Social Networks
Prof. S. R. S. Iyengar
Department of Computer Science
Indian Institute of Technology, Ropar

Link Analysis (Continued)
Lecture - 113
PageRank as a Matrix Operation

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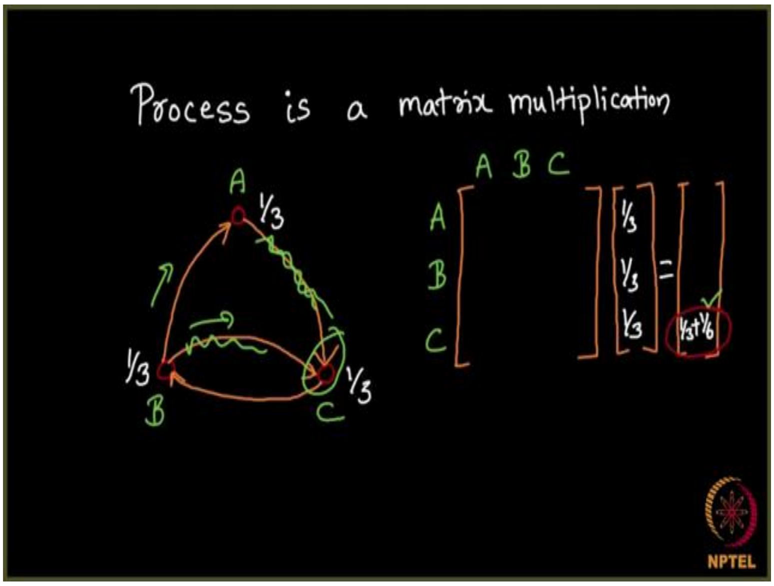

So, we saw a graph on three nodes right. I would like to see, if this process can be better understood by writing it as a matrix operation. So, that is my motive. This process is a matrix multiplication and we will see how exactly one can see this as matrix multiplication good.

So, now, let me try writing 3 cross 3 matrix like this. You will soon understand what the motivation is behind writing it as a matrix, but please bear with me as of now try to see what I am trying to do here ok. It is a very straightforward process. So, I will write down a matrix like this and then I will write down 1/3, 1/3, 1/3 and that is how we start that is where we start from as you can see it is 1/3 here, 1/3 here and 1/3 here correct.

So, we start as 1/3, 1/3, 1/3 and what I need is the next vector whatever I am going to get. And what is that? As you all know the value of A B C will respectively be so much, we start with C being 1/3 + 1/6. Why is that? That is because you have this C here, C has 2 incoming edges and from B C gets B gives half to A and half to C and we gets 1/6 from C gets 1/6 from B and it gets 1/3 from A correct.

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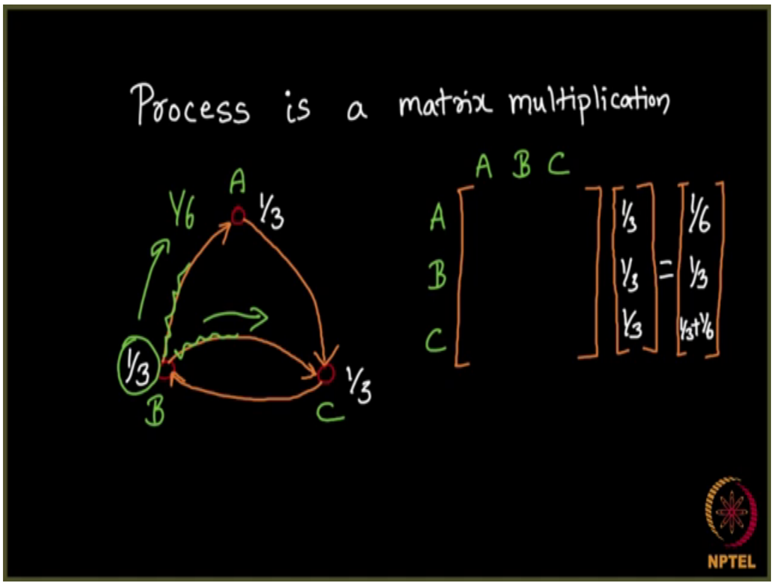

Now, what next? B gets 1/3 right; how is that? B gets 1/3 from C everything of what C has B gets

So, I am going to write 1/3 here. Next A gets 1/6, why is that? That is because from B you have to it just going and half is given to A and the other half is given to C and half is 1/3 happens to be 1/6. So, it is going to be 1 over 6 as you can see.

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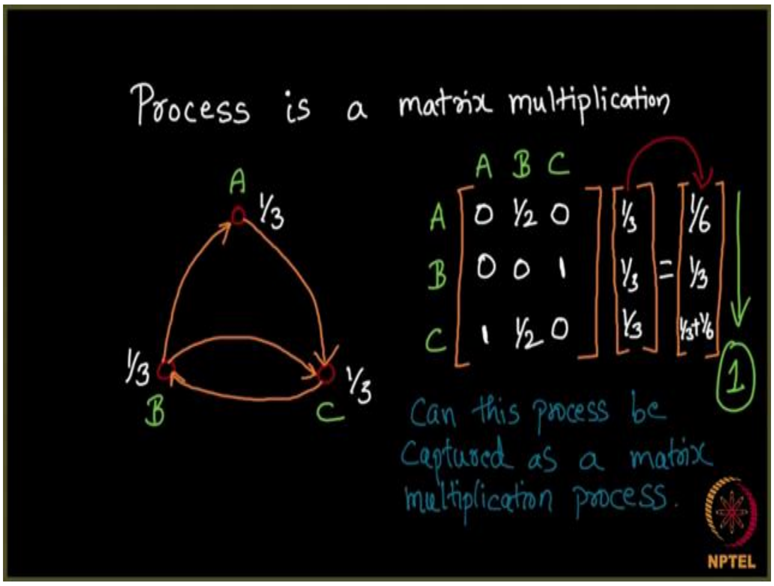

Next you observe that this converges to want this, this adds up to 1; not converges this adds up to 1 right. And my big question right now is; what is that matrix which when multiplied with this vector gives rise to this vector ok.

What is that matrix? Let us investigate it right. So now, I will write a matrix which will give me 1/3 1/3 1/3 as 1/6 1/3 and 1/2; 1/3 + 1/6 as you can see is 1/2 all right. So, can this process be captured as a matrix multiplication process? That is my question all right. Yes, it can be is what you will observe very soon that is because this is the matrix which will give rise to this vector when you multiply this vector and this is my matrix, you can verify it.

So, take a minutes pause and see how exactly this matrix is giving rise to the next iteration. Let me go through it slowly so that you all understand. So, when you multiply 0 half and 0 to 1/3 1/3 and 1/3, basically this half gets multiplied which is 1/3 giving you 0. 1/2 gets multiplied with 1/3 giving you 1/6 and 0 gets multiplied with 1/3 giving you 0 right ok.

So, as you would have observed, this is precisely the process that is happening here correct that is precisely that is happening here. So, I am just capturing it as a matrix. It is a straightforward thing, you can observe what is happening here; take a couple of minutes and then observe it we will go to the next slide and we will see what is this to do with a page rank.

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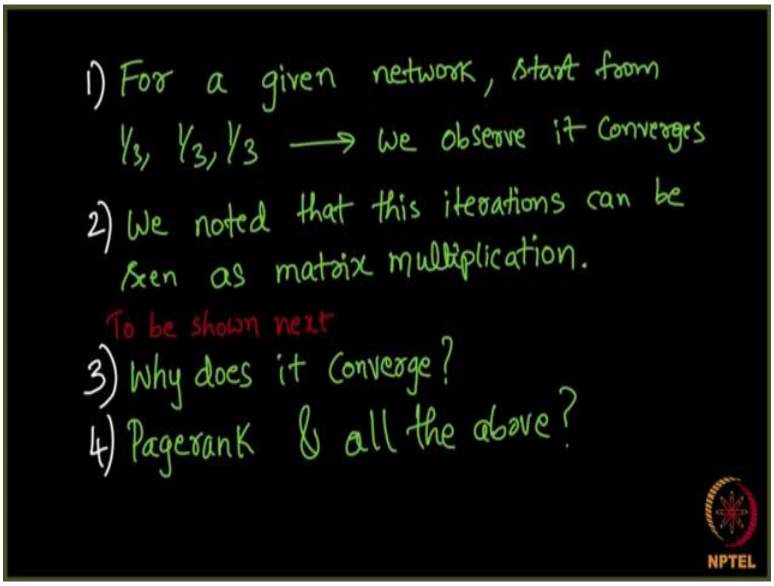

Now, what have we done so far? For a given network, we start from 1/3 1/3 1/3 and see if it converges or not. We observe that it converges. This is the first point. The second point is that we note that these iterations, these iterations that we are doing right now be matrix multiplication process correct; we just saw it right now. Coming next, we are going to show this next that why does it converge. Whatever we saw in the Google spreadsheet if you remember, it converges right. Why exactly does it converge? What is the process here right? And the fourth point is what is page rank to do with all these things ok.

We will see this one by one.