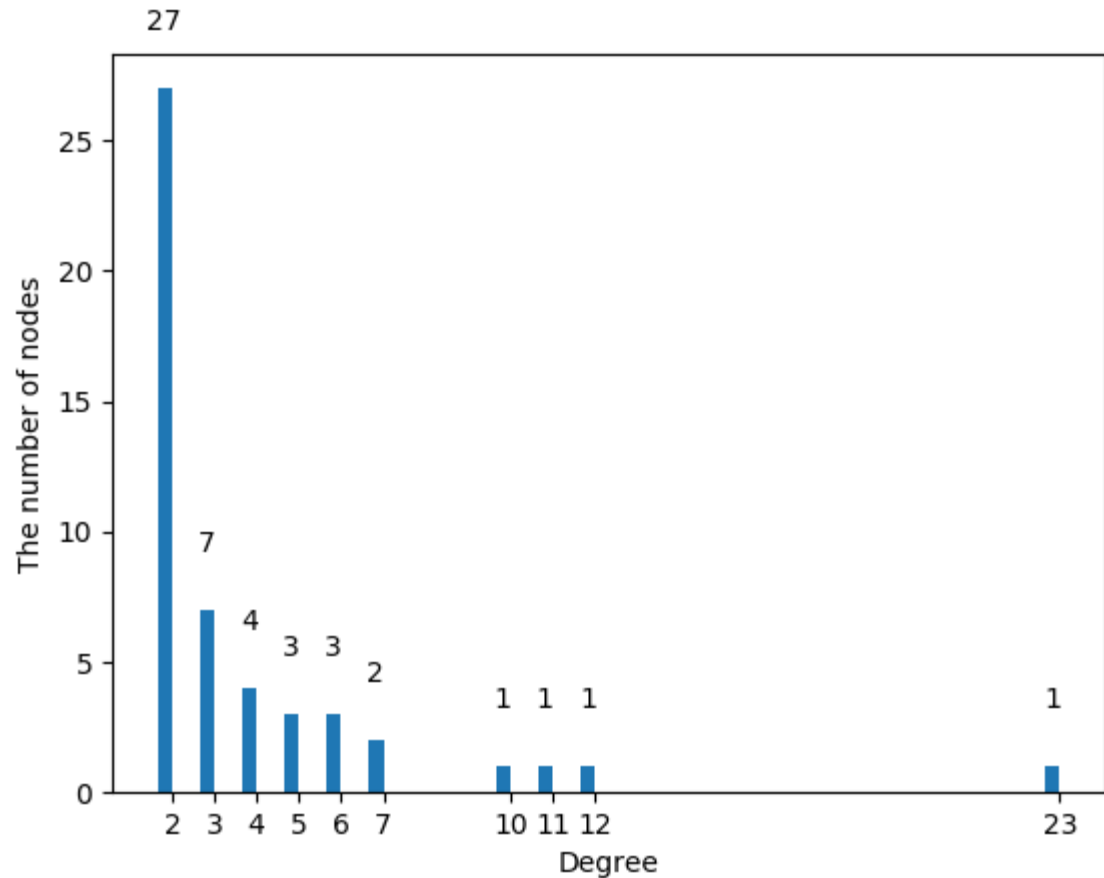
Show Edge

Preview

Network Analysis

Degree Centrality

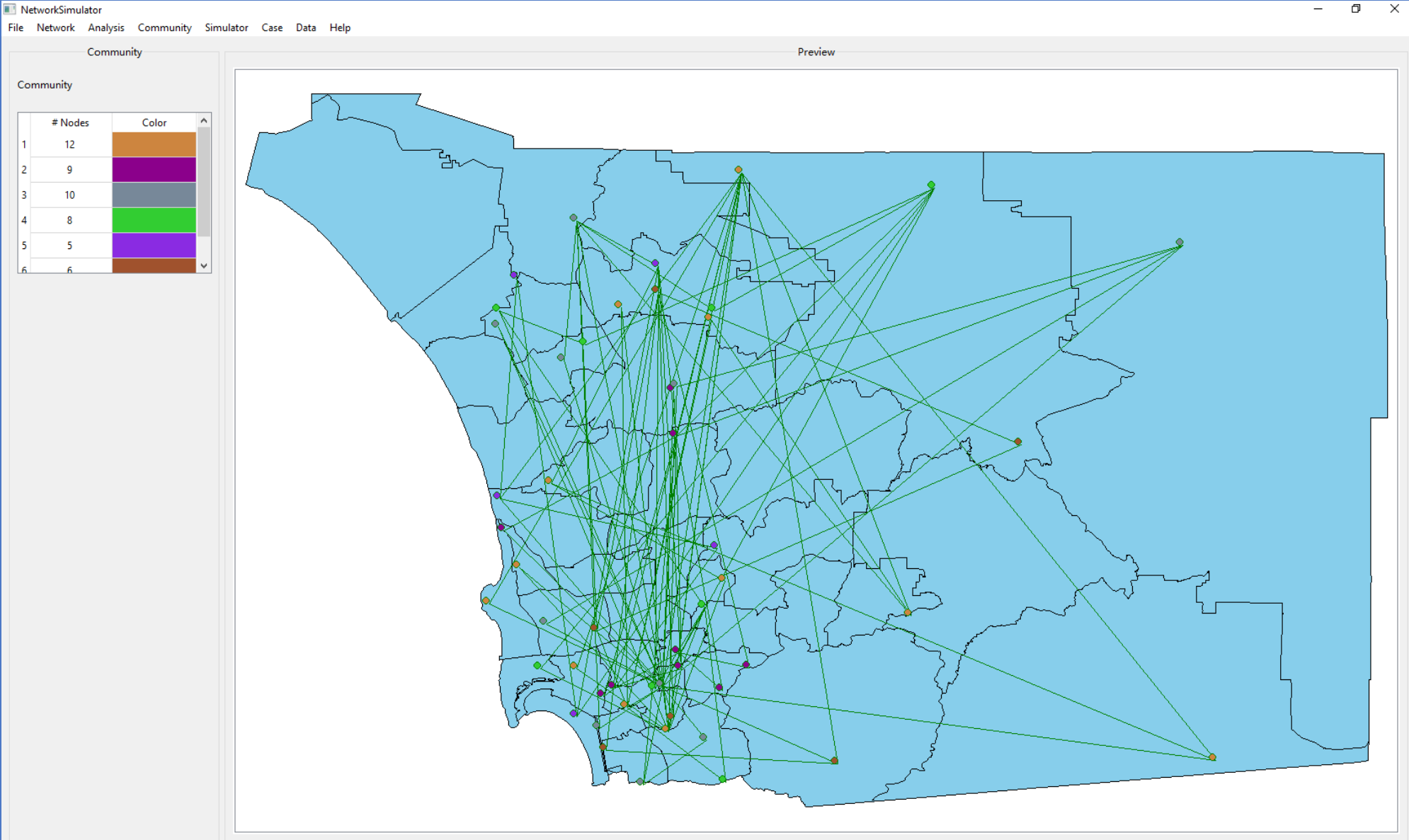
Node 21: 0.0408163265306
Node 22: 0.0408163265306
Node 23: 0.0612244897959
Node 24: 0.0408163265306
Node 25: 0.0816326530612
Node 26: 0.0612244897959
Node 27: 0.0612244897959
Node 28: 0.0408163265306
Node 29: 0.142857142857
Node 30: 0.0612244897959
Node 31: 0.0612244897959
Node 32: 0.0408163265306
Node 33: 0.0408163265306
Node 34: 0.0408163265306
Node 35: 0.0408163265306
Node 36: 0.0408163265306
Node 37: 0.0408163265306
Node 38: 0.0408163265306
Node 39: 0.0408163265306
Node 40: 0.0408163265306



Network Characteristics

	Character	Value
1	# Nodes	50
2	# Edges	97
3	Modularity	-0.0122223403125
4	Diameter	2.97925311203

Community Detection



Information Diffusion- select seed nodes

Network Simulator

File Network Analysis Community Simulator Case

Simulating Information Diffusion

Seed Nodes

Number:

Algorithm:

Opinion Leaders

Whole Network

Each Community

Proportion: %

Linear Threshold Model

Threshold:

Independent Cascade Model

Popagate Probability(Seed Node)

Popagate Probability(Normal Node)

Preview

Information Diffusion- select opinion leaders

NetworkSimulator

File Network Analysis Community Simulator Case

Simulationg Information Diffusion

Preview

Seed Nodes

Number:

Algorithm:

Opinion Leaders

Whole Network

Each Community

Proportion: %

Linear Threshold Model

Threshold:

Independent Cascade Model

Popagate Probability(Seed Node)

Popagate Probability(Normal Node)

Information Diffusion

NetworkSimulator

File Network Analysis Community Simulator Case

Simulating Information Diffusion

Preview

Seed Nodes

Number:

Algorithm:

Opinion Leaders

Whole Network

Each Community

Proportion: %

Linear Threshold Model

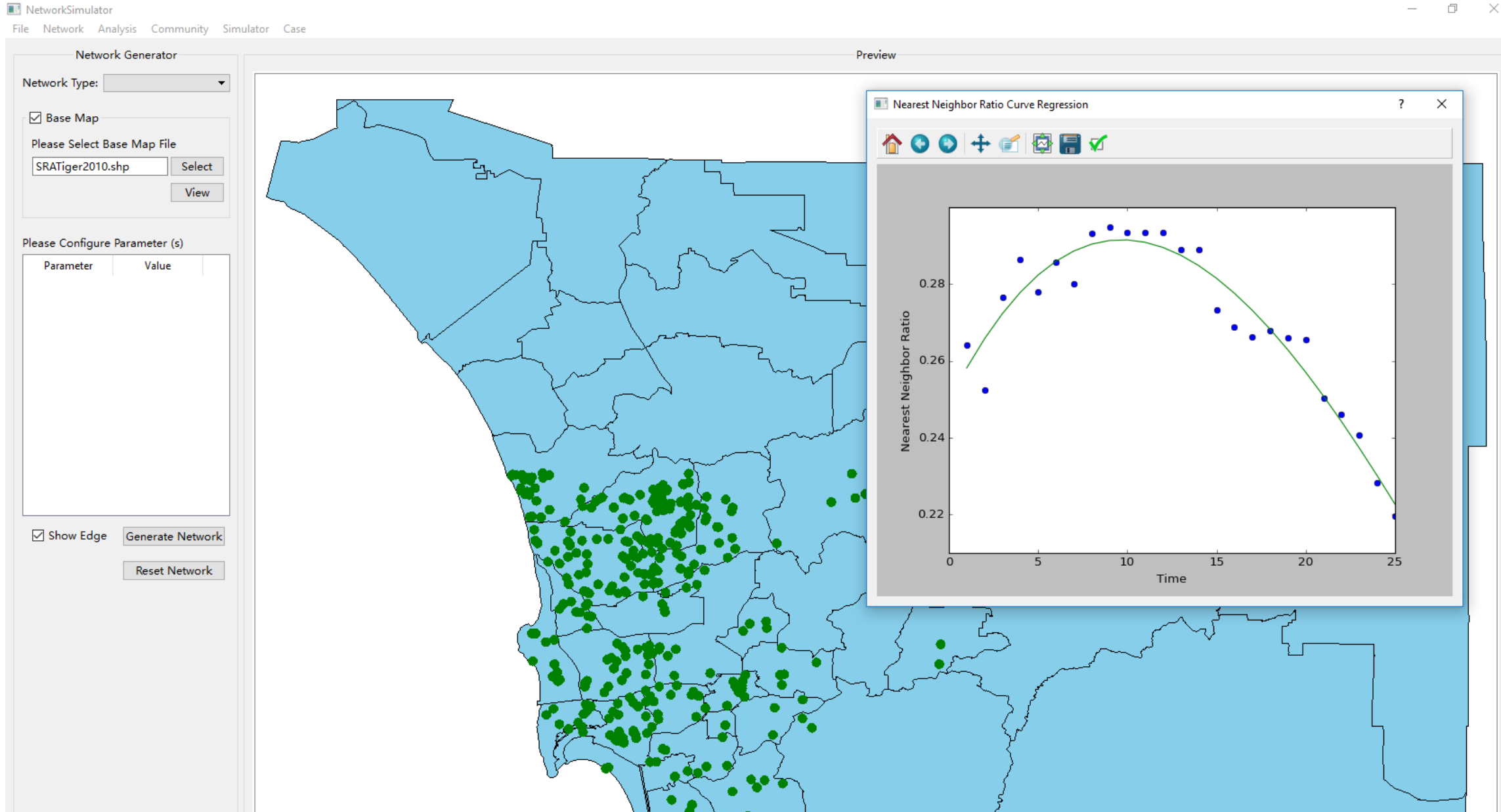
Threshold:

Independent Cascade Model

Popagate Probability(Seed Node)

Popagate Probability(Normal Node)

Case Study-spatiotemporal process



Integrated packages



A Python package that provides functions for analysis and manipulation of large networks.

SNAP was originally developed by Jure Leskovec

Integrated packages



PyQt is a Python binding of the cross-platform GUI toolkit Qt, implemented as a Python plug-in. PyQt is free software developed by the British firm Riverbank Computing.

Integrated packages

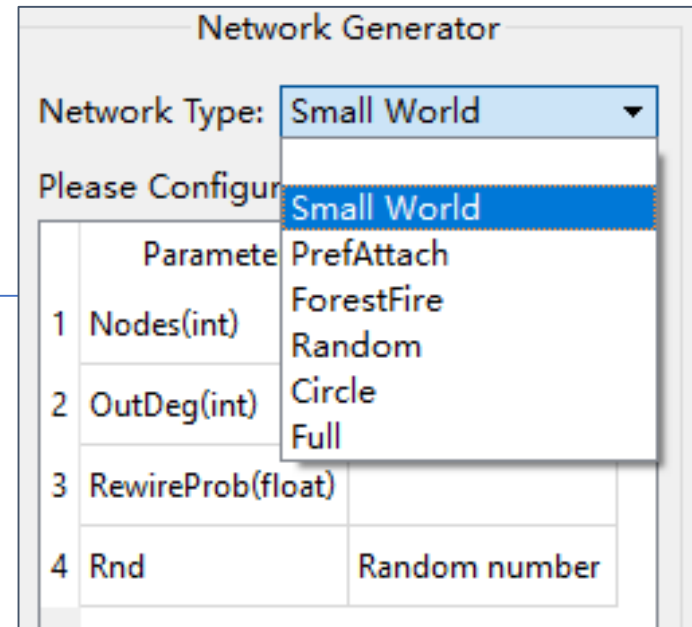


matplotlib is a plotting library that provides an object-oriented API for the Python programming language to embed plots into their applications using general-purpose GUI toolkits.

Extensible

```
NetworkType = ["Small World",  
              "PrefAttach",  
              "ForestFire",  
              "Random",  
              "Circle",  
              "Full"]
```

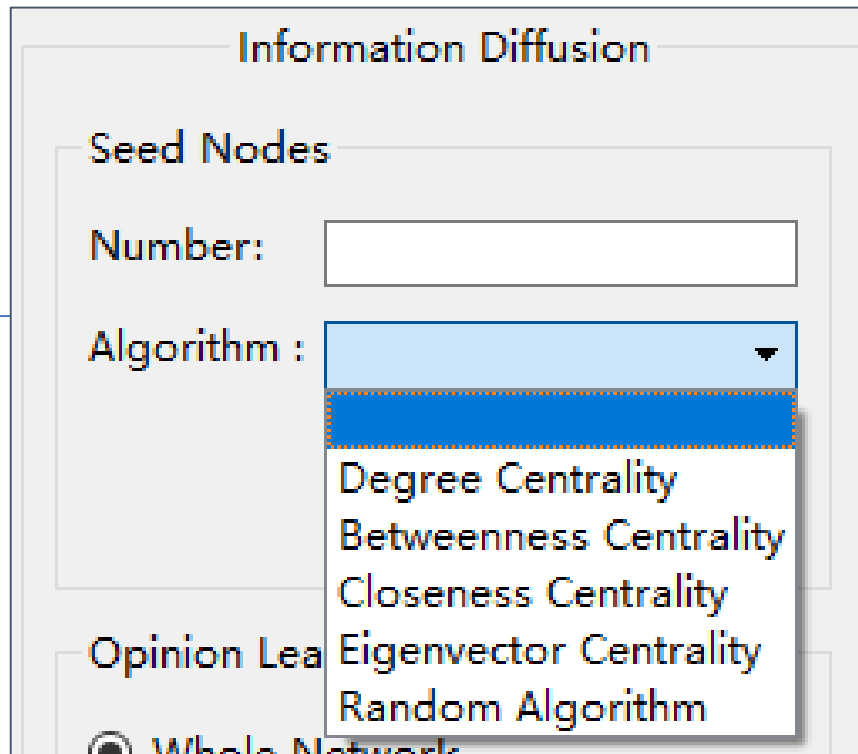
```
NetworkTypeParams = [  
    ["Nodes (int) ", "OutDeg (int) ", "RewireProb (float) ", "Rnd"],  
    ["Nodes (int) ", "OutDeg (int) ", "Rnd"],  
    ["Nodes (int) ", "FwdProb (float) ", "BckProb (float) "],  
    ["Nodes (int) ", "Edges (int) ", "Rnd"],  
    ["Nodes (int) ", "OutDegree (int) "],  
    ["Nodes (int) "]  
]
```



Easy to add new network models

Extensible

```
AlgorithmsforSeedNodes = [ "Degree Centrality",  
                           "Betweenness Centrality",  
                           "Closeness Centrality",  
                           "Eigenvector Centrality",  
                           "Random Algorithm" ]
```



Easy to add new algorithms
for selecting seed nodes