

Social Networks
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Homophily (Continued) & Positive and Negative Relationships
Lecture – 69
Outline of implementation

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Steps for Implementation

1. Create a graph with 'n' nodes, where the nodes are the countries.
2. Make it a complete graph by adding all possible edges. Also, assign '+' or '-' signs as weights to all the edges randomly.
3. Display the network.



Before we start the implementation, we are going to look at the steps that we are going to execute during with the implementation. So, that its easier for you to follow and understand the subsequent videos.

So, let us look at the bigger picture first. Our aim is to have a network of countries where the friendship or animosity details amongst these countries is stored in the network. Given this scenario a number of unstable relationships amongst the countries emerged which tend to move towards a stable state.

So, over time what happens the network starts from an unstable state and it gradually moves towards a stable state. Now, what do we mean by a stable network? Its a network where there is no unstable relationship. So although, all the triangular relationships will be stable and that network does not change after that. So, our first aim is to observe that how the network evolves from unstable state to a stable state. Now second thing that can be observed in this scenario is that. Once the network becomes stable the nodes in the

network can be divided into two groups such that: the nodes in the first group are all friends to each other, the nodes in the second group are all friends to each other. However, the nodes in the first group are enemies to the nodes in the second group

So, that is an interesting pattern that emerges. And the second aim of our implementation will be to observe this division of nodes into two groups. And we will see how the relationships existed amongst the countries initially, and how the relationships exist amongst the countries later after this evolution.

So, to start with we will create a graph with n nodes where the nodes are countries. We are going to make it a complete graph by adding n choose two edges and we are also going to randomly assign a weight either positive or negative to all these edges. And after that we will display the network. So, this is the starting step. Once the network is created our aim is to analyze the unstable triangles in the network.

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Steps for Implementation

1. Create a graph with 10 nodes, where the nodes are the countries.
2. Make it a complete graph by adding all possible edges. Also, assign '+' or '-' signs as weights to all the edges randomly.
3. Display the network.
- 4.1 Get a list of all the triangles in the network.
- 4.2 Store the sign details of all the triangles.
- 4.3 Count the number of unstable triangles in the network.



So, what we are going to do is: we will create a list of all the triangles in the network. So, if there are n nodes, they are going to be n choose three possible triangles in the network. Since we have to check whether these triangles are stable or unstable, we will store the sign details of all these triangles. Maybe, we will create a list where we will store the sign details of each and every triangle.

Now, you might remember from the previous video that if the triangle has 3 or 1 positive edges then it is stable. And if the triangle has 0 or 2 positive edges then that triangle is unstable right. So, we are going to use this detail to check whether a given triangle is unstable or not. And we will finally get the total number of unstable triangles in the network

Our aim now is to move the network from an unstable state to a stable state. Basically, we have to see what happens when there are unstable triangles in the network. Since we know that they tend to move towards a stable state so that is what we are going to implement in our video.

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5. While the number of unstable triangles is not zero, do the following:

5.1. Choose a triangle in the graph that is unstable.

5.2. Make that triangle stable.

5.3. Count the number of unstable triangles



So, what we are going to do is we are going to choose a triangle which is unstable and will move this triangle to a stable state. Now I will show it during the implementation.

So, we will make that triangle stable and after the triangle becomes stable a number of relationships change and due to that the adjacent relationships also get affected. So, the adjacent triangles may become stable or they can become unstable as well. So, this changes the total number of unstable triangles it can increase it can decrease. So, we will actually see during the implementation how it fluctuates

After this moving of one triangle from unstable state to stable state the total number of unstable triangles will change, so we are going to keep a count of that. So, we are going

to do this until the total number of unstable triangles becomes 0. So, we are going to repeat the steps 1 2 and 3 here until the whole network becomes stable.

So, that is the whole idea of making the network move from unstable to stable state.

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6. Now that there is no unstable triangle in the network, it can be divided into two coalitions, such that in each coalition, the intra-edges are positive, and the inter-edges are negative.



Now, as I told you once the network becomes stable it can be divided into two groups right, where the nodes in first group are all friends and the nodes in second group are all friends, and they all and the nodes in first group are enemies to the nodes in second group. So, how can we create that network? Now we have a stable network and we have to divide it into two groups, how do we do that? There can be various ways that we can use to divide the network; what we are going to follow here is that.

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6. Now that there is no unstable triangle in the network, it can be divided into two coalitions, such that in each coalition, the intra-edges are positive, and the inter-edges are negative.

6.1. Choose a random node. Add it to the first coalition.



We are going to choose a random node and we will add it to first group, after that we will look at the neighbors of this node some of these neighbors will be positive some of these neighbors will be negative. As in the some of these neighbors will be friends, some of these neighbors will be enemies.

So, we are going to take the friends of this node and we will add the all of them to the first group. And the enemies of this node we are going to add to the second group. After that we will take the friends of this node which we added to the first group, we will take them one by one and we will repeat the same process for them. That is we will we will look at their neighbors, we will add the friends to the first group, we will add its enemies to the second group.

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6. Now that there is no unstable triangle in the network, it can be divided into two coalitions, such that in each coalition, the intra-edges are positive, and the inter-edges are negative.

6.1. Choose a random node. Add it to the first coalition.

6.2. Also put all the 'friends' of this node in the first coalition.

6.3. Put all the 'enemies' of this node in the second coalition.



So, we will keep taking all the nodes from the first group which we have added, if there if they have not been processed they are going to repeat this process. So, we will put all the friends in the first group, we will put all the enemies in the second group.

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6. Now that there is no unstable triangle in the network, it can be divided into two coalitions, such that in each coalition, the intra-edges are positive, and the inter-edges are negative.

6.1. Choose a random node. Add it to the first coalition.

6.2. Also put all the 'friends' of this node in the first coalition.

6.3. Put all the 'enemies' of this node in the second coalition.

6.4. Repeat steps 6.2 and 6.3 for all the 'unprocessed' nodes of first coalition.



And we will keep repeating this process until we have processed all the nodes in the first group. So, at the end of this process we will be having two groups of nodes as stated.

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6. Now that there is no unstable triangle in the network, it can be divided into two coalitions, such that in each coalition, the intra-edges are positive, and the inter-edges are negative.

6.1. Choose a random node. Add it to the first coalition.

6.2. Also put all the 'friends' of this node in the first coalition.

6.3. Put all the 'enemies' of this node in the second coalition.

6.4. Repeat steps 6.2 and 6.3 for all the 'unprocessed' nodes of first coalition.

7. Display the network with coalitions



And then we will display the network with the two groups, and we will observe the kinds of relationships that existed amongst the countries initially, and the kinds of relationships that existed amongst the countries after all this evolution.

So, these were the steps that we are going to follow let us now start the implementation.