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Digital Image Processing of Remote Sensing Data

Lecture – 20
Limitations and Future of Digital Image Processing

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Hello everyone and welcome to the last lecture of digital image processing or remote sensing data. And we know about every good thing has to and time and we have reach together and this stage. We are going through the all types of discussion with related with digital image processing or remote sensing data, including different types of enhancement and then interpretations differences modeling and the some indication about indication and some application we already discussed.

But as we know remote sensing data has got enormous possibility. We already used for various applications starting from your whether monitoring forecasting and general expression will ground water expiation in oil expression. You know the people are impaling remote sensing in data. Here is a very powerful but the same time you know there is inverse tool has exist.

Every tool every technique has got the limitation, so remote sensing in this particular lecture you may discussing about the limitations, what are the limitations of remote sensing? And how these limitations will come I will written in the opportunity in the future of digital limitation because these are all evolving things, so remote sensing digital image processing these are all evolving. Every day some developments are taking place.

Very interesting whatever the development which happens with the mathematical domain or in computer science domain ultimate the all so calculates in the field of digital image processing as

well and remote sensing so any development which has taking places in the electronics may be in the navigation system in the other things wait and up improvements in our remote sensing data.

Even the development of the high quality battery may increase the life of the remote sensing center. Sensor which in a space, so all kind of technological developments in directly their benefits will come in few years time in remote sensing as well as in digital image processing. So future is very bright in case of remote sensing and digital image processing how our current limitations are also there.

Because none is universal, so we will se one by one what are the limitations. So let us see we will start first limitation, then we will take the feature. The limitation here is the image accusation in both quantization's. And here is some problem, because the qualitatively when we analyze an image in its fine. But there is be go for qualitative analyses then many issues evaluate. Then that's creates lot of problems in quantitative analyses of remote sensing data.

So digital image processing is fine when we go for example is be go for temperature estimations. Now in between there is atmosphere. If the atmospheric distortions have not been removed, then the temperature value and we will get through all kinds o0f analyses may not be two representative value of the time when the data has required. Now this is one issue and another one is how compare with whom because for comparison.

In case of temperature values then surface temperature value which have been drag form satellite data for comparison we are having a point data not a special data. There is suppose which is know I have which are the example or modus example where one pixel is of one square kilometer. And where is your utilize limitation is providing data against the point. When we compare this data point data the special data definitely we are want to have the differences in the values. And that dead depth creates problem when we go towards the quantitative this is of the remote sensing data through image processing steps.

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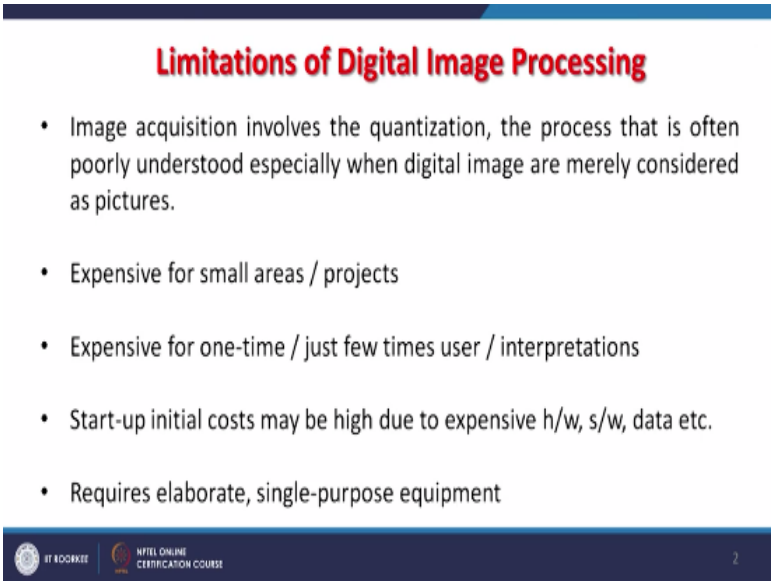

So the image accusation involves the quantization, and this process is often poorly understood especially when digital image are merely considered as pictures. So this because the first it is data is collected in form and then it converted in to this step. So this quantization process will creates some limitation process of remote sensing data very expensive for small areas and project.

If I have to work for this small area that digital image processing software in satellite image computer it becomes very expensive for small area. But if I am covering on a large area and on regular places I have to use these techniques then it is fine. But it for a small project for the small area this is the limitation. And other limitation is expensive for one time just for few time users interpretations.

Because the again it mention in the previous cases that only once a technique remote sensing has to be implied for a project only one that is really expensive. But if we know the regular things then it is done. So the counter and this one and alternate it is one, if there are people who can do the image analyses, digital image processing interpretations on your behalf as well, so those facilities are available but they will charge.

That is why it is said expensive for a small area or one time users. The initial cause the start of initial cost may be high due to expensive hardware, software data now data most of the remote sensing data now a day's especially moderate resolution data is available free of course. But if somebody very high especially the data may be 3o and 40s in data one has to buy. But otherwise the data has not be reduce in now a days.

Where hardware and software is will definitely cost to the user all we come are establishment. Requires elaborate single purpose equipment. Generally you have to have all kinds of peripherals in the digital image processing system. So that one can create good outputs as well as. And it is might be single purpose equipment. But now a days because of the things of developed from a that one a simple workstation on pc.

A good standard digital image processing system can use a software can installed and this can also various purpose. So this limitation is getting minimize now a days but the some field has get. It was a requirement that you should have a separate system for this digital image processing. We will go through the limitations, the limitations is accuracy may be difficult to evaluate.

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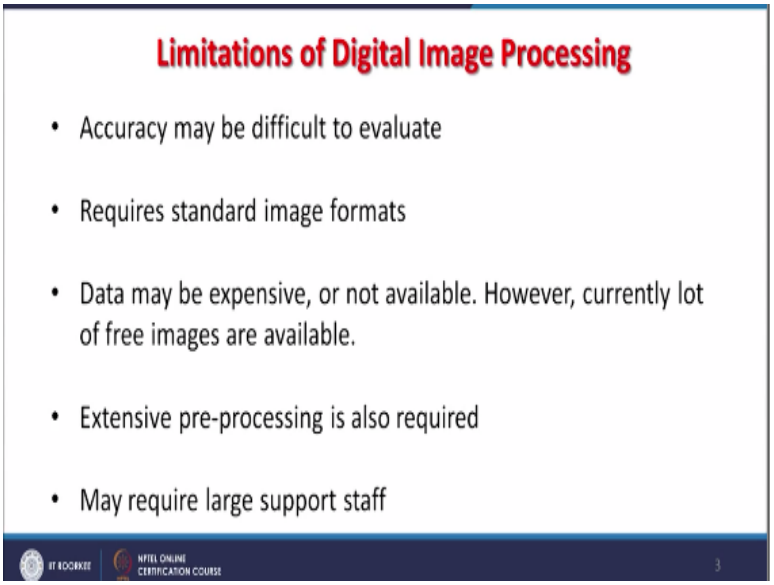

Because once has I mean, I already mention. Once we go for quantitative things is starts becoming complicated. So here the accuracy part because some of these done by classification now how to access accuracy how accurate the classification is after whole cost of digital image processing. And where problem comes because everything has to which ground check and there is no use an remote sensing data.

Then has going in the field do the mapping and preparing the new values. Instead of using satellite to using after so much of processing will use map through the satellite images, and then each unit in the field is being check. So these dilemma always there is creates the accuracy is

chosen problems are there. So once we go for quantitative assessments or accuracy issue it seems always difficulties in challenges and limitations are there. And these accuracy is comes, because of resolution of especial resolution of the data. Sometimes the especial resolution we are having ability of the resolution. And then become very difficult to create something very accurate on it. Because remote pixel is a unit and a unit means indivisible. We cannot see, we can divide a pixel and where the problems come.

So that if it is a course resolution then might be you might be having special resolution in it. So dig native we do not know any difference accusation. Everything is same just one pixel value, so accuracy is means are difficult to evaluate. In case of remote sensing digital image processing and this is a the digital image processing has a input here is many time we required the standard image formats.

Sometimes what happens new satellite has come two data is available but the format is not understandable or we cannot open the data in standard image processing software. And therefore the problem comes then somebody has to program it and then only I owe one would be able read the data in that particular image processing software so these formats why there is a change why can we have a inversely format is very simple because this quantisation or radiometric resolution is improving day by day so the special resolution and this is causing the requirements of new formats to be developed image format.

So that these can be handled very easily like for example instead of having just 8 but data one can have a senor like in no a way which are it is a 11 bit data now on a standard image processing software no away each other analysis cannot be done because they are designed for 8 bit and the format of these data is also different so this formats plays very important role in digital image processing and one can say that is also one of the imitations but because of evolving technologies these hue will keep coming keep erupting in due course of time as well.

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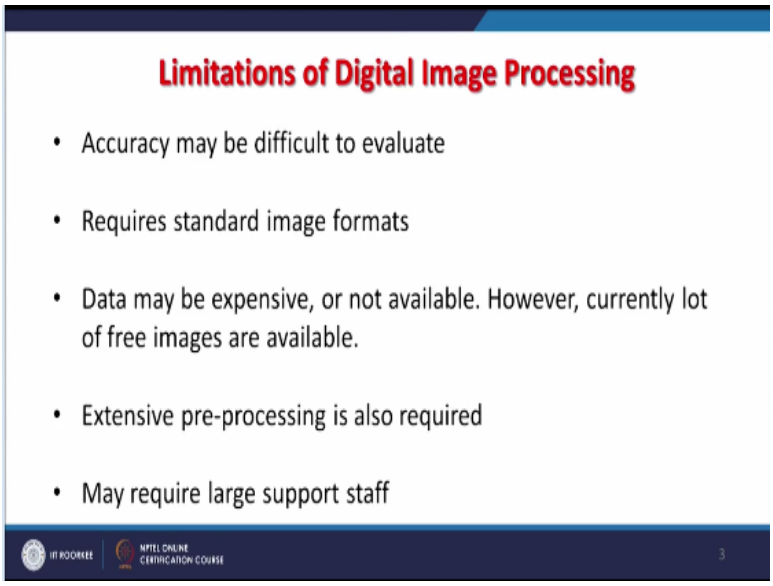

Data may be expensive especially now a days I am talking about high special resolution data may not be available this is a another issue because the archives I have motioned earlier also that since 1972 onward you are having archive of land side MSS but the data which you are looking the season of that particular season you want to you are looking as post monsoon image of a particular area of 1975 now that may not be available in archive so none availability of data can also hamper your analysis.

So those issues will keep coming how a kind be lot of free images as I have been motioning are available for our espousals for making use of them in change deduction studies mainly in change deduction studies extensive pre processing is also required lot of pre processing if you want if you go for quantitative analysis lot of pre processing is involved radio metric corrections atmospheric corrections geo metric all these will cost money and therefore it is said that these are the limitations for digital image processing especially for the data which we are going to use for quantitative analysis.

And therefore it may require large supporting staff so for a single project this these things may not be viable but other can definitely deliver on certain cost the this another problem is because once the data in digital format this issue has become larger now the copy right issue because it is easier to copy image from one media to another media you can download and you may not get credit to all may not give a in return money or some other credit those who have credited those images.

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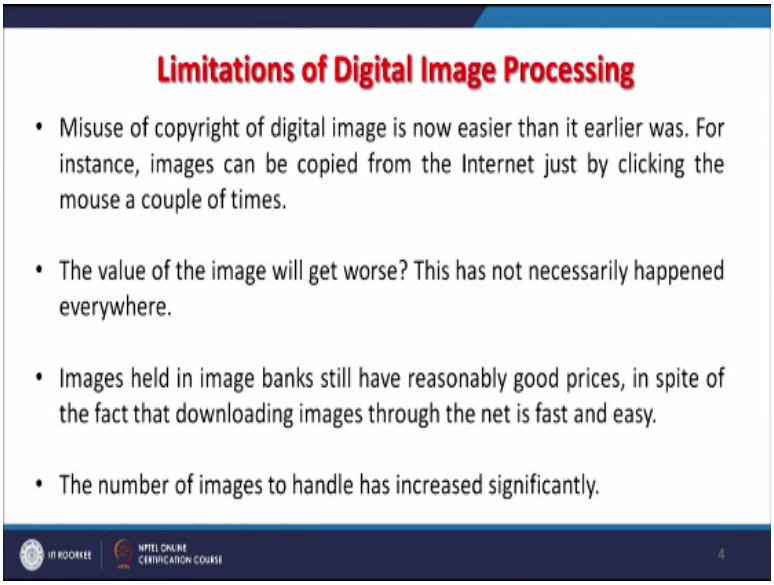

So the miss use of copy right on digital image is now easier than earlier was. This problem as become larger and for instance images can be copied from the internet just by clicking mouse a couple of times all the many such data sets are available and we do not give the credits those you have provided the data then we say violation and reach of copy right and that creates some legal problems in digital image processing, now this value of image well get worst this has not necessarily happened everywhere this point is that though course resolution data is becoming available almost free of coast.

But high special resolution data is very expansive from two angles one is a it is already expansive and second is that it covers a very small area and if you are area of interest is large then you have to acquire lot may senses with high special resolution as I have discussed in earlier lecture that higher the special resolution smaller the or the width of this path and the swath, and this creates the big problem so a for example a lancer dimensions make over a 150 km area in one scene.

By may be roughly 150 or 160 km where as I come image having 1m resolution will cover area of just a 11 km swath width is roughly that so in order to cover the same area of interest by lancer and her you have to buy you have to arrange lot of high resolution data lot may senses are required and therefore it will cost so this is becoming worst when you go for higher and special

resolution of course if data is available free then you say different thing but as I have mentioned high special resolution data generally is not available free cots only relatively moderate resolution course resolution data is available free.

Image held in image banks is still have reasonably good prices in spite of fact that downloading images through the net is fast and easy, so sometimes say while acquiring the data specially high resolution creates lot of requirements and processing and so on so forth so thin can also be considered as one of the limitations of remotes sensing data as well as digital image processing number of images to handle increased significantly because there we might me looking a larger area took over.

And this may involve a lot of images to be handed and therefore the mosaicing issues will come because if I have t mosaicing just 4 scene I may be not encounter the problems if a compare to the if I have to mosaicing 20 scene because the time difference the scene as in difference weather conditions difference may create problems while creating a see less mosaicing so this becomes another limitations or digital image processing when are going to cover a large area with high special resolution data because at the swath bit reduces.

The temporal resolution also becomes poor so that means that a course resolution like 1 km resolutions satellite sensors are flying almost two times in a day over the same part of the earth but if 1m resolution data and the swath is so narrow that the satellite may come after 15 days or 18 days, so this time difference will create main changes in the vegetation condition may be in the water body conditions or may be in weather condition.

And while making more exhaust such data sets will bring many new issues so this is another very big limitation of digital image processing. Now these thing have become more technical in non expert of the field cannot now handle and so it require a VL good technical people to take so this may not be a disadvantage for everyone but for those who are not aware how to all these tools how to handle them what is how data is acquired, how dis-process then it becomes a limitation for them.

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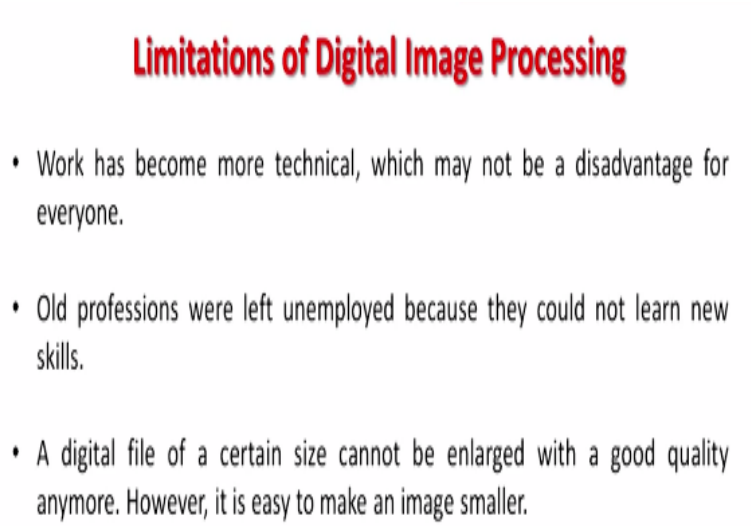

Now old professions they are left unemployed because they could not learn new skills as I have been mentioning that the development or evolution of digital image processing and same time remote sensing sensors images is so fast that it is very difficult to keep a track of everything and therefore the senior people older people they find very difficult to catch with the things and that may be the one of the limitations.

Because things are evolving at a very fat rate same with the like mobile technology, a digital file of a certain size cannot be enlarged with a good quality anymore, what it means that if I have acquired the data of a particular spatial resolution now by knowing I can increase the spatial resolution of that image and I am looking for some better spatial resolution data then I have to buy a fresh data set.

And that may give you because the technique does not exist anymore, so it is easy to make an image smaller by doing sub sampling but it cannot improve this spatial resolution once a digital image has been acquired by a sensor, so that may be also consider as one of the limitations of digital image professing. Now this point has come already indirectly that limitations of digital processing requires a specialized training.

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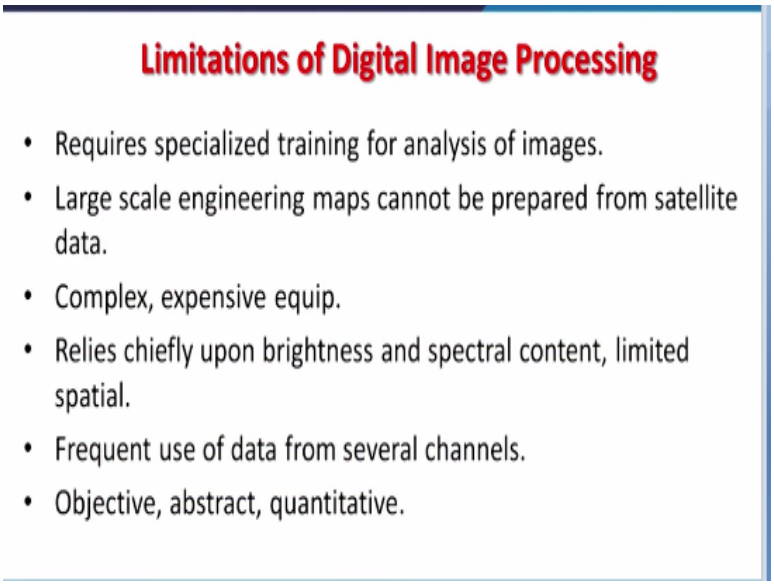

For analysis of images because like in classification good understanding about that particular technique is required if somebody does not move about fussy logic or a moral network then one cannot imply the technique to do a classification, so therefore this technical requirements specialized training has become essential for performing certain types of digital image processing.

Now large scale engineering maps cannot be prepared from satellite data that means a satellite data or digital image through digital image processing we cannot substitute the engineering maps the importance of engineering maps is there, these are the compliment into each other, so the information or the maps the utility of engineering maps is still remains same and so that these maps can be enriched or in the big round we can have a good satellite image which is perfectly registered with the engineering map.

But we are not substituting engineering maps with satellite images so when we go for very large and very detailed engineering maps then their satellite images probably through digital processing cannot be employed to full extent. Now that equipment which we go for digital image processing especially I am talking about the software are complex and expensive. They cost the standard software and therefore the whole project becomes very expensive.

Rely chiefly upon brightness and spectral content and limited spatial resolution this is also because for everything a most of the time we are using the optical remote sensing data and it completely depend on reflection brightness values and in what part of EM spectrum it is being

used, so that thing also if we think about hyper spectral remote sensing then a spectral constraints are not there.

But the data handling is so use that normal image processing systems cannot be implied neither hardware nor software. You need a space sliced thing for every not only the users have to be equipped with new knowledge but also the hardware, software part. So this thing is there, frequent use of data from several channels this can also create some kind of limitations and that use the data from different channels may be having a different quality.

And therefore there might be a problem they say as I have been seeing the quantity, once we go for quantitative analysis of remote sensing data through digital image processing or objective analysis there might be some limitations are there with these technologies. Now some times satellite images are costly if repetitive coverage, are required to study the dynamic features especially high resolution data I am talking and because if I need a time series data of a small area at a very high spatial resolution this then this option is very expensive.

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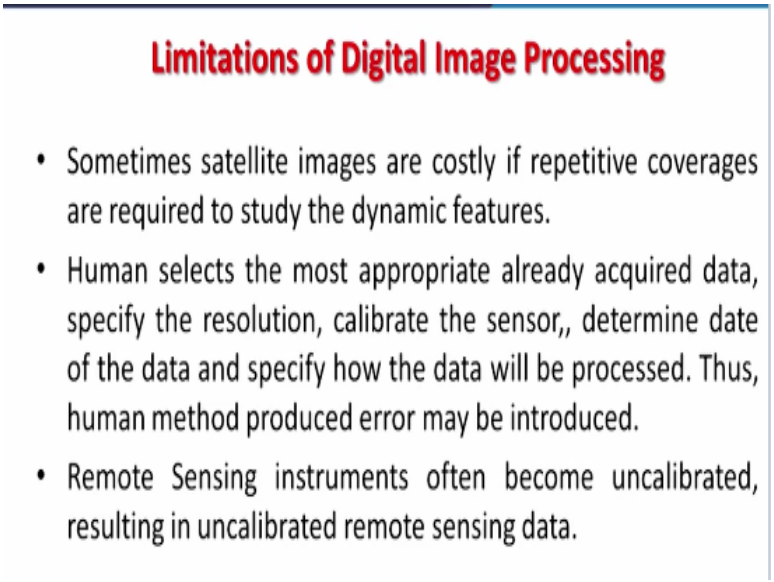

Human selects the most appropriate already acquired data and generally as specifying the resolution, calibrate the sensor, determining the data of the data and specify how the data will be processed thus human methods produced error may be introduced that a one person though he is very expert bit he may have choices of his own for a spatial resolution for data of the scene and

processing a steps and that at the end of the day for certain project that may creates some errors ultimate limitations.

So that things is also there now remote sensing instruments often become un-calibrated resulting in un-calibrated remote sensing data, so that the sensors which are there which of this the digital data which we are going to use may give some problem once they become uncalibrated because they are in space the sensors are in space on board of some satellites now this calibration cannot be done only the some image processing tools can be employed to minimize these distortions which are coming from uncalibrated remote sensing data.

So that may become a limitation sometimes some sense has though it has be launch but the data becomes completely useless because now that to that extend the calibrations cannot be done and therefore the data might becoming but it is no use of that further limitations of remote sensing or digital image processing has.

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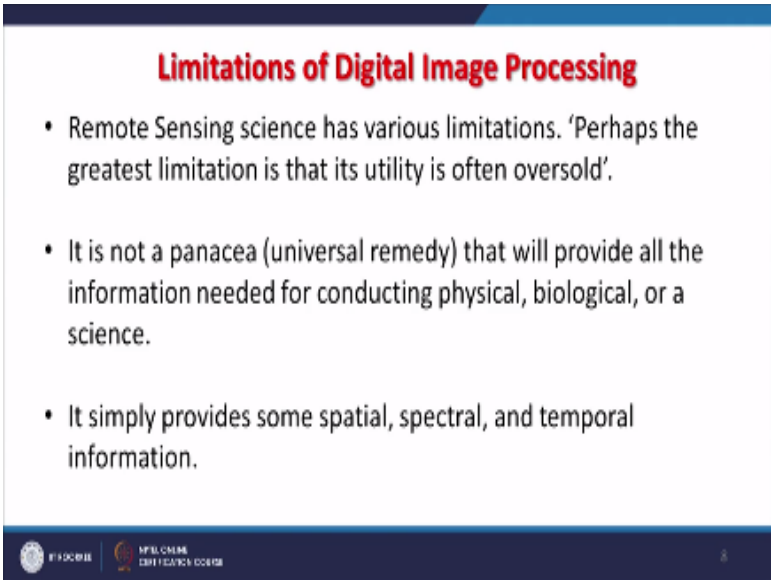

Various the perhaps the greatest limitation is that utility is often oversold, remote sensing GIS, computer science and everything has been oversold some people think that everything can be solved all problem can be solved by using employing remote sensing and digital image processing so this is over selling, this is not true in all the cases all nothing is universal, no technique is universal and therefore there one day or another you would find limitation which

each and every tool or technique so with the remote sensing, so with the digital image processing.

So over selling may create problem for remote sensing and digital image processing users has fine. It is not a panacea that is universal remedy that will provide all the information needed for conducting physical, biological or a science, so that kind of that I have been saying that it is not a universal solution for everything remote sensing or digital image processing cannot solve one of the limitations the large limitation once I have said the once the data has been acquired spatial resolution cannot be improved.

This is the highest limitations, if this would I have been possible then only one kilometer spatial resolution data would be sufficient and then by employing different intelligent image processing, technique one could have created the data at 10 meter, 1 meter, 10 centimeter but this is not possible, so that is one of the limitations. And simply provide some spatial, spectral and temporal information.

Everything cannot come through the remote sensing or digital image process, what it is providing these three information, it is providing spatial resolution or spatial information, it is providing spectral information again certain bands of EM spectrum and temporal resolution the each satellite or sensor is not over passing everyday of the same depending on the spatial resolution as I have been mentioning, course are the resolution the temporal resolution is high.

And higher the spatial resolution the temporal resolution becomes poor, so these are the inverse relation between temporal and spatial resolution can create some problems in different projects.

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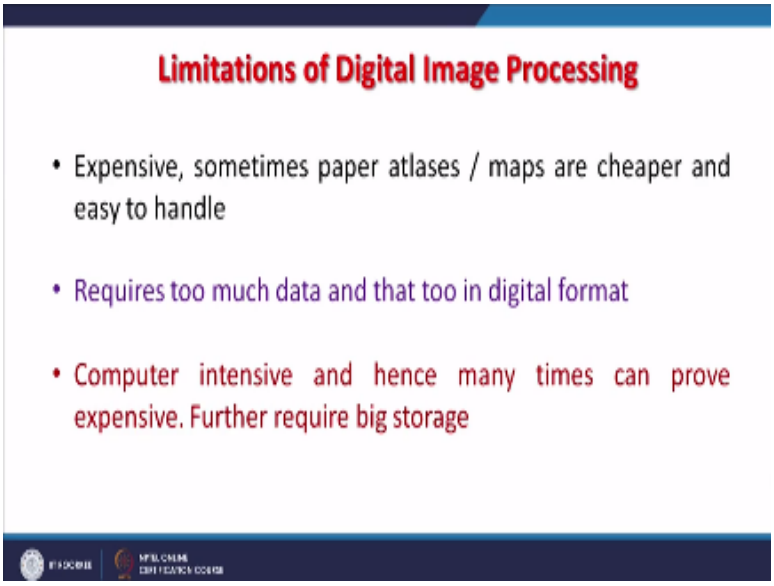

Now expensive word has already come that some time people compare very senior people or they can compare the using atlases paper atlases much, much cheaper than going for expensive solution through remote sensing and digital image processing that is true but those are the analog things they are the frozen things we cannot do much with atlases or these paper atlases but with the remote sensing data lot many things can be done I have shown some examples.

How the image interpretations inferences even to the modeling we can go related with certain problem issues. So this expensive issue will remain they are you can consider as a limitations but a comparison has to be in that sense that paper analog things cannot be a truly compared with digital things in that.

It requires too much data and that too in digital format, of course for digital image processing everything has to be in digital form. One example I showed that using a map a paper it was scanned created in a digital format and then image processing was done maybe pseudo color transformation and chain detection map was created but everything has to converted into digital format that is the requirement, so one can consider that is limitation but this is how it has to go.

Now computer intensive of course because it has to handle the digital data hence many times can prove expensive further require big storage, here storage is a big issue and one can consider as a limitation because as we are going towards higher and higher spatial resolution the storage requirements are increasing exponentially, not only spatial resolution but in spectral resolution

earlier in like in case of landslide MSS we had just four bands in case of more days we are having 36 channels.

In case of hyper spatial we are going to have or already having 256 channels and this is spectral resolution has improved spatial resolution might be improving or has improved so the radiometric resolution instead of having just 8 bit data now we are having 13 bit data or 24 bits data and therefore handling of such data with standard image processing systems becomes very big problem and therefore ultimately it cost so it becomes expensive.

So expensive tag has one of the limitations of digital image processing will always be there it may become larger and bigger in future. Now limitation we continue on this that.

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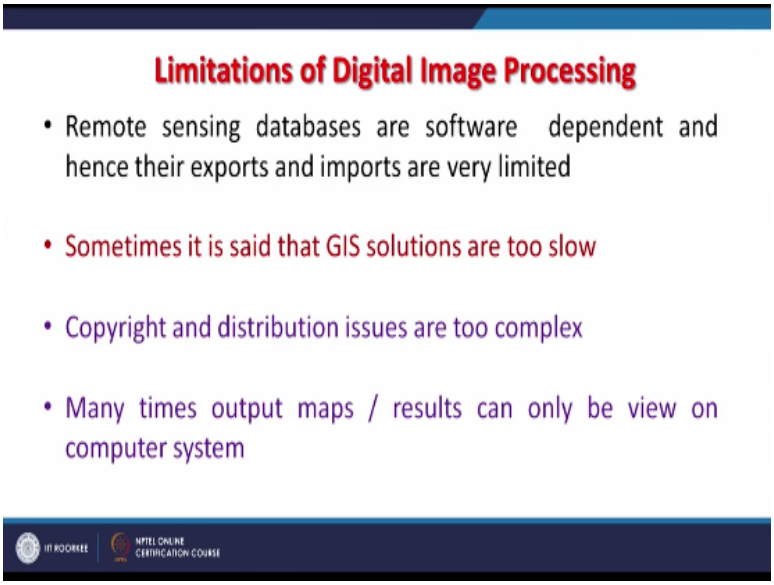

Remote sensing databases are software dependent I am using suppose a dos image processing software a dras image processing software requires data in one particular image format which they have designed like img format. Now everything has to be, has to go in order to use smoothly everything has to be converted in that, and that means cost because it will require more hard disk space, more convention, more time consuming another things.

So these data basis are software dependent and hence they are export and import are very limited, so if I want to use in some say NV software or some other software sometimes I have to

convert from one format to another and that cost ultimately so we can consider as one of the limitations of digital image processing.

Sometimes it is said that GIS solution are too slow because ultimately nowadays we are going for an remote sensing data after digital image processing becomes a one of the major imports in GIS based his studies or analysis and there this solutions are expensive and slow as well copyright and distribution issues are too complex this we have already discussed here many times output maps results can only be view on computer system this is another limitations.

That every time an if some new image processing a steps has been taken some beautiful maps are their images or images are there on the screen but when we go for printing then limitation comes so everything has to be seem on computer screen and that may be considered as one of the limitations because once we go from digital to analog some limitations will come.

So that's one of the limitations of digital image processing now we have seen lot of limitations of digital image processing also some limitations leaved limitations with a remote sensing data one or two limitations with also with GIS but a now definitely there is a future of digital image processing and remote sensing.

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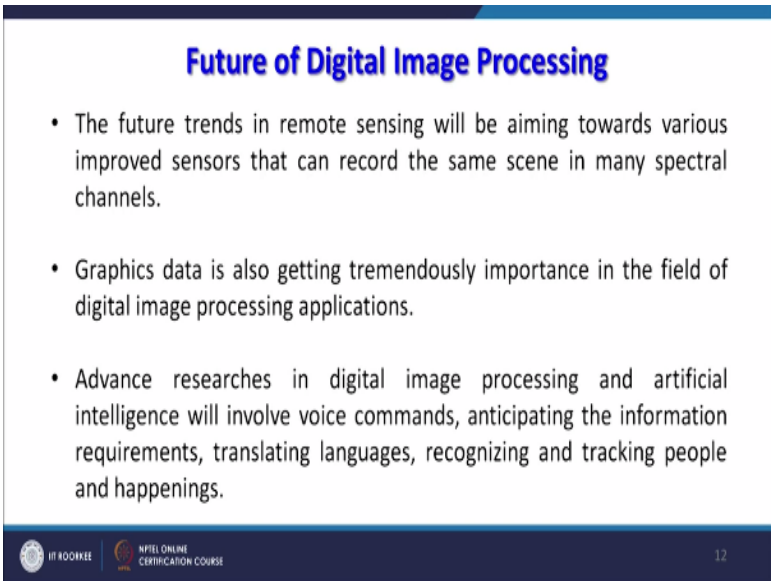

So we will end this course by some projecting notes having thinking about the future what is going to happen in near future the digital image processing will involve new more advance intelligent and automated remote sensing data analysis systems this is already we are about things are evolving as I have mentioned earlier that any development in mathematical domain computer science electronics all will peculates slowly in the digital remote sensing and the digital image processing.

It is already happening so will happen in future so any development in software engine or in mathematical domain ultimately will benefit the future of digital image processing and sensing with increase in power and sophistication of modern computing the concept of computation can be extended beyond the present limits.

I can tell you that few years back it was even it used to require lot of time to display a image of the resolution on a screen because this techniques of the image fast image display and not only techniques but hardware we are not available but now things are become much faster and the result of this you are handling now more data other than handling one or two seams very handling now it is we are mosaicing it is seams already in mosaicing for seam is possibly difficult.

And many near future very quickly we would be able mosaic so the data is too rate of handling is speed everything is improving so there is nothing to worry in that sense that one day it the day has not come that are will not come when we will say no nothing can be done no more things can be done that’s the future of remote sensing and digital image.

It too include that advancements in various digital image processing applications which are already role being new applications are coming like in case of digital image processing in the image classification I have mentioned that you instead of just based on spectral classifications we are now going for object oriented classifications and classifications based on the neural network classifications based on the logic or image processing tools.

These are coming based on the wave length one example of image compression based on embedded line that is 50 mm image being compressed undistructively into one mm image so that is the development so similarly in future may be we may seem some more sophisticated more

advance data compression of digital image processing tools due to variations in digital image processing and other related technologies there will be millions of systems in the world

And there integration an everything will happen the future trends in remote sensing will be aiming towards various improved sensors, sensors are also improved because the electronics are improving so the sensors are improved and these would be able to see the more respective journals as we are seeing through in this hyper spectrum.

But in currently there is only one satellite so therefore there is applicability of such sensors but in future I am sure that might be increase and we will have a ready availability of where expected data for many applications which we do not know and we might be applied in remote sensing and digital image processing for the those applications which we can note think even today.

A graphics also of the computers are getting much more advance and much more powerful both from they are handling side through software and hardware so that is another feature advance research is in digital image processing and artificially intelligence will involve voice commands anticipating the information requirements translating languages recognizing and tracking people and happenings.

In nearly time the chain deduction may be done based on the learning's the systems will do on the based on the old or data that kind of feature of digital image processing so this brings to an end of this particular topic as well as on the digital image processing of remote sensing data course so thank you very much and enjoyed your studies of digital image processing thank you very much.

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