Computational Systems Biology
Karthik Raman
Department of Biotechnology
Indian Institute of Technology-Madras

Lecture – 29
Lab: Network Models & Perturbations

In today's lab video, we will study network models and perturbations and how I will show you how can one use Mathematica or MATLAB to use some of these analyses and following this.

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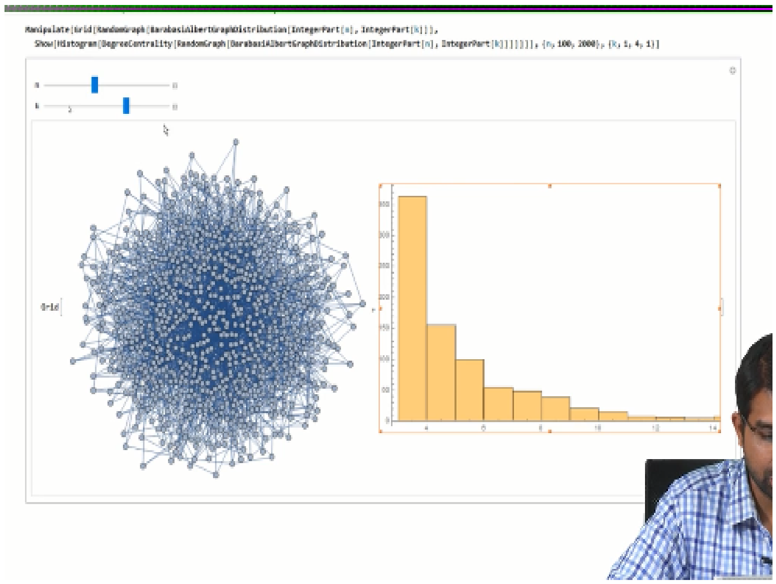

We finally can have our MATLAB Mathematica demo. So, this shows you this is the degree distribution and this is the network itself for a Barabasi Alert graph and I can vary N and K. Right where N is the number of nodes that gets added and K is the number of links that form. So, if you see I decrease K this looks very much like the Barabasi network said we are generating with just.

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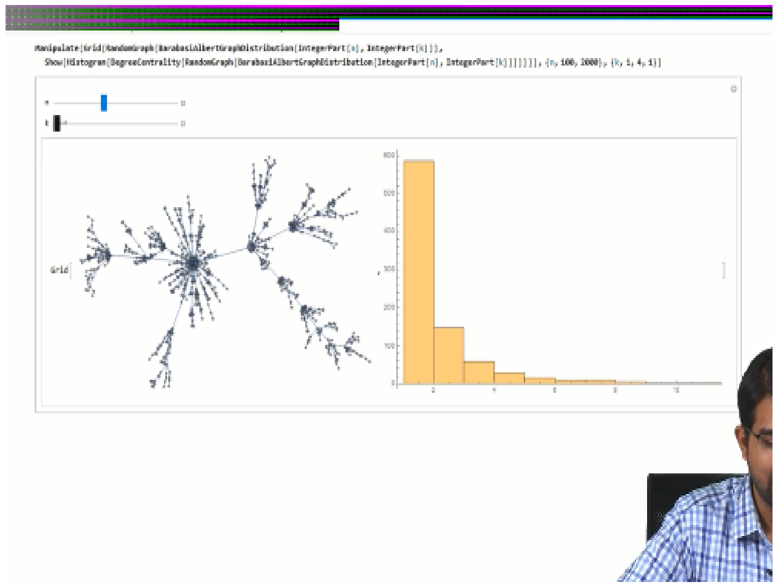

No triangles no clustering right and then if you slightly increase you start that clusters start forming wow did you see the fundamental change completely different **“Professor - student conversation starts”** and still the degree distribution remains perfect you have a beautiful power log no doubt about it the one hidden factor here is we kept the original network the same it is basically juts this like an edge. “**Professor - student conversation ends”**

So because any kind of network could grow so if you think back the important of Barabasi Albert algorithm is that it allows for network growth. So, you did the growth using preferential attachment whereas watched against was network rewiring. This was network growth so many real network grow over a period of time. So if you have a city it is not going to remain static the social network in the city is going to grow over a period of time.

And if you have a you know a protein network or if you have a power distribution network all of these things dynamically can change over time. So, in a protein network you may have different operation maybe you will have duplications and so on **“Professor - student conversation starts”** depth, depth too but usually for the periods there normally studied depth may not be very important in you know.

In most of the network but I mean it certainly can be modeled “**Professor - student conversation ends.”** But you see that the degree distribution remains nice clean power law maybe I should have a fit also showing you and then you know how does gamma change as you vary N and K. But you can see it become super dense so those one nice thing about Mathematica it may be possible if the other things are going to make this slider.

And show you how things vary as you vary certain parameter. It gives you a good picture of what is going on.

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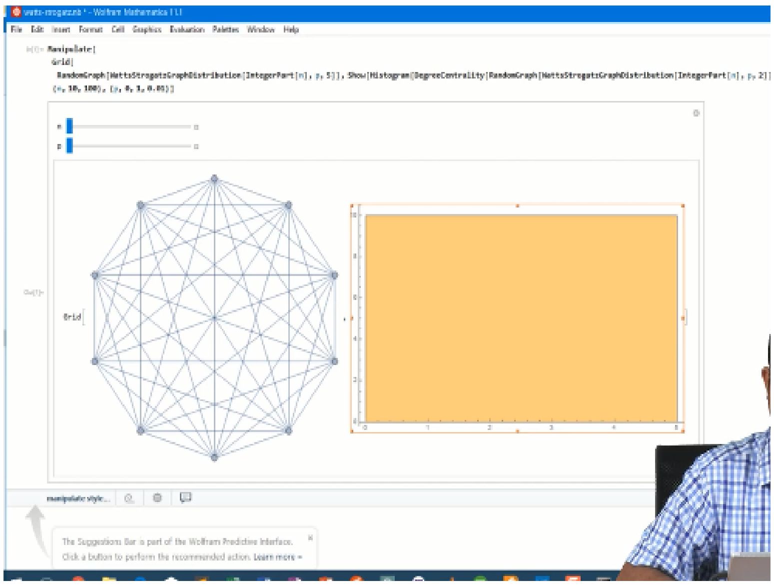

Let us look at what is strogatz how does your watts strogatz network look like. What is that it is a big band right so only one point in the histogram and I think I have set K as 2. So, technically this code is not fully correct because these would be two different random graphs and I am showing you one picture on the left and another distribution on the right. So, in this case it is same because P is 0.

But when I change I do not think that the correspondence will be maintained. So, I am sure this is not changing different n yeah so what happens this looks very much like a random network right not truly I do not know it can fit oh yeah this looks like a Poisson to me almost right but yeah you need to really worry about the fit but some intermediate is there it looks very very different this is your regular lattice.

But at some intermediate stage it looks very interesting behaviors if I want to plot clustering co efficient and other things by the side it is just to show you what can be done.

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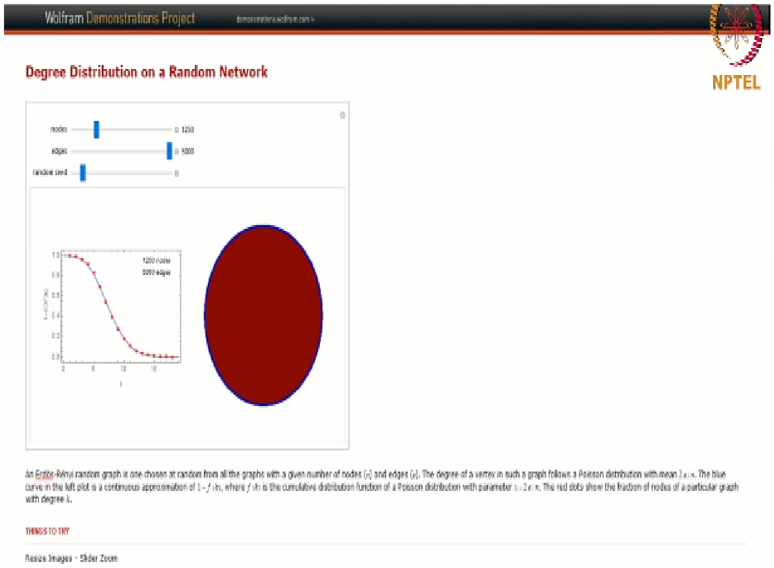

Yeah I think this was a built in MATLAB thing so you have very low edges so you can actually plot a characteristic path length or something right what happens when I keep increasing the edges right see how the distribution changes this is sort of a cumulative distribution so it is not that nice but let me show you a different.

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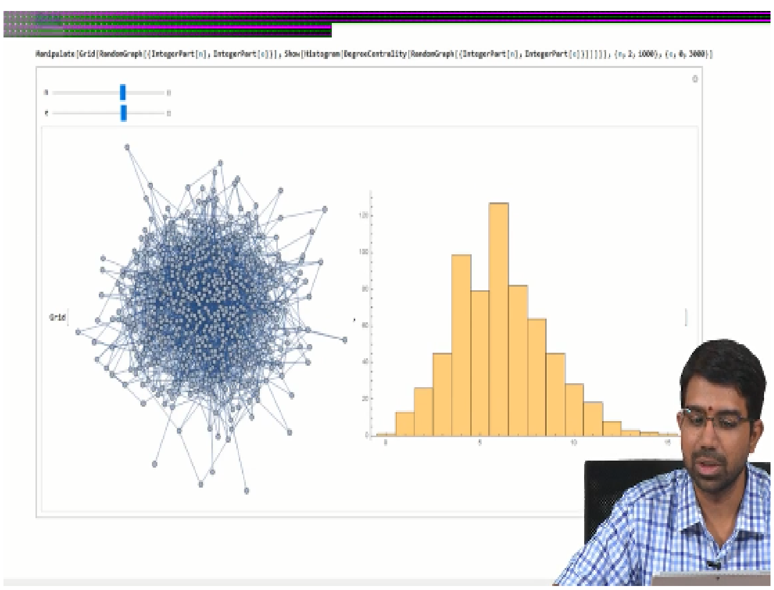

There is an addition any random graph so as you increase the edges you will see at some point a giant component emerges some point you will have a single connected component. Just watch almost yeah you can see a nice binomial Poisson kind of distribution so you can just play around with these to understand some of the concepts.

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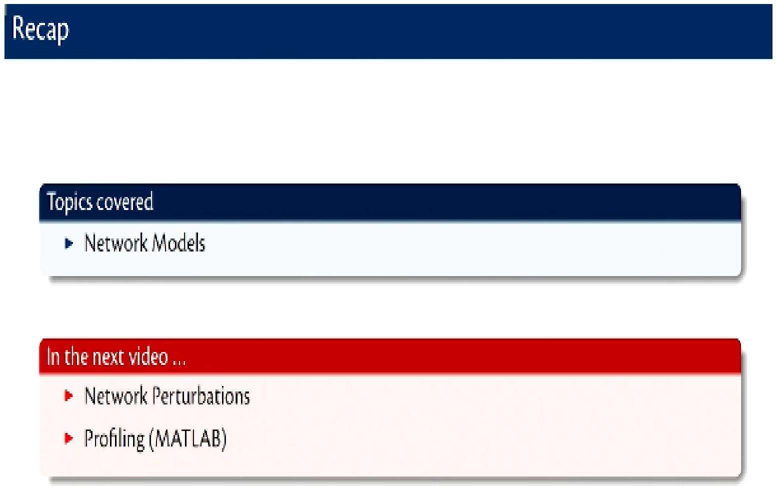

So, in this video we did look at network models and in the next video we will take a closer look at how do we perturb and study perturbations using MATLAB and I will also introduce you briefly to the concept of profiling although from a MATLAB centric perspective but is a very interesting way to look at how fast your code runs where are the bottlenecks and so on.