Remote Sensing Essentials
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Lecture-26
Digital Image Processing Demonstration-2

Hello everyone and welcome to a new discussion and this discussion basically is related with the demonstration of a digital image processing software. And we are going to see here a different demonstration on a satellite image especially about the false colour composite. But as you know that we have been going through this slide that 2 types of software's public domain and commercial and today the demonstration which I am going to have on a commercial software which is on RGS.

And we will see that how this false colour composites are formed and how you know different permutation combinations can also be done here. So we go back to that option the software.

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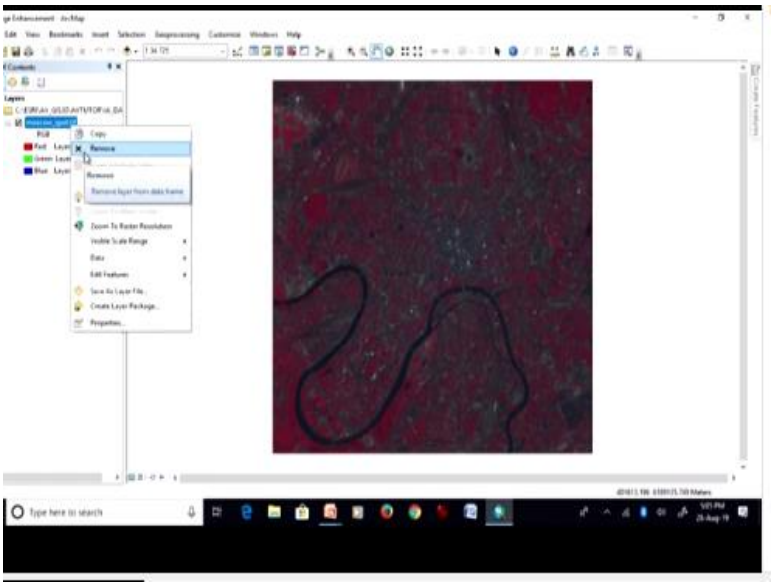

In the earlier discussion also be left with this image, this is raw image of a spot satellite of Moscow and there are 3 layers but the first time when you add this image, there will be a different scenario. So, what I am in order to demonstrate this one, what I will do I will first remove this image and now I will add here.

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So, I will get the access to this image and this is a stored in a tif format in this Moscow spot. And when I add this image, this comes in a completely different colors and these I deliberately did it otherwise I would have already done it on the already displayed image. But I have removed it and again brought back. So when you double click here or in any other softwares the purpose here to understand how false colour composites are made.

The purpose is not how false colour composites are made or handled in RGS I am no we advertising any commercial software. But in order to demonstrate things we have to use some softwares and therefore, I am using this software, so if I see here, that red band is layer 1 . Because this is a multispectral image and so you know red band is layer 1, which is not true it should have been in effect here, the layer 3 that is infrared channel.

The band 3 should have been here and instead in blue and the layer 3 instead it should be 1 and 2 will remain and the green remain for the layer 2. So when I choose this one and even if I do not go for this alpha I am sorry gamma stretch and no stretch at all just go for this kind of options then this is what the false colour composite image which I see here.

So as you can see here that now I am getting a false colour composite, remember false colour composite in which the vegetation appears as red because red channel has been assigned the infra red channel has been assigned red colour that also we will see now here. So what I am going to do I will repeat the layer 3 which I know is band 3 or infrared channel and in all these 3 layers. So the virtually what I am going to have a grey image, this is what you are seeing here now is a grey image and that grey image is nothing but the band 3 that is infrared channel.

As you can see here that in this particular part, this is the brighter part and this is also a brighter part where you are having a you know the high density of vegetation also the vegetation is present in other areas as well within this image. So that is why when we go for false colour composite and like here when I go for band 2, band layer 2 or band 2 or layer 1 here, again I go back and I get a false colour composite.

So this is how false composites are formed, if that combination is not followed then you are not creating a standard false colour composite. There are standard keys are also available to interpret a false colour composite image but if I choose altogether or default you know this composite then I am having problem there. Like here when I displayed this image the arrangement or something like this and what we are seeing an image having that arrangement was also had a gamma stretch by default and the image was looking like this that is not false colour composite.

And therefore, interpretation was such image is very difficult. So if the image is already in 3 bands multispectral image and it has been prepared through some other software in a false colour composite. Somehow, the softwares may take a band 1 in the red colour like here and green band 2 in the green channel and band 3 in the blue channel. If this is the scenario, you are not getting false colour composite though the original image is false colour.

So best thing is assigned band 3 that is the infrared channel red colour and band 1 blue and green as it is and then you choose this one and of course then you get a false colour composite. So single image will definitely look individual single image as I was showing in the infrared channel that these areas had the maximum brightness and as you can see also in the false colour composite. Since we have assigned red colour and therefore they are appearing as red.

Now the water body here which is a basically river is appearing dark here why because a now we are not using single channel. But we are using multiple channels and in these channels the water bodies are having very dark signature or dark pixel values. And therefore water body is appearing dark plus in particularly in infrared channel what we see is a the water basically having the infrared energy is absorbed by the water completely and therefore a freshwater or clear water will always will have a very dark scenario.

So what I am going to do I will again change these values have a grey scale here and likewise and apply again may be without or maybe with a gamma stretch and when I say okay, this is what I see here. Now see it just focus earlier we have been focusing on vegetation now focus on water bodies. So and the river and this is all appeared in dark vegetation is having high reflectance.

So recall your these spectral signature curves or a spectral response curves and in infrared channel vegetation will have high reflectance, healthy vegetation will have a high reflectance and this is what you are seeing water body. A clear water body will have you know complete absorptions almost complete absorptions and will appear dark in the infrared channel. Now we will be also going through the other channels and see what are the responses in the visible part of EM spectrum and especially 2 channels, 1 belongs to the blue part of the EM spectrum and another one belongs to the green part of EM spectrum.

So if I go here and instead of having all 3 I will not choose as a band 1 in all these 3 layers. So that means I will be displaying only band 1 and which is basically the blue part of EM spectrum, the first band and this is what you are seeing. Now focus on the vegetation part, which has the healthy vegetation in the infrared channel here is appearing dark. So in blue and green, in green you may have some reflection of the vegetation in the visible part.

But in the blue part of human spectrum you will not have anything, water body again still appearing dark but that kind of contrast in water body and vegetation and other objects which we have observed in band 3 that is infrared channel is not seen here. So If I do it a little different way now I bring the band 2 here that is our green band here and apply this one, see that the now vegetation is having some reflection b but a still it remained dark and water bodies also remaining dark.

So when in all 3 channels blue, green and infrared water body is appearing dark and therefore in false colour composite also, the water body will be appearing dark as I am going to demonstrate again going back to our original false colour composite, this is what it is. So if a because the 3 channels are being used to create this false colour composite and for infrared channel we are assigning red colour therefore vegetation is appearing red.

Because in infrared channel vegetation is having high reflection, water body in all 3 bands blue band, green band and infrared band water body had the black signatures or dark signatures and therefore in colour composites also whatever the colour composites you will create, it will be

always dark. So if I go back to the default one which has a normal sequence in you know descending one or ascending one whatever the way you want and if I apply, this is what I was getting.

Initially when I added this image and again but notice that water body is still dark. Because in all 3 channels it is having dark signatures. But if, in 1 channel a object or features are having brighter signatures compared to other bands like blue and green. For example, vegetation then whatever the colour you will assign to infrared channel that colour will be for the vegetation. In this default one the blue colour has been assigned to the infrared channel and that is why you are seeing a different scenario here.

Let me bring back this is 3 and this is 1. So now we have come back to the original FCC and things are now here in that way. So whenever you create a false colour composite first of all you need to have 3 channels 1 also you need to have 1 infrared channel and 2 other channels blue and green. This is a standard practice of creating a false colour composite. Because interpretation of false colour composite, you are also having interpretation keys which we will be discussing in other lectures.

So for that purpose and everyone understand about standard false colour composite. So you need to have 3 channels, 1 infra red, blue and green and when you assign red colour to the infrared, blue to green and blue likewise in a reverse way then you get a standard false colour composite is being shown here. And of course, the stretch part will also come here that you can start stretching like any generally in the default it will go for some standard deviation or histogram equalization one has to be careful that you see first what is the scenario in when I am not going for any kind of a stretch.

This is the scenario no stretch is being there at all, this is the original image and this is how whenever you get a original satellite image without any image enhancement techniques I am not discussing about atmospheric correction or radiometric correction or geometric correction. I am discussing about the image announcement because those corrections will be done separately.

And some are like radiometric corrections generally are done by the agency who supplies the data or put on net.

And this atmospheric correction is done by the users as per their requirements and geo differencing also one has to do it that will be also done by the user. Now here when I do not have any stretch, so when you get an image and display first time and if in default this option is for a stretch type is choosing none. Then this kind of display a dark image without much contrast, without much brightness you would see and if you see the histogram, this is what you see here that most of the values are within the range of minimum value in this scenario in this particular image is 26 and maximum value is 253.

But there are only few, see the frequency that is frequency x is that is y axis hardly few values are having 255 values or 253 values. Rest are the just in between maximum values are located between this part and this part . So the here this one is around 127 value and this value is around 26 or 25. So minimum value of course is 26, so within that range the maximum values are located and the highest frequency value the count you are having is this one which is around the mean value which is 68 value.

So a initially the histogram is not occupying the full space or full range of pixel value which is available in 8 bit scenario is 0 to 255, this is the 8 bit scenario which we are discussing. Now when we go for any kind of a stretch these values are redistributed. So we will now go back and see the after stress if I go and choose a the first option rather second option that is the standard deviation.

And without going for any gamma stretch options or any other thing just apply this is standard one and the value n is 2.5. And this is what the contrast has created, suddenly the image becomes very bright and having contrast as well. Now when I go back through this histogram, this is what I see originally is also shown in grey colour and that redistributed one that means they stretched one through standard deviation 2.5 values standard deviation.

Now it is occupying the full dynamic range and therefore our image has started looking brighter as well. So this way we start doing our image enhancement, I will repeat again that this is not necessary that for all the images we will do the same way it is not. It depends on image to image and even image belongs to the same area or differentiation, different enhancement techniques would be performed one.

Second is if you are going for further processing like a classification and other things, it is better not to do lot of stretching to your input image. Because after all you are going to for this pattern recognition or object recognition through the classification and that may create problem there. So it is better not to do too much stretching or no stretching and for classification purposes. Otherwise for display purposes, for interpretation purposes and using some for other purposes, definitely one should create better contrast and brightness in the image.

Otherwise the original image looks very bad for any purpose. So for that we have to do this. Now I will also go through some other stretches which are available stretch type you can choose histogram equalization very quickly I will go histogram equalization here and then I apply see the results are completely different than that standard deviation. Histogram equalization will create very much contrast, too much contrast in the image and darker areas have become much more darker brighter it has become much more brighter.

One can also when we go for you know this kind of stretches like minimum maximum histogram, specifications, percentage piecewise percentage or some sigmoid. So lot of options would be available to improve your image quality so also you can see few more options are there for different bands and when I was discussing the image statistics and histogram. At that time I said that it is always better to spend some time on the histogram of the raw image.

And if it is you are handling a false colour composite, colour composite then for all bands which are involved there, see their histogram, see their statistics, minimum, maximum, mean and standard deviation all values. Because they will tell you that which enhancement or a stretch will be better for your image which you are going to use. There are some other options in this

particular softwares are also available which I want to just mention few here few more minutes here that pens sharpening.

Pens sharpening means if you recall the image merging technique which we have discussed that low spatial resolution multispectral image with high spectral resolution but panchromatic image, that image merging or image fusion also called pan sharpening, that can also be done. Then you require a pan image for the same area and that has to be of course, geo reference or reference to this image also and then you choose different a methods.

So since I have no choosing in this case a pan image for input so, I am not getting other options but by default it goes for IHS and when I showed some results from this image merging I2 showed through this is HIS that is intensity hue and saturation transformation. So your original image first is a splitted into 3 components intensity, hue and saturation and then the pan image will substitute your intensity image from this a colour composite and 2 hue and saturation will remain same again there will be backward transformation and then you get an RGB image false colour image in which the intensity image is coming from high spatial resolution panchromatic data.

In this software, this is can be done very quickly and that is what this option is the pan sharpening. So pan sharpening can be done here, once you choose this one, then you get all these options available to you, so that even has to really apply. So whenever you handle any images as I am repeating first study the histogram, see the different bands responses of different features of present in the image in different bands, for example vegetation.

(Video Ends: 23:05)

For example water bodies may be forest land or a cropland and other things and after studying image, after studying histogram then as per the requirements go for appropriate stretch type. So this brings to the end of this discussion about demonstration of software. Today I have used this RGIs which is commercial software, thank you very much.