Geographic Information Systems
Prof. A. K. Saraf
Department of Earth Sciences
Indian Institute of Technology – Roorkee

Lecture - 15
Demonstration through GIS software

Hello everyone! and welcome to this demonstration of GIS software which will include mainly 2 things in this demonstration is about our raster data compression which we have already discussed in the previous lectures.

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And little bit we will spend time. Because there is no specific kind of tools are available but when you start saving the data, you would find that such options are available. So, I would be demonstrating to you one with the ArcGIS software and also other one very popular software's which we anyone can imply because you say, not open source but it is in public domain freely available software.

So that I will be showing and next is of course, geo-referencing which we have discussed in length that what is exactly geo-referencing. So now, we will be doing geo-referencing through software. **(Video Starts: 01:29)** So as in our GIS software, when we want to save some file, suppose here I am having this one file which is in IMG format which is a satellite image. And if I want to save it at places, I will get these options of you know data compression.

Like if I go here and save my data. Here like export data that means maybe I am going to save in different format which I can choose here. If I do not choose then I am having the option for compression type. And if I go for compression type like LZ77 which we have discussed in the lecture and also in the JPEG format which is you know, a lossy compression technique. LZW 77 is not lossy, it is lossless compression.

So, we can resort this way. And when we save of course, it will provide the compression. Depending on the file format, these options will be open for us. For currently, I cannot force that how much compression I want. But if I would have a different file in my display, I would have a different option available. So that, I will also show you. So, these compressions as such may not be available in typical GIS software's.

But elsewhere, we can access these a little differently that I will also show you. Now another way that when I go like here and export map. Now I am just displaying this one. And here I can choose various file formats which my target. So, suppose if I choose TIFF. Now here, I can also control resolution and other thing which I am not going to discuss here. But what we are discussing here is the data compression.

So, when I go for the format, there it asks me about which compression do you want. Again, LZW is supported here or there are some other options are also available for which we have to you know go for those options. Before going, please check because maybe the basic compression techniques have been followed but little different name has been given like deflate.

So, here you can control the quality that what kind of quality. I want 50% quality but 50% sort of compression that way also. Similarly, if I go for JPEG again, I can control the quality here. So, these are more sophistication which are available with this such software's by which we can go for data compression. Now if I do it little differently in this software which I will just demonstrate to you.

That is also one of the ways of making our display fast which is called pyramid which we have also discussed earlier in our you know, theoretical aspect or theoretical lectures. So, if I will demonstrate that one also that how pyramids are worked. See these are 2 scanned

toposheets means topographical maps of Survey of India like 53J 11. If I choose that I would like to display this one.

When I say add here, now first time when I will try to display this image or add this image into my project, it will ask me would you like to construct pyramid? See, this is what and also suggest that what it will do and what will happen. So, pyramid building may take few moments depending on the size of file. This is quite big size. And would you like to create a pyramid and if I say yes then what it will do?

It will create you know few files here which are some additional files which are created in our data. So, I can just show you that those files will be created like here. I am having just these 2 toposheets, 53J 11, 12. J 11, I am intending to add. So, before that I have to decide I would I like to construct the pyramid or not. And the best part in these good software's that help is available all the time.

If you want to know what really pyramids are. First time if you are so, you will be directed to that will come quickly and what pyramid will do. So, all details are also available here plus your resampling and other techniques which are required for this. So, instead of changing these resampling techniques, I go for the default because I do not want to compromise the quality of my image. And what kind of compression I want?

Again, I can choose different file formats. So, I am just keeping the default. I can go for LZW because LZW as you know is a lossless compression. Whereas same time, you also know that the JPEG formats are lossy compression. So, I do not want for time being because my purpose is to demonstrate to you about the efficacies of pyramid. So, when I go and request that okay, create pyramid. Let us see what happens.

It will create pyramid as it is doing here. And once pyramid is there, it will add this one in my project which has been added like this here. Same time in my folder, it has created 2 more files. One is called you know this TIFF file of course that is there. And for that original file was this. And then this file that aux file has also been created. So, these 2 additional files have been created.

They are basically whenever next time; I will go for you know displaying this one then I will not be asked to create pyramid again. For example, if I remove from this project; removing from project that means that I am not removing from my directory. The data will remain intact, only from the display I am removing. So, if I remove and then again go for use that file to display, now this time it should not ask to construct pyramid because pyramid has already been constructed.

See here it has not asked and now I can add very well. So, likewise as I mentioned that all these compression tools; raster data or vector data compression tools are not available at one place neither in Arc Toolbox or elsewhere. But whenever you will save file is in a different format with format will support with kind of compression accordingly, the option will come to you.

So, in that way you can definitely go for compression. LZW option as you have seen many times, it is coming. Because it is lossless compression and if you keep in that format still you would be able to use your file without decompressing it. So, in that way, it is also quite good compression tool which we have already discussed in theory.

Now if you away from directly from GIS software, there is a very popular software **(Video Ends: 09:52)** which is called Irfan View. As you can see here, this is about Irfan View and this is freely available. This has been developed by individual. A person is called Irfan Skiljan and he is just enthusiast and he has developed this software which will allow you to save in various formats.

And also, it will allow you for various variants of compression tools are also supported. This fellow also challenges the people or say if you go to his site then he mentions that if you can provide the details about the file format, he can add in this software. And therefore, in future then you can start using that one. So currently I am displaying a satellite image of Moscow and just forget about the colors and other things.

Just take it as a satellite image. Now I am going for save as and you would see that what kind of option, it is providing. See the options. I can save that file. Original file is already in TIFF. So, I can save that file say in JPEG or in GIF or EMG, BMP; this used to be also a quite popular format BMP, bitmap or a there are many-2 such raw image data format.

So just for demonstration purpose if I go and save as a JPEG. Now as soon as I choose here, I am having options for compression here. What kind of compressions I want? And very interesting part here is that sometimes we have to provide like our own digital photograph; passport size photograph and the site says that photograph should not exceed 100 kilobytes or 200 kilobytes.

So, instead of bothering, one can do the compression from here also. So, you can fix the size. Accordingly, automatically it will go for the quality change. So, if I say change here and I say I want this file in 300 kilobytes and when I save it, it will save for me. So, before I do this part, I should save as a temporary file this one. So, I am safe from everything point of view. And then accordingly it will decide.

And you can keep original JPEG file, IPTC. Several options are there which you have to explore depending on your requirements. So, if I go for this one, this is what it will do. And I have already changed that one. And here I can save that file into temporary folder. And there the file which has been saved in temporary folder, definitely will should be having a very small size which is just 18 kilobytes.

So, I said not exceeding 300 kilobytes, it has reduced that file to 18 kilobytes and it is in JPEG. So, this provides a compression tools if I instead of saving as JPEG, if I choose format like TIFF. Now sorry, I have to bring the original file first here. But anyway, this now is in JPEG format if I go for and save as JPEG, again lot of options are available to me.

For TIFF, see this RLE; run length encoding, it is available. LZW is available. Pack bits is like block quotes. it is available. Huffman RLE and if you do not want to do any kind of thing that is also. And this ZIP also available. But as you know the ZIP that how this the ZIP does compression, we do not know about that. But remaining like JPEG, LZW or RLE, we know all those details. And we have already discussed that part.

So, this tool Irfan View allows us to convert from one file format to another. Also allow depending on the type of file, it will allow you for compression. Instead of that if I say if I use a GIF one then for GIF, I am having again almost same options as in case of JPEG. But

again, if I change and say I want to have bi BMP format; for BMP, there is no options of compression. But for EMF, again I am.

So, it depends on what kind of format you are going for compression. Accordingly, you would be given the option. So, software's have been designed in that way that depending on the input file format accordingly whichever the compression techniques will support that particular file format. Those options will come automatically whether it is in ArcView or in ArcGIS. So basically, this completes our raster data compression demo. **(Video Ends: 15:31)**

Now, I come to the next demo here. And that is our this **(Video Starts: 15:36)** geo-referencing. So, for geo-referencing, what I would suggest that before doing geo-referencing, the first thing one should do that one should bring in background any already geo-referenced map. Like for example here, I am having state boundaries. This map is little older because it does not have now divisions of J and K.

Nonetheless, so these state boundaries or even boundary of India which is already geo-referenced. And as you can see that these values are being displayed in geographic coordinates in DD; that is in decimal degrees. So, if you can have that one, this will help. Also, this ArcGIS software is having one additional feature that if I am already displaying a file like here India boundary and which is already geo-referenced.

And I am having another file which is a geo-referenced but in different map projection. And if I add that file then you know, there is a possibility on fly projection that means I do not have to change anything. Automatically seeing the file which is residing first in my project, the next input file will follow the projection system of already existing file. And this is called on fly projection.

So, this will help us or speed up our geo-referencing part as well. And basically, those things if they are geo-referenced or are having different map projections then the software will take care about this. And this on fly projection facilities are now available in many software's also. So, once I have added the file which I have, this file which I have discussed from pyramid point of view. The quality of file is not very good.

But deliberately I have chosen this file because for some time for some projects, we would like to use very old data and from where the old data will come, either from satellite images or old topographical maps. So, here this example is old topographical maps. And this is in geometric domain which you can see here. These values are false. They are not true decimal degree value.

But once we will complete the geo-referencing part then you would see that these values are in true decimal degree in geographic coordinates and in map of India that toposheet will reside where it belongs to. Only this will happen once the geo-referencing part is completed. So, let us start doing geo-referencing.

For which basically what we require if I do this part and then you have to add the extension which is called geo-referencing extension in this particular software. And depending on the software which you are using that might be a part of standard geo-referencing or may not be there. So, let me remove other things just keep this file and the boundary of India file.

So, since there is only one raster file or image is there so, it has already automatically taken as input. No other options are there. Now, next step if you recall the discussion in theory part about geo-referencing; first is to find out register ground control points; GCPs. So, you know the best way of doing this thing. First like what I am going to do? I will register all corners first and then see what happens.

So, for that I will zoom this part quite so that 2 things I want one my screen that I want these values so that I can read these values. And also, I want to see this cross of longitude and latitude clearly. So, I will zoom to that level where I can see these things very clearly.

Now, next step is to add control points. Help is also provided. It says that select control points from the source un-georeferenced that is what in the background, our map is toposheet to the reference because we are doing geo-referencing of itself not using any other source. This is very important because here we are not having any master; we are creating this one as master. No problem, this can also be done.

This is what I am going to demonstrate. So, first control point I am going to collect here like this. Now, first left click then right click. Now I am having options to feed the values in DD

whereas in display what you are seeing values in DMS that is degree minute seconds. So, I need to convert these values into DD. Very simply you can do it because it is rescaling instead of 0 to 60, you are rescaling 0 to 90.

Because 60 minutes equal to 1 degree or 60 seconds equal to 1 minute. So, we will rescale it. Just reading it and rescale it. So, we will type 78 point, this 30 will become our 50 and same with the latitude that 30.50. So, we say okay this is my control point number one. For time being, the image has disappeared. Because one thing from rubber-sheeting point of view now at that location in map of India or on the globe that one control point has pulled that point.

So, no problem. We will bring back that point again here and that is here now, this point is. Now next thing we should do like shoemaker I gave the analogy. I would go in the diagonally opposite corner to collect another GCP; another control point. So, again the same thing I will do. I will zoom to that level where I can read these values as well as this cross.

So, next control point I will do like this and see automatically system has learned now. So, it is predicting that what kind of values you are going to have. Currently because of just based on one value, the prediction may not be very good. So, here it is 75 and this is 29.95, it is predicting. So, basically it is not that one. But it is 30.00. Okay and this is again gone in that. And now 2 points have been tied here.

As you can see this point. Sorry, this point I got wrong. Very good, no problem. What I will do? I can because this 15 should have also been typed there. So, what I will do. That is good that you know unintentionally this mistake has happened. Now I want to remove this point. So, I want to remove this point which can be done like here. Delete the link and I will recollect it, no issue. This is sort of iteration process.

And we keep doing till we get the satisfactory registration. So, after this again I will collect more properly for this one. Here I go like this. And this is 78.75 and this is 30.25. These are in DD, DMS in the toposheet whereas we are typing in DD. So, this is simple conversion from DMS to DD. And once it is done, no problem it will disappear for time being but when we go zoom to layer it.

So, now, 2 tie points are there as if you recall that even for first order polynomial, you require minimum 3 points. So, before that no options other will be open to us. So, let us collect 2 more points and then we will see. So, now I will go to this point, again zoom. So, in the same way, again collect the point. And now this prediction is going to be more accurate, so like it is 78.75 and this is 30.50. 51, it was showing quite accurate.

Now again I go there, one more point I would like to collect first and then we will see what things have become visible to us. So, here again I collect the point same way as I have collected 3 previous points. Now prediction is becoming much more accurate about the location and here it is going to be 25. And now see this has not disappeared because now it is getting tied, this rubber-sheet is getting tied.

Now if I see this table, see everything now would be should be available to us. See here it is given only option of first order polynomial transformation. And second order, that is not available but if we collect 6 points then definitely the option for second order will also come. We collect more points, then we will also get option for third order and so on.

So, in that way the software's have been designed nowadays like that you will not commit a mistake. So, here now what are these residues. They are suggesting what kind of errors, we are having here. Since we are having just 4 points does not matter still, we can see that what are the total residuals we are having, which point is wrongly or rightly. At this stage, that situation will not come.

But if we keep collecting the data, definitely we will have few other options. And once you have collected the data, let me also collect few more data here like we have done it here. So, we will do it one point here. And so likewise, we can collect many such a thing layers and once you have collected suppose sufficient data, you have chosen the second order polynomial.

Now when you go for this thing and you say rectify. So, what it will do? It will save everything and go for the next step. So that I would like to also demonstrate, you can of course go for update also. But I am going for rectify. So, now it is giving me few more options. Like first step was registration, second step was to finding that transformation function, choosing an appropriate polynomial order.

So, just for simplicity in this demonstration, I kept only up to first order of polynomial that means I am transforming my this toposheet image from geometric domain simply to geographic domain using just 4 corner coordinates because I am having more confidence in my GCP. So, I can go for the next step without much problem. But if you want more, very accurate geo-referencing then you can collect few more points.

But especially one should collect in the center. Corner points have already been selected. So, it would be better if we select in the center which will take lot of time. So, I have just chosen first order polynomial. Now the third step is going for resampling which will decide the pixel value for the image. So, all 3 options which we have discussed in theory; nearest neighbour, bilinear and cubic convolution, all 3 are available.

What I said that nearest neighbor will keep always your pixel way intact without any modification. So, if I am going to use this toposheet say for digitization, I would choose only nearest neighbor. I will not go for bilinear or cubic convolution because these 2 options will modify my pixel value. There will be a compromise on the quality of my image which I do not want. Secondly, I can also choose here the format as well.

And like original file is in TIFF suppose for example I choose the ERDAS imagine software. Now, compression again, I can choose. And what compression it has been implemented is only RLE that is run length encoding. So, I can choose that one also and plus, I can at this stage also change the resolution. But generally, one should not try to change the resolution just like that.

You know little calculation is required because this is too small value here because this toposheet has been scanned at a very high resolution already. But if it would have been a satellite image then you can control the resolution otherwise whatever it is coming in default, you can accept. And of course, what would be the name of the file that you can choose and once you save the file.

Like for example if I save this file and maybe I kept in a different here and I say this is 53J 11 Georef and I am keeping in my database, sorry, like this and I am changing this here like this. So, it will go in my temporary folder and the format is going to be this. The compression is

going to be the RLE. And I can say go. Now, it may take some time because it depends on the size of your image. First 2 steps, it has already completed.

The third step, it is doing that is the resampling. Resampling for individual pixels, it is picking from original image following the option which we have given the nearest neighbor and then finally, it is transforming there. And once it is done then this image will be added in our project which would be geo-referenced. So, if I go and zoom this layer, see those coordinates which I have collected or those control points which I have collected, they are being shown here also.

And I should get that image as well. See now this image is Georef image. Let me bring here and along with where it will fit for the Indian boundary. So, if I zoom out, I should be able to see this one properly here. And if you see in the bottom, it is showing in degree decimal. So, the non-geo-referenced image was not if I go for this image and do like this. Because for time being, it is also having geographic coordinates.

But originally when I added that image which was in geometric domain, you did not see any degree decimal. So that is the advantage of having things like that only. See now this toposheet is belongs to this part of Uttarakhand because now this is geo-referenced and it has gone to the place where it belongs in geographic coordinate system.

Earlier both the map of India; state boundary and my input image, they are lying to because one was in geometric domain, another was in geographic domain and they were not coming together. Now both are coming together. So, this brings to the end of this demonstration which I have shown in between the raster data compression.

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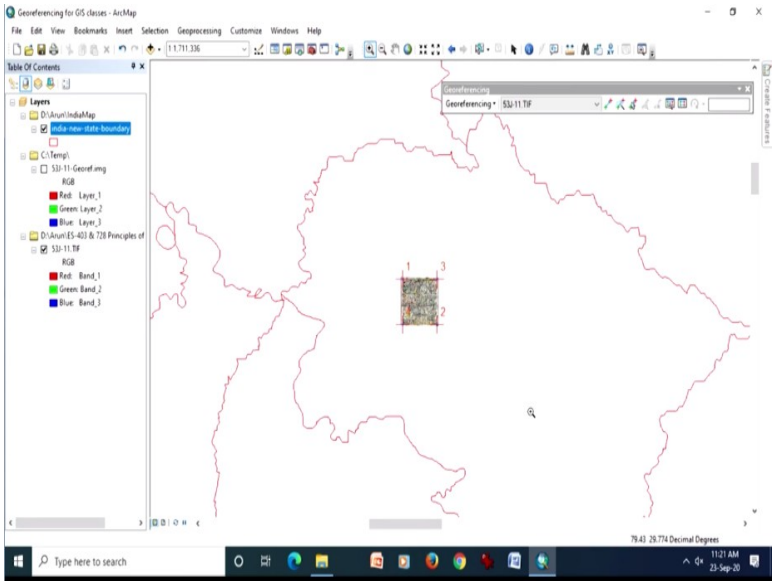

How at different stages those options would be coming. You choose judiciously about the compression depending on the file format and depending on the size of the file. And second thing is about geo-referencing. Geo-referencing is a time consuming if you go for say third order polynomial then you have to collect so many points multiply by 3, I suggested. So, it will take lot of time to collect reliable common GCPs.

If instead of toposheet, if I am having one master image and slave image, it will take more time. So, you must spend some time or be ready whenever you are going for geo-reference. It's a painstaking job but it has to be done very accurately. Nowadays, most of the satellite images or digital elevation models which we get from internet or different portals, they are already geo-reference.

So, if I download, add in my project, automatically it will go to its geographic location without any problem. The only thing which I have to do before adding in my project first I should display a map that I am going to follow. Like here I put first map of India with the state boundary and rest will follow accordingly. So, thank you very much.