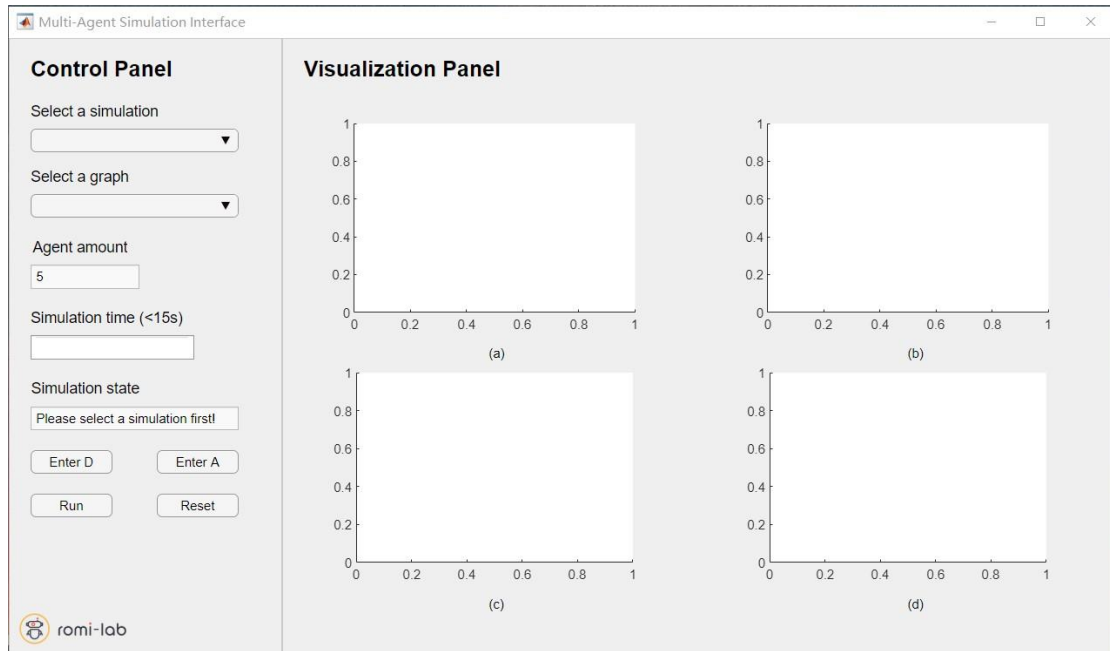# App Usage Instruction

1. **The main window.** Open the app, you will see an interface:



The interface is divided into two panels. The left one is the control panel, where you can change the simulation settings; The right one is the visualization panel, where you can see the simulation figures.

2. **The control panel.** In this app, we integrated 2 different simulation demos. You can select the specific simulation in *"Select a simulation"*.

The amount of agents is fixed as 5. You can set the simulation duration as you want by inputting numbers in *"Simulation Time"*, but you should note that the maximum allowed simulation time is 15s. During the simulation, you can see the simulation running state in *"Simulation state"*.

We also integrated 5 different graph topologies of multi-agent system, the first four of which are undirected graphs, and the fifth of which is a directed graph (note their degree matrices and adjacency matrices are different). You can select a specific graph in *"Select a graph"*. For every option (except the last one), there will be a picture pops up for your convenience to check the topology. We also support you to design your own graph topology with the *"DIY Graph"* option in *"Select a graph"*, but you should note that the amount of agent is still fixed to 5. For different graph topologies, you can input the degree matrix and adjacency matrix by clicking *"Enter D"* and *"Enter A"* buttons, respectively. For each button, there will be a pop-up table for you to enter the elements of the matrix. You should enter the right matrix. If the matrix you have entered is wrong, there will be a warning.
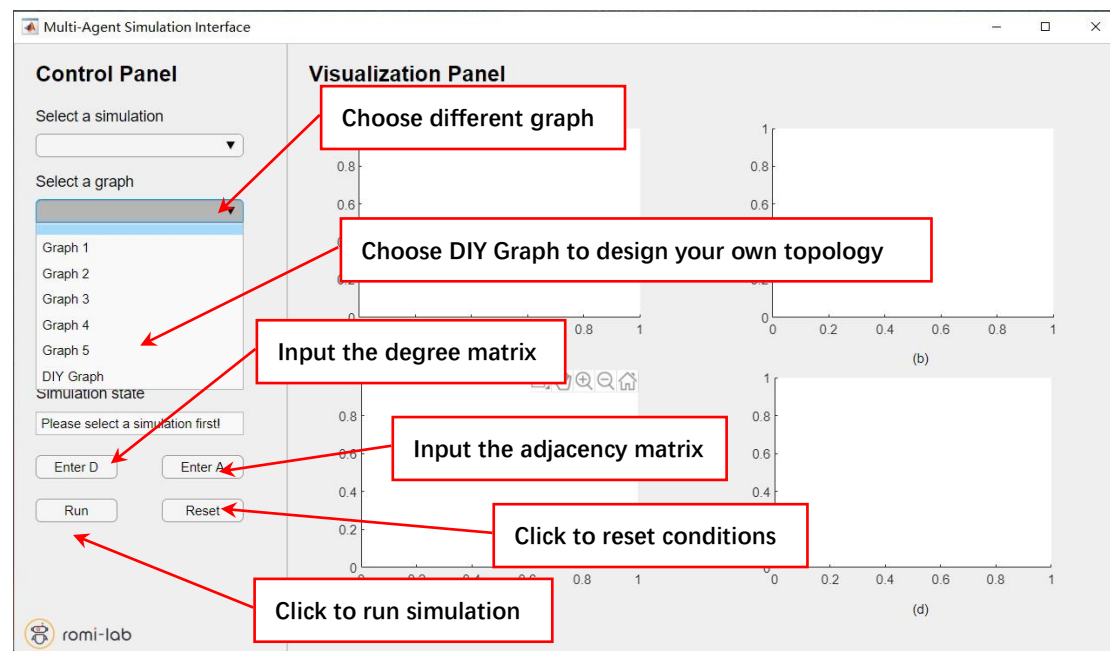
**Multi-Agent Simulation Interface**

**Control Panel**

Select a simulation

Select a graph
Graph 1

Agent amount
5

Simulation time (<15s)

Simulation state
Please select a simulation first!

Enter D     Enter A
Run         Reset

romi-lab

**Visualization Panel**

Graph topology

Table for inputting degree matrix

Degree Matrix

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 |
| 5 |   |   |   |   |   |

(a)

Table for inputting adjacency matrix

Adjacency Matrix

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Complete   Please input the entries.

Graph 1

(d)

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**Multi-Agent Simulation Interface**

**Control Panel**

Select a simulation

Select a graph
Graph 1

Agent amount
5

Simulation time (<15s)

Simulation state
Please select a simulation first!

Enter D     Enter A
Run         Reset

romi-lab

**Visualization Panel**

Degree Matrix

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 |   |   |   |
| 3 | 0 | 0 |   |   |   |
| 4 | 0 | 0 |   |   |   |
| 5 | 0 | 0 | 0 | 0 | 0 |

Complete   Wrong degree matrix!

Warning of inputting wrong matrix

(a)

Adjacency Matrix

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Complete   Please input the entries.

Graph 1

(d)
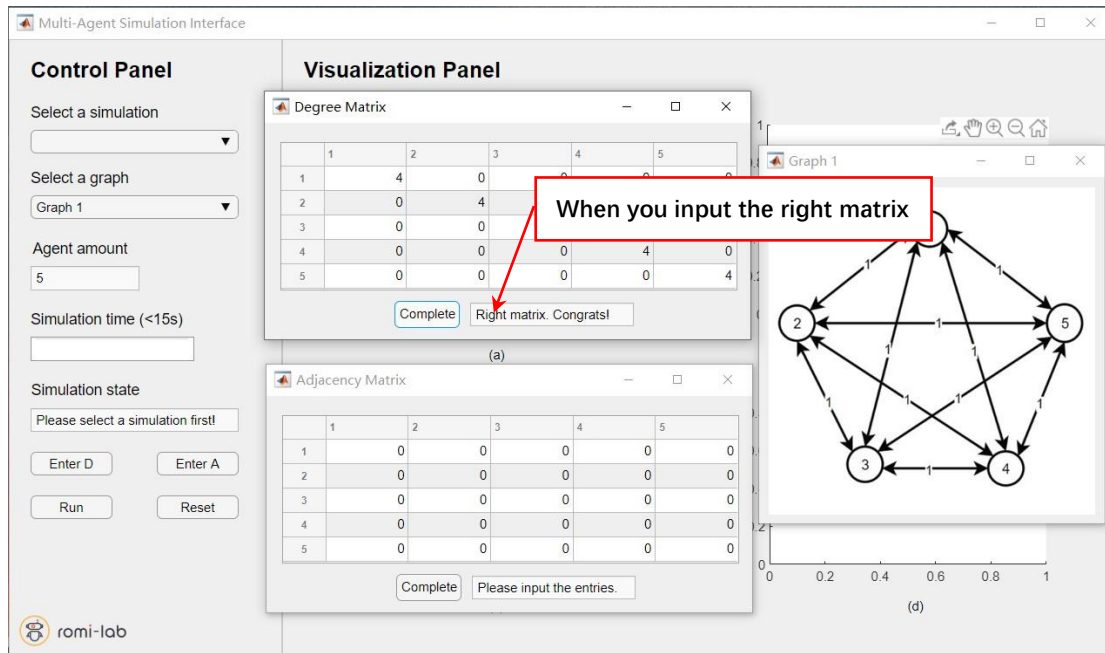
After all the conditions are settled, you can click *"Run"* button to start the simulation. If you want to turn to another simulation, you can click *"Reset"* to clear all the previous settings.

3. **The visualization panel.** During the simulation running, the program will plot the figures in the visualization panel.

For *"Consensus"*, agents will gradually converge to the same point. For "Position-based formation", agents will form a circle gradually. For all demos, four figures will be presented. If the simulation runs right, you will see something like the below screenshot. You can also save the figures as you want.