Traditional and Non-Traditional Optimization Tools
Prof. D. K. Pratihar
Department of Mechanical Engineering
Indian Institute of Technology, Kharagpur

Lecture - 16
Faster Genetic Algorithms (Contd.)

Now, I am going to discuss the working principle of visualized interactive genetic algorithm and let us try to see the working principle of this particular, the genetic algorithm and how to make it faster. Now, supposing that I am giving the task to the GA that we will have to say optimize a function.

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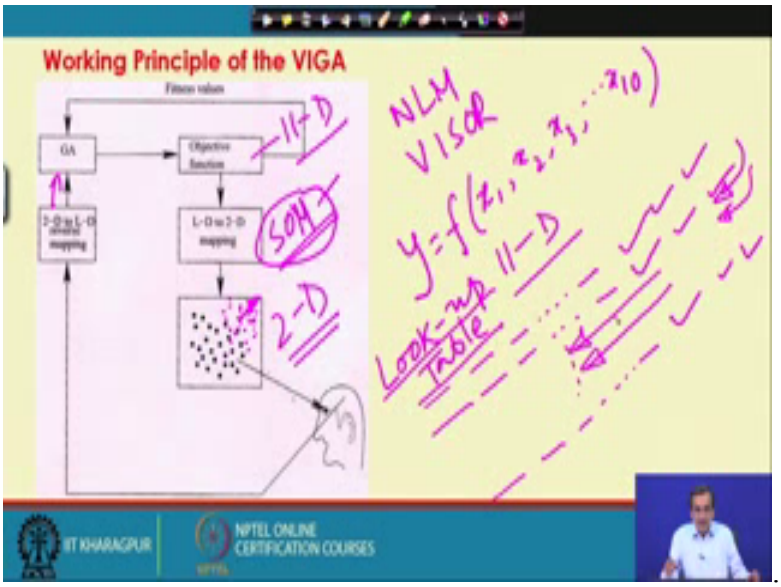

We will have to optimize a function that is y is a function of a large number of variables like x 1, x 2, x 3 up to say x 10. So, this particular objective function is in 11 dimension, y is a function of 10 variable. So, this is in 11 dimension.

So, the surface of the objective function a is in 11 dimension. So, we cannot visualize this. So, for the purpose of visualization. So, what we will have to do is so we will have to do the mapping to either 2 D or 3 D. Now, what I do is so this task are given to the GA and the GA will try to find out the optimal solution. So, what I do is in the code of GA we write down the expression for this particular objective function and we mention the range for each of the variables and we said the GA parameters and once we have given

all such information to the GA. Now, we start that particular the GA and GA will try to find out the optimal solution.

So, GA is working on the objective function which is in 11 dimension, higher dimension and we cannot visualize. So, what I do is for the purpose of visualization. So, this 11 dimensional data we try to map it to the 2 dimension and how to do that? So, this method I have already discuss, like we can use some non-linear mapping tools like sammons non-linear mapping or visor algorithm or self organizing map. So, all such tools I can use or anyone I can use let me consider on using say self organizing map. So, I will be getting the data in 2 dimension and once I have got this particular data in two dimension, now so this particular box will come on the computer screen and this was implemented in open GL. Now, with the help of a cursor if I just click at a particular point. So, its fitness value that is the value of the objective function that will be displayed on the screen.

Now, if I just click at another point, another point, another point. So, I will be getting all such fitness information and supposing that G is going to solve 1 maximization problem. Now, I will just go on clicking in a particular the region and I will try to find out in which direction the value of this particular objective function is going to increase or the fitness of this particular objective function is going to increase and we will try to find out the correct direction along which the fitness value is going to increase. At this particular information this user will collect from this map the 2 D map and this information he is going to give it to the GA that you concentrate only on this particular region, if you want to hit the globally optimal solution or the globally maximum solution and GA unnecessarily should not concentrate on this other area or other region.

So, this problem information is given by the user to the GA. Now, GA is working in higher dimensional space, but this is in 2 d. So, this 2 D information actually we will have to convert it to the l D because GA does not know the 2 D information, GA is working in l D or 11 dimension. So, this particular 2 D dimension so we will have to convert it to the l dimension and we will have to go for the reverse mapping. Now, how to carry out this particular reverse mapping that I am going to discuss, now if I use a self organizing map now this is a topology preserving tool. So, whenever I am doing the mapping from higher dimension to lower dimension. So, the information like the hard

dimensional information and the lower dimensional information those things are remembered by this particular the algorithm.

So, I have got a huge data. So, this corresponds to the higher dimension and this corresponds to the lower dimension, similarly I have got a huge amount of data. So, this higher dimension, this is the lower dimension. So, it will maintain 1 huge table at this particular table will be stored automatically inside this particular the program of self organizing map. So, it will remember this l D to 2 D that is higher dimension to lower dimension mapping.

Now, the moment we get the information here in 2 d. So, I will come back supposing that I am getting one information, here that if I move in this particular direction it will be a good direction; that means, in 2 D or 3 D I am getting this particular information. Now, corresponding to this 2 D and 3 D what should be the higher dimension or l d so that we will have to find out approximately using the principle of interpolation and if I can interpolate the information in higher dimension that information we will have to pass it to the GA because GA is working on the higher dimension.

Now, by doing this actually what we are doing we are going to help the GA that you concentrate your search in a particular region where there is a possibility that you will be getting some globally optimal solution at unnecessarily you concentrate on the other region. So, that type of information we are giving it to the GA and that particular extraction of the information is actually, we do the extraction using the problem information or the information of the objective function.

That means we are going to use the problem information just to guide that particular genetic algorithm. So, that the genetic algorithm will become faster and the, its search speed will accelerate and it is going to hit that globally optimal solution soon. So, this actually the working principle of this visualized interactive GA. Now, as I told for this l D to 2 D mapping supposing that I am using self organizing map which is going to keep this particular information of l D to 2 D the that information intact.

But supposing that in place of this self organizing map I am going to use say sammons non-linear mapping or say visor algorithm, now in that case what we will have to do is. So, we will have to maintain one look up table, now this look up table is actually a carry information of this higher dimensional data and there corresponding the 2 D data or 3 D

data. So, this particular information we will have to store in the form of a table which is nothing, but the look up table, if I use the sammons non-linear mapping n l m or the visor algorithm, but if I use self organizing map. So, this particular table will be automatically generated and it will be stored inside that particular the algorithm.

Now, using this particular the self organizing map what we have done is we have solved a number of test function and we have solve a few real world problem also.

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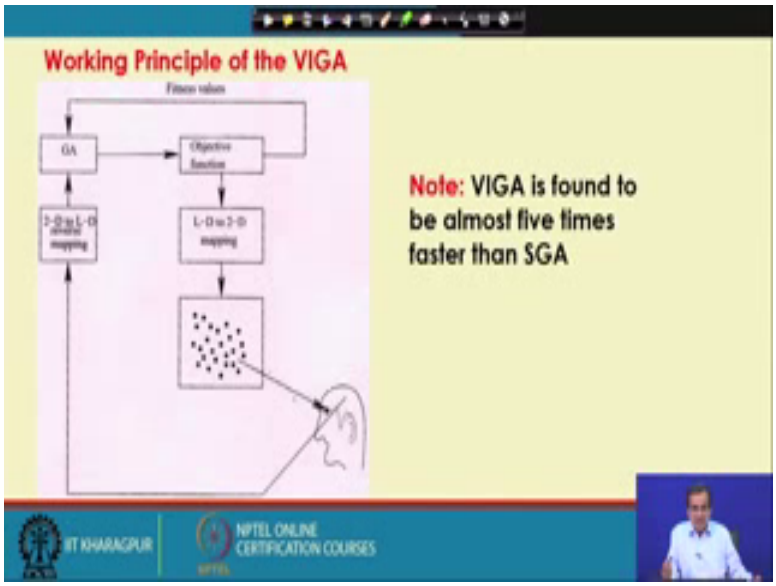

Now, we have seen that that this visualized interactive GA is found to be almost 5 times faster than the ordinary the binary coded GA or simple genetic algorithm.

Thank you.