Social Networks
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How to go Viral on Web
Lecture - 155
Programming illustration- Myopic Search: Introduction

The next part of our programming screencast is we will see how we do search on the small world networks, search on the small world networks.

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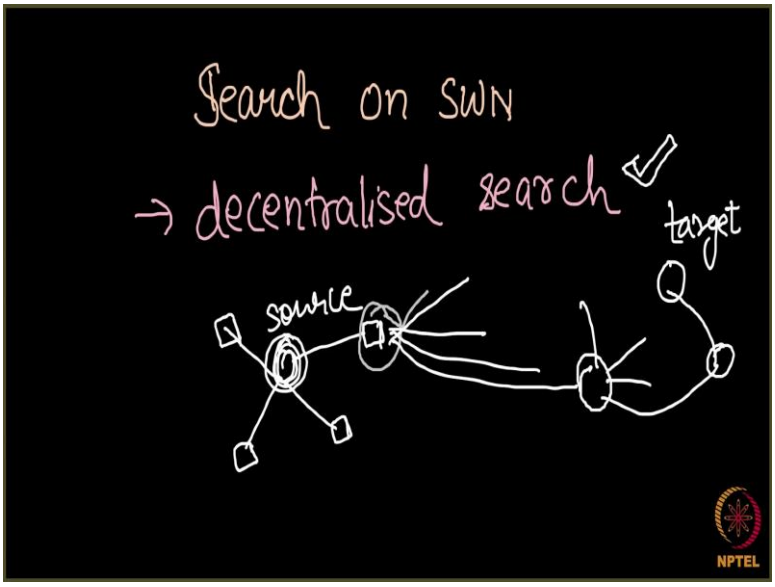

And, as we have discussed before the search on the small world networks is known as a decentralised search. Decentralised search because, it is a collaborative effort, there is no central authority no central node in the network which help you searching. And, we are have we have briefly looked at how do we do this decentralised search right.

So, how do we do this decentralised search was something like here is a node in this network and let us say this is the source node and it wants to find a path to some node, let us say the target node, let us say it wants to pass on some later do this target node. So, how this source was going to work is, it was going to look at all of its neighbours and for all of its neighbours it has an estimate of the distance of its neighbours from the target. So, the source looks at what is the distance of this neighbour from the target, what is the distance of this neighbour from this target this neighbour and this neighbour.

And it might find out that this neighbour here is closest to the target. So, it chooses this neighbour and this neighbour again here this neighbour, again here looks at all of its neighbours and chooses the one which is closest to the target. And, this one looks at all its neighbours and chooses the one which is closest to the target.

And, hence the letter in this process the letter reaches the target. Now, what we are going to do this? We are going to look at how do we do this decentralised search on a small world network, on a Watts-Strogatz model which we have studied before.

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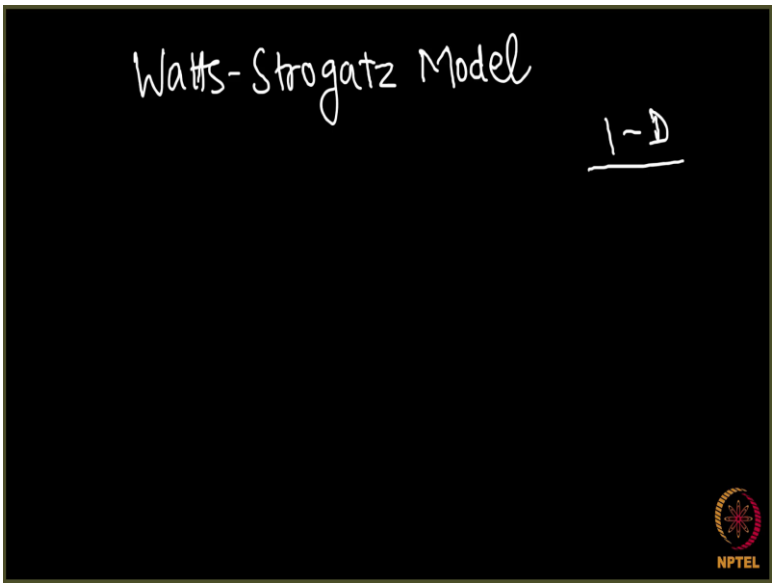

So, given a Watts-Strogatz model how do you perform a decentralised search on this model. So, let us say the model which we are talking about is that the is the ring model the one-dimensional Watts-Strogatz model and we want to see how do we perform a decentralised search over there.

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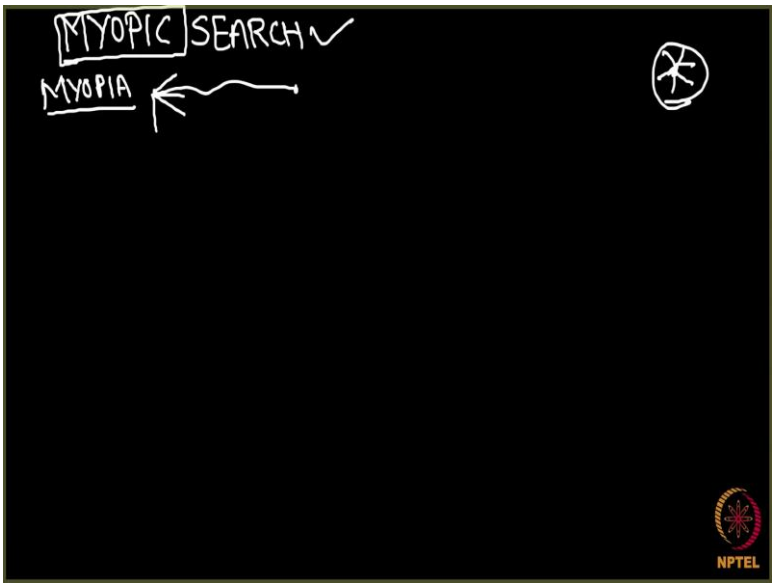

So, let me tell you this kind of search is known as the myopic search as well. So, we call this decentralised search as myopic search. Why myopic? Do you remember myopia we are studied it when we were in like 6th or 7th or 9th class, I do not remember? So, myopia; myopia is nothing, but the short sightedness; short sightedness means that you can only look at a small distance you cannot look at a long distance.

And, that is what happens in the decentralised search right, you do not know about the entire network, you know only about your locality. And, based on your locality you decide where you want to pass a letter and hence myopia. And, hence this search is known as the myopic search. Let us quickly see how we perform a myopic search before starting with the screencast. So, let me take a 1-dimensional Watts-Strogatz model here.

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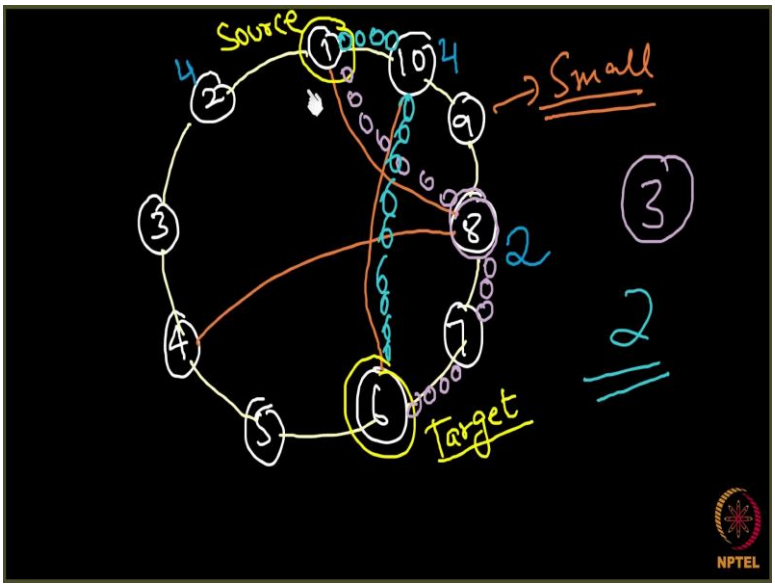

And, let us say I take here ten nodes arranged in a ring 1 2 3 4 5 6 7 8 9 and 10. Now, here write it 10 nodes which are arranged in the form of a ring and for the sake of simplicity I am going to connect each node. So, the homophily links each node 1 edge towards its left and 1 edge towards its right; now these are the homophily links in this network in this homophor ring and next my aim is to lay some weak ties in this network. So, I am simply instead of rewiring as we have discussed before I am simply going to add some edges here.

So, let us say I add an edge from 10 to 6 and then I add an edge from 1 to 8 let us say and let us say one from 4 to 8. And, these are be 3 weak ties in this network which makes this world small, which makes it a small world network. Now, how do we do a decentralised search over here? So, let us say our node 1 here is the source which has the letter and let us say the node 6 here is the target. We want to pass on the letter to this target which is the node 6. Now, how do our myopic search, how do our decentralized search work here.

We have seen before how does decentralised search work every node is going to look towards its neighbours and choose the neighbour which is closest to the target node 1 here. So, node 1 here it is supposed to pass on the letter to the node 6. So, according to our myopic search decentralised search it will first look at node 10 and then look at the distance of this node 10 from the target. Now, here I would like to tell you when you

look at the distance of your neighbours from the target you do not have information about the weak ties which your neighbours is connected to.

So, I might know my neighbour and I would have an estimate of the distance to the target. I will not be knowing the weak range the weak range ties of my neighbours the weak ties I will not know, I am very sorry long range contacts and a weak ties of my neighbours I will not know. I will know my weak ties, my long range contacts, but not the long range contacts of my neighbour. So, the node 1 here knows that he can pass on the letter to the node 10 and he can pass on the letter to node 8 or to the node 2.

And, then he calculates the distance for node 2 what is the distance from the target, it is 1 2 3 and 4, the distance of node 2 from the target is 4. And, then he looks at the node 1, looks at node 10 and what is the distance of node 10 from the target. Since, it does not know the long range contacts of node 10 so, we calculate the distance of node 10 to be 1 2 3 4. So, the distance of node 10 from the target is 4 and then node 1 also no more 8 whose distance from the target is 2.

So, what will happen according to decentralised search or the myopic search, the node 1 will pass on the letter to this node 8 over here. And, now this node 8 over here has the letter and then this node 8 looks at all of its neighbours node 9; whose distance from the target is 3. And, then node 1 whose distance from the target is 5 and then node 4, whose distance from the target is 2 and then node 7, whose distance from the target is 1 and it will simply pass on the letter to node 7.

And then node 7 will look at all of its neighbours and the target is its neighbour. So, it will pass on the letter to the target. So, we can see here that this is the path which our decentralised search will find, and the length of this path is simply 3. My next question to you, now we understand what decentralised search is, what is myopic search. Do you think this search policy is optimal? What do I mean by optimal? Optimal means do you think that it has found out the best path, can you find a path from this node 1 to node 6 in this graph path from node 1 to node 6; whose distance is 3 and its actually possible.

So, if you looked at this path over here you start from node 1 and then you come to node 10 and from 10 you can directly go on to this node 6 over here. So, there is a path of length 2 from the source to the target in this network, but our myopic search has found out the path of length 3. So, it confuses that our myopic search our decentralised search

is not optimal it is not optimal, but still it gives us a path of a quite less distance with a less knowledge. So, one we were working out the optimal path from node 1 to node 6 we have assumed that we have the global knowledge about this network.

So, anybody who is knowing this entire network can find out this path, but if you know only the information about your locality, about your neighbours which is few in the real world which is difficult to get an optimal path. So, you follow this greedy approach which is called the decentralized search and find out this path. So, we will be doing this and what we will be looking at in this programming screencast is let us say here are the number of nodes in our network.

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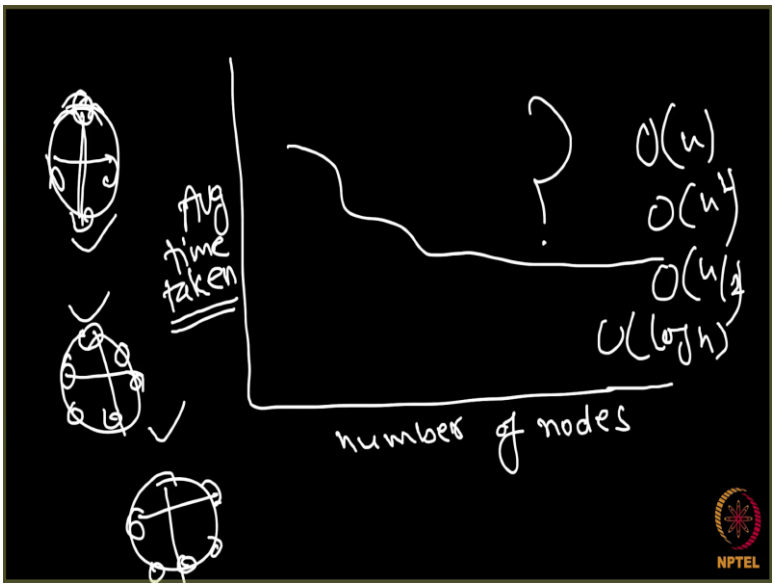

Say here are the number of nodes, mainly you can make a ring having 100 nodes, you can make a ring having 200 nodes, you can make a ring having 300 nodes and so on. So, different sized rings we are going to take of course, with the weak ties over here. So, different small world networks one dimensional small world networks we are going to take. And, then we are going look at we are going to do decentralised search on these networks and will be looking at what is the average time taken.

What is the average time taken to find the distance to find the path from the source to the target? How many steps are taken and will see at how does this plot look like, whether it is order of n whether it is order of n square or order of n by 2 or order of log n or order of log square n; what is it you will be looking at this in the second programming screencast.