Biometrics

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Lecture No. # 23

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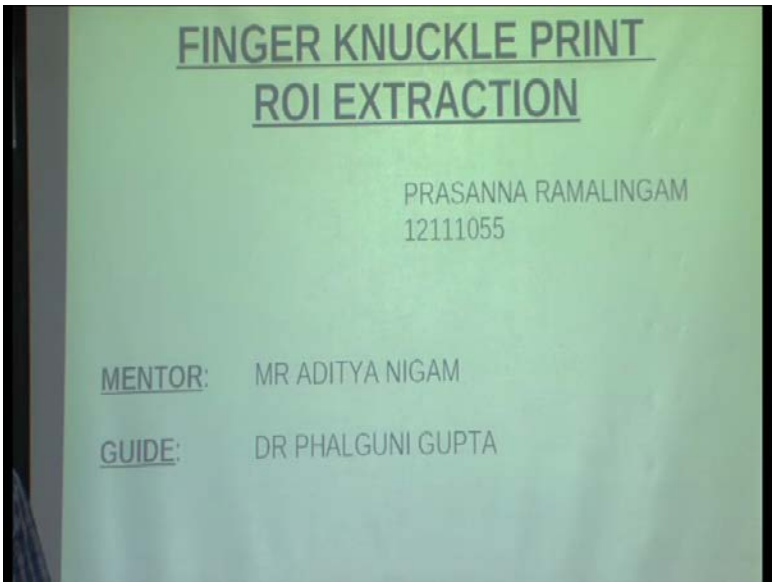

Good morning everyone, problem statement-problem statement is to design and implement a method to extract region of interest from a given finger knuckle print in.

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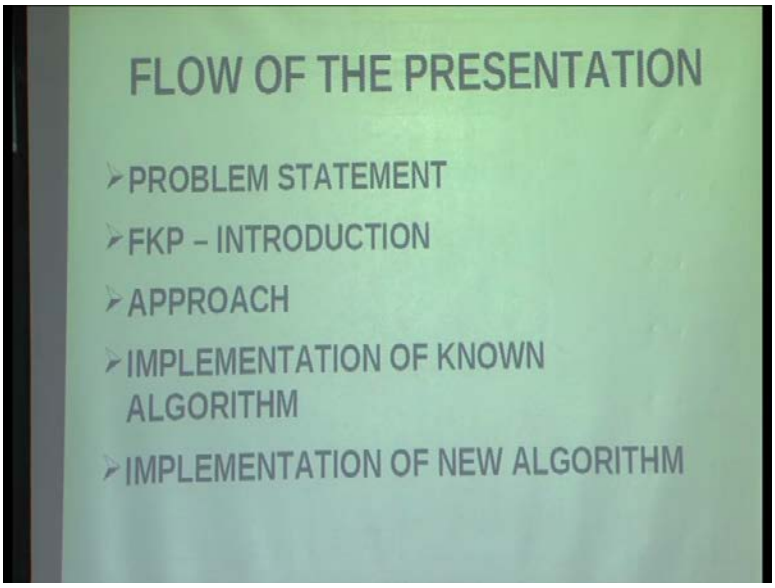

The scanner that they are using the images that they have given the full images of a finger, I have given the hint starting point and the limitation is, I think that requires images like the horizontal images. So, if we somehow manage to get images like this or horizontal images or even like this and the this point then may also block.

Is it?

Yes sir.

So, what should tell what the d p i-d p I, You are suppose to tell scanner specification if you have a scanner on scanner I put my hand like this.

If you place your scanner like this then you have to press, You can get better images, because in place of that what you can do is that place fingers like this and take an image at a distance and then you can say that it will work on that.

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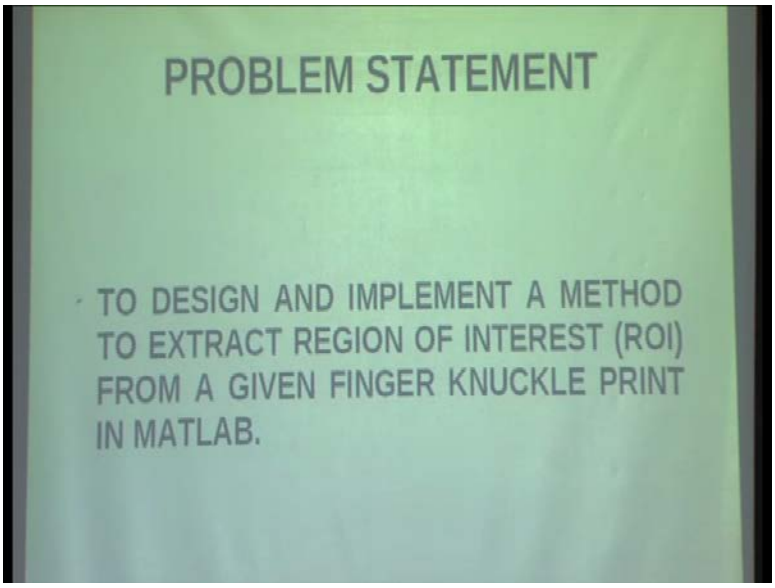

See, if you use this scanner, because I do not have any problem, because you have to procure this scanner so you can use it but, if you cannot use because it is dependent on their database. You understood;

Yes sir!

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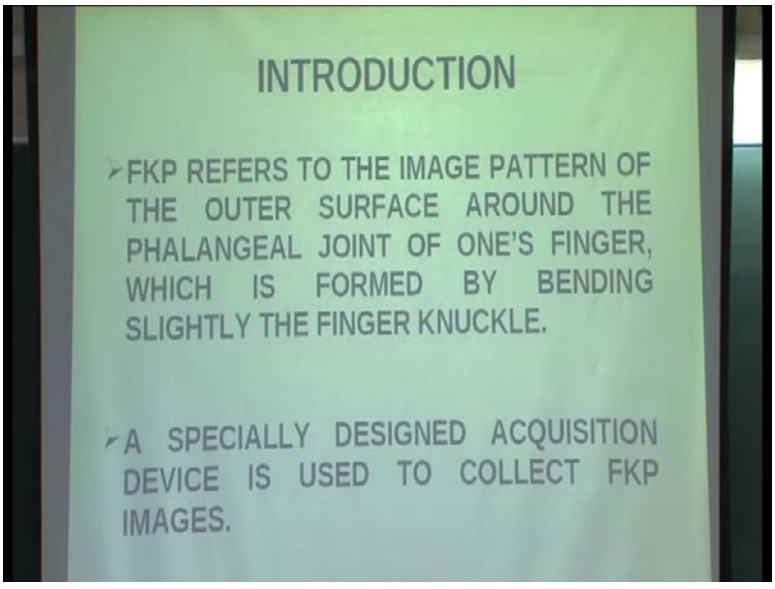

So, does this act scanner is this 1 and go for that if you say that I do not want to base on standard scanner. Where p p i is 250 very low resolution or you say no sir, I want a different type of say, I have like all those things you can think image.

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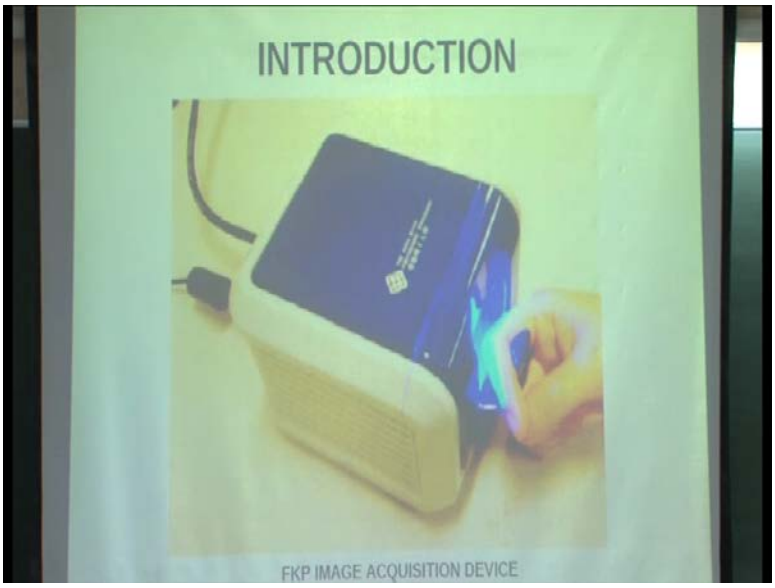

You are now telling me that on this scanner.

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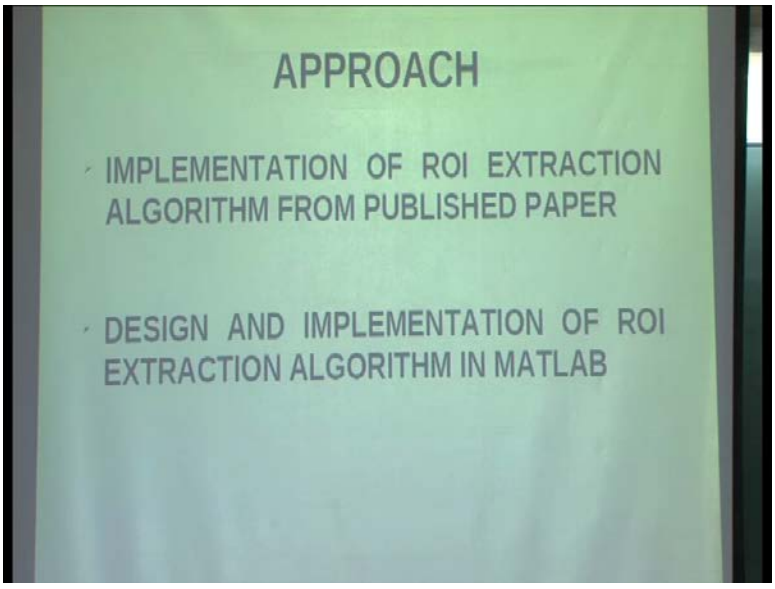

You should work on this scanner. Am I 150 k b p s?

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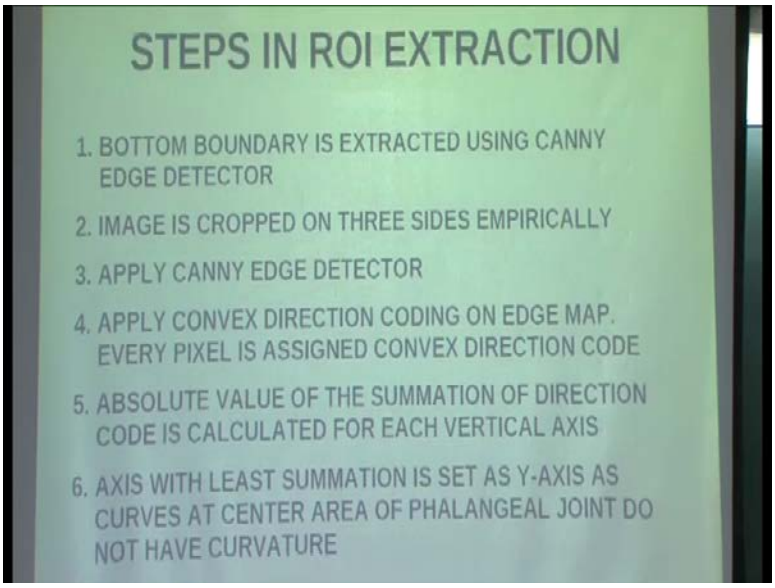

Sir these are the 6 steps in r o i extraction.

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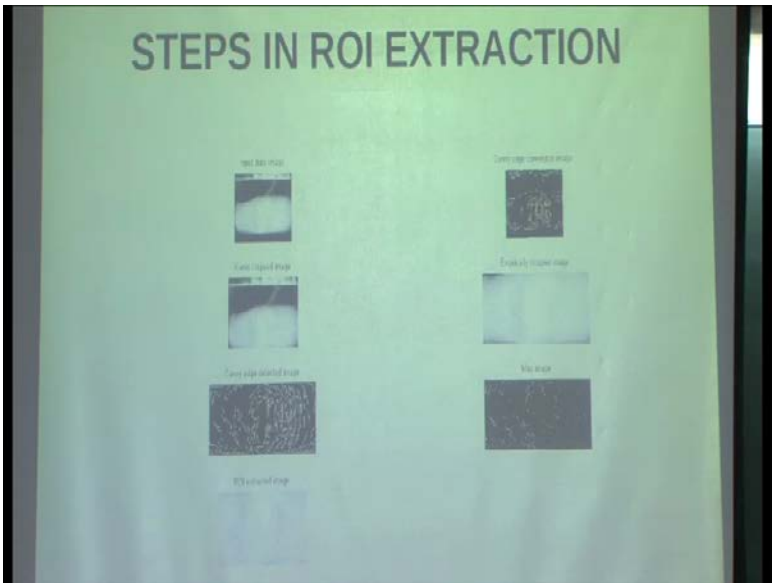

What they have done, they have taken the canny edge from this edge. This length or the image where the image resting with the cropped it and update weight age for this curvature that if it is convex outer and convex they give minus- minus plus.

Then what they have done is they have done a loop to check what they are saying that at certain point. It is the weight age will be minimum, because the 1 side will be convex other side will be there. So, that they are taking a central axis, if it is a central axis 1 time

it will be this way other time, it will be this way so total is a, it will be extracted is 100 into 200 into 2 .

By implementing this we take this axis-this axis is not always in the central of the image but, that part is not that. How they are taking, this how they are taking this 1 10. My approach is that the quality of the image is good though in the sense that all that image is characterized under the same device so they are lying on the and the immediate is the same.

So, no my aim is to take 4 axis then I can use this r o, I what I can do is that I wanted to type an so that there is no connotation and networks of these value I can pass as it is.

If you know that the scanner is with you and I can always make point it out on the scanner where might be.

Yes sir it is there sir.

If it is there and you know the central.

Yes sir,

Then why are you so much.

If I know that, this is my centre. It will take 3 to a only you need to know the bottom axis and propriety.

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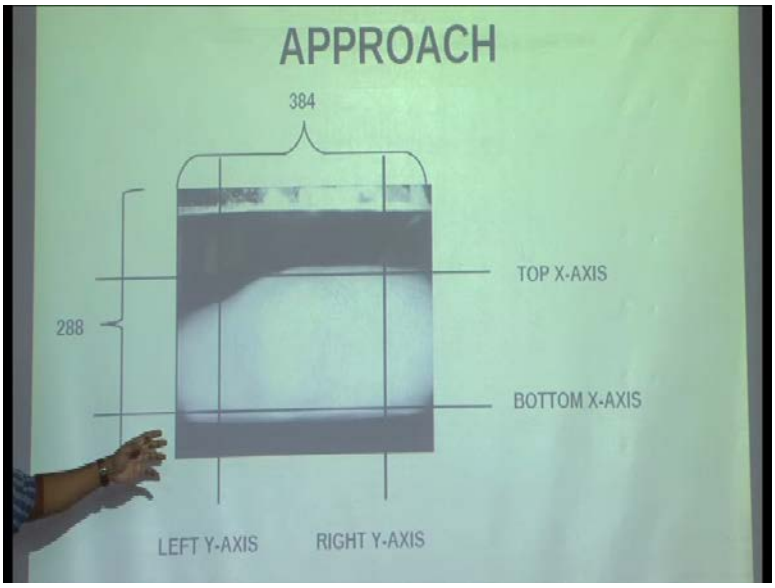

This 1 I will proceed. So, first I start with the bottom axis what happens is that I applied canny detector and got the random row and maximum summation in the horizontal axis. When I take average of these rows these are row images.

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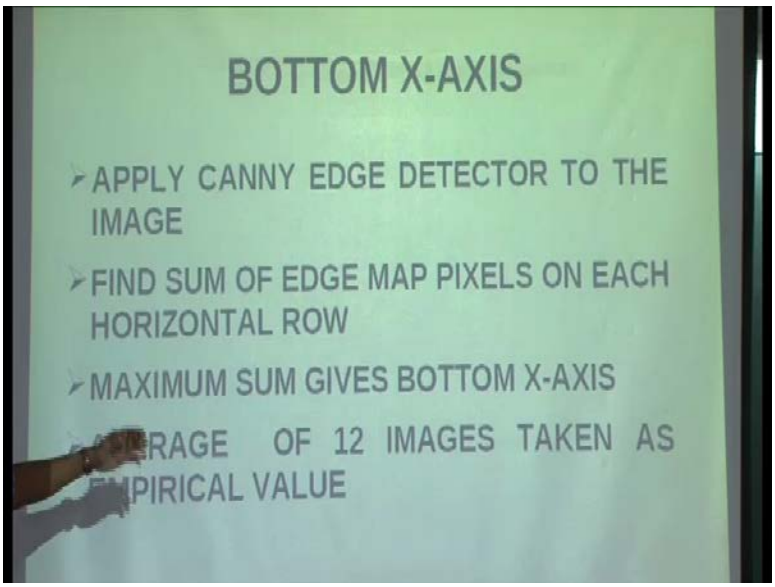

Then average is 252 so this is 252, so the total image is from 1 to 288 and that is from 1 to 385 then the 252 is then for the top axis again said that no 1.

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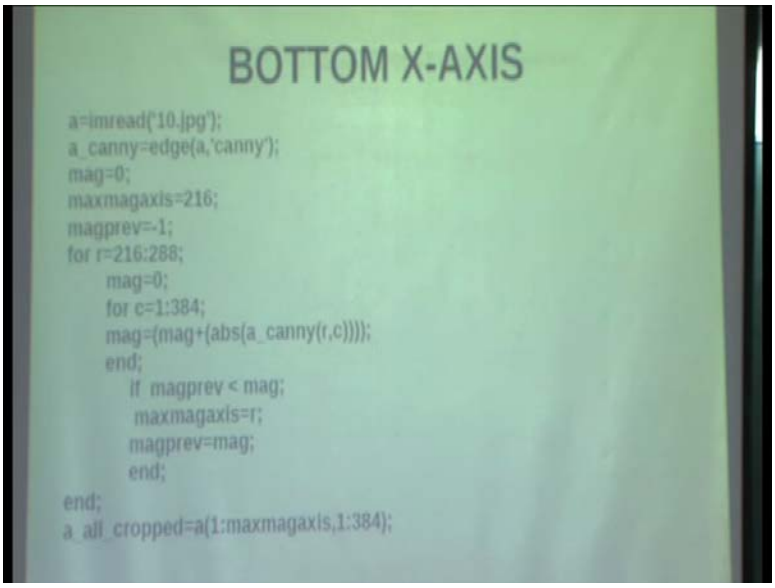

Can consider that when i take the image if i then again they will be again it is not guaranteed that I will get maximum canny information at the top but, seeing the image I can rate it as a second quarter.

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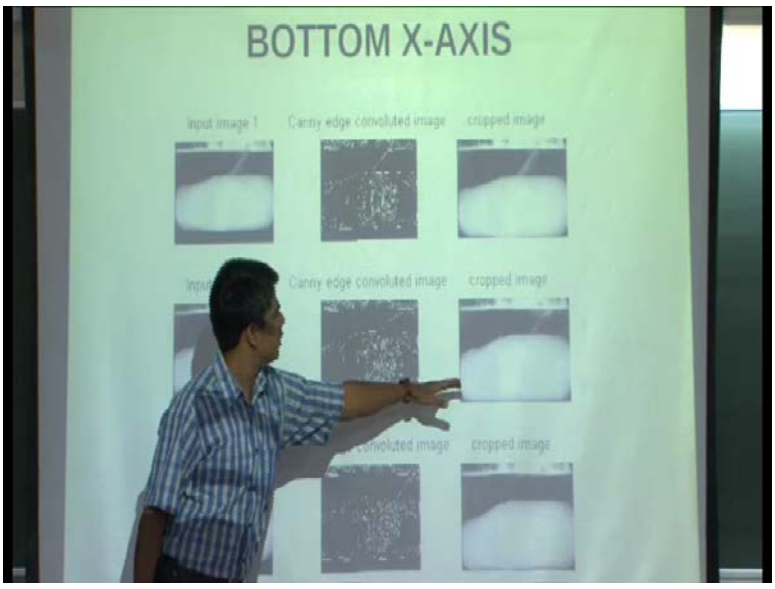

The rate is at the second quarter of the image, that will be from 72 to 1 44. You are getting as now this is the top cropped having the total average as 128 the image that I take if it is a built image if the camera if it focus on this area but.

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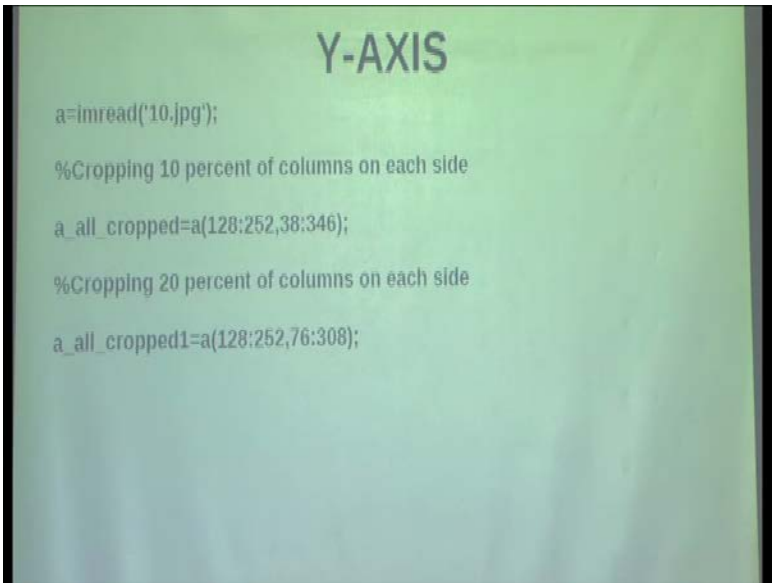

This is there that if it not able to out of focus image cropping on 20 percent or 10 percent or 40 percent this works but, there is a core for that.

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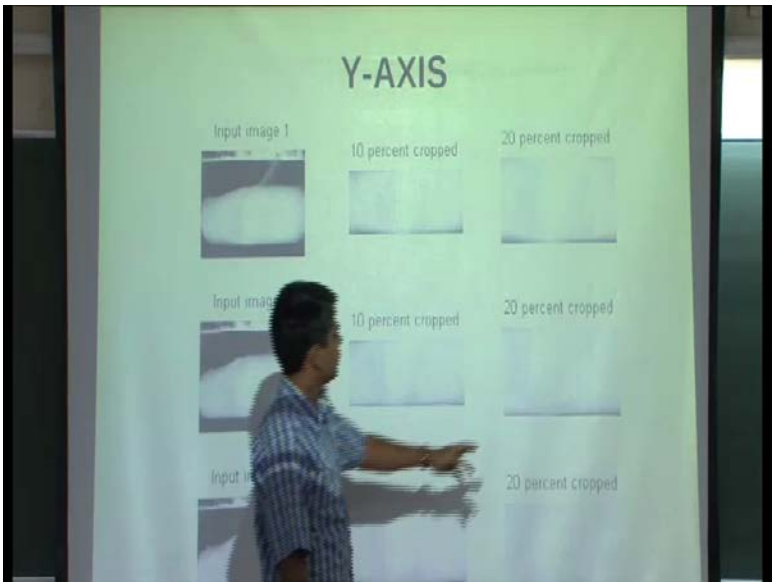

Because the problem is that like sometimes-sometimes, it is on the left to axis so then I am losing all the data which I so usually my approach is this. That I just made this whole lines which are there values and without any completion I can, you can crop the images, which are there problem.

I have to use this pixel intensity which is there because the camera which is facing the length each length, so there is a brightness at the centre. So I try to this so again taking the again taking the maximum magnitude of this 1 central axis like this taking central axis and again I tried to do like what they are and taking the axis atone line.

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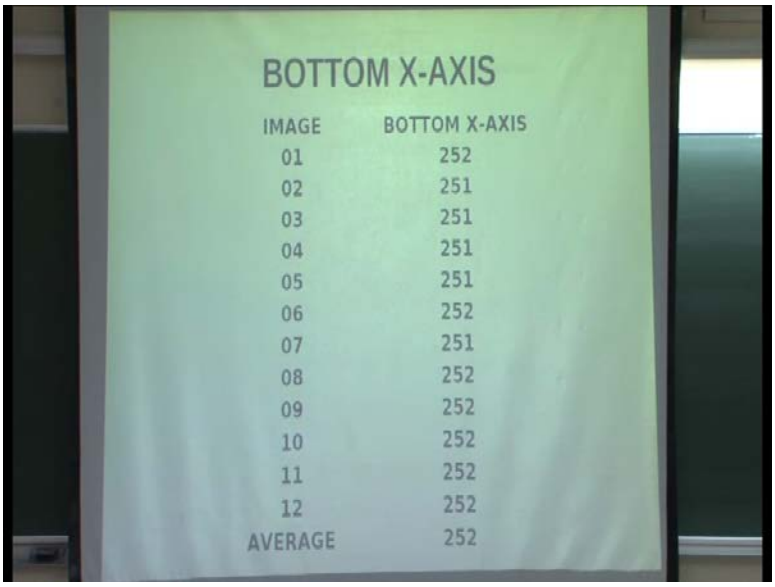

When I tell that 1 so I made it 120 only, so it is 100 and 20 to 252.

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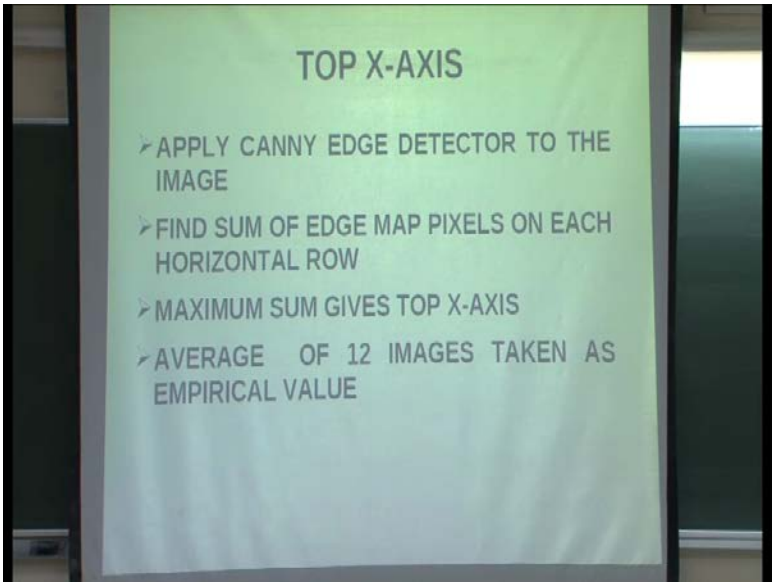

So, these are the size in the empirical method. They can just crop it by 20 percent but, that do not go the size is 1 25 into 233 using pixel intensity you can size 1 25 by 2 41.

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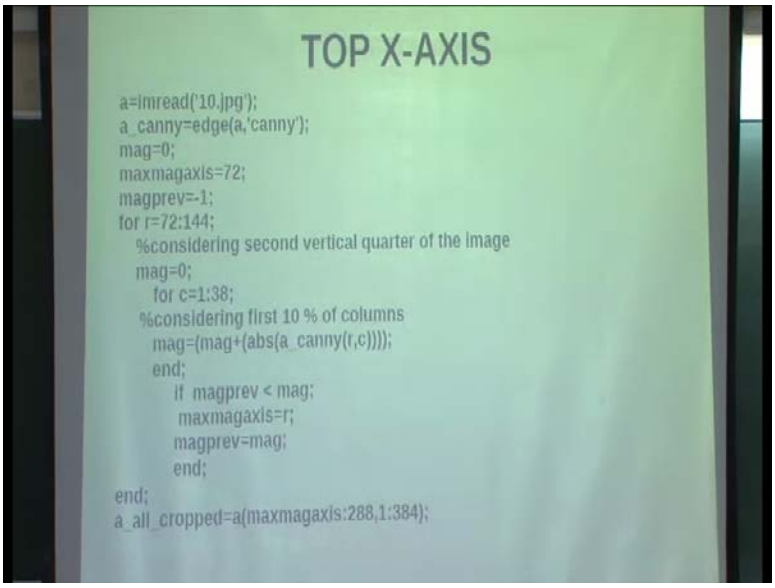

In that case what you will do is if you are using,

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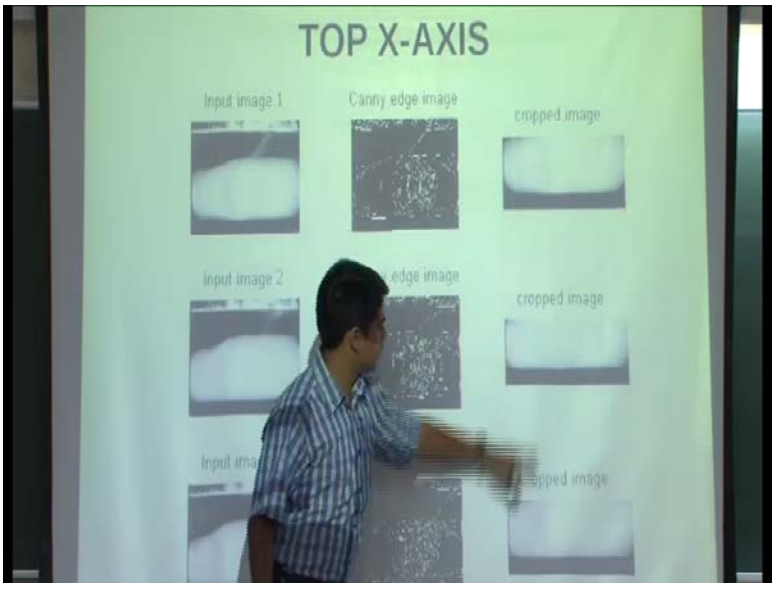

Not necessarily but, the only thing is that if this is not central exactly then I am using that or if I am using 10 percent then it will be then in other image it will be.

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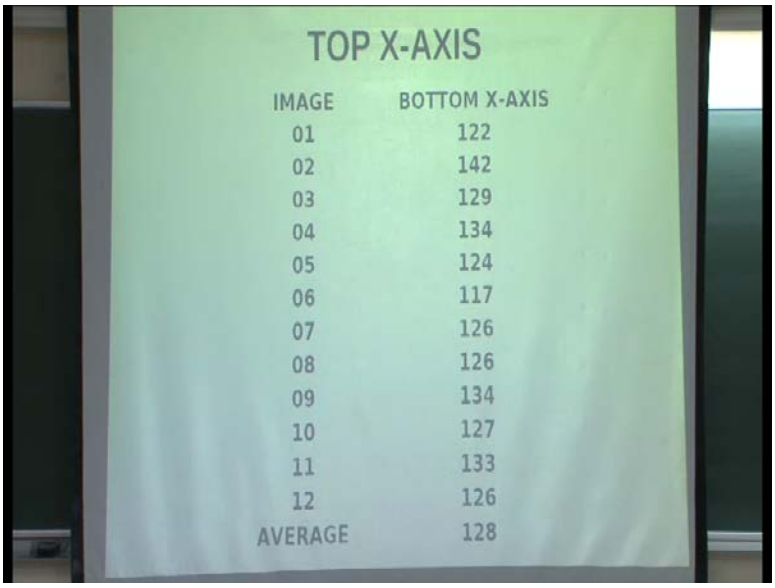

For me, I put that second I use the there is no restriction.

There is a triangle for this.

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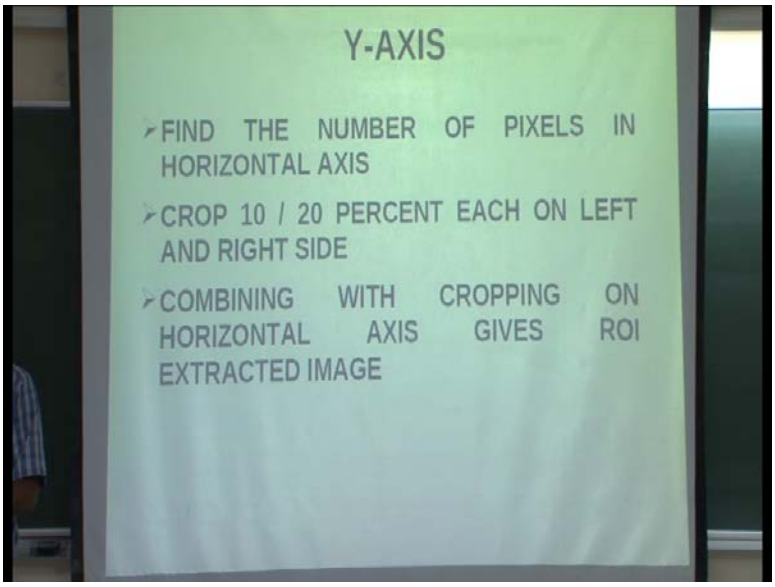

Inside harder,

Yes there is a hard thing and you cannot fix the distance and everything. Now the person has to keep the finger and

And when you are projecting this triangular 1 although that.

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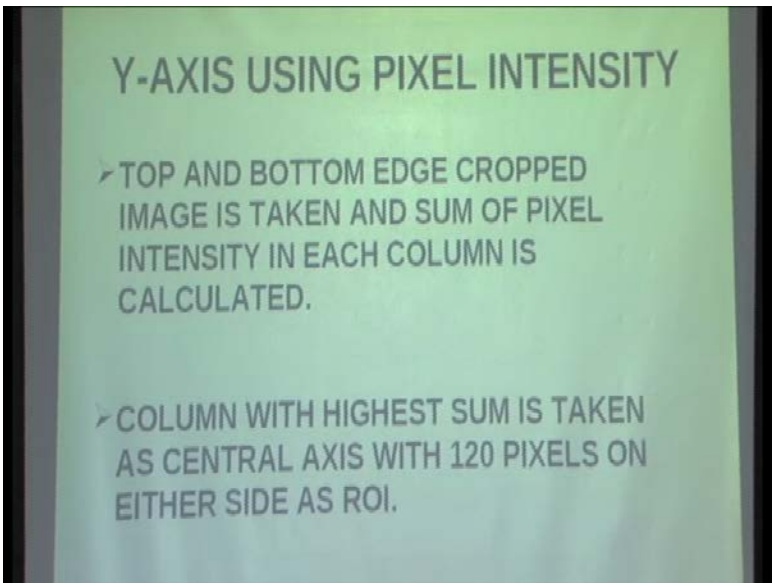

Now this is that, so what you do is there any requirement of projection.

Because the image which we are taking, it is like this so the things that we focus at least at these places it does not focus.

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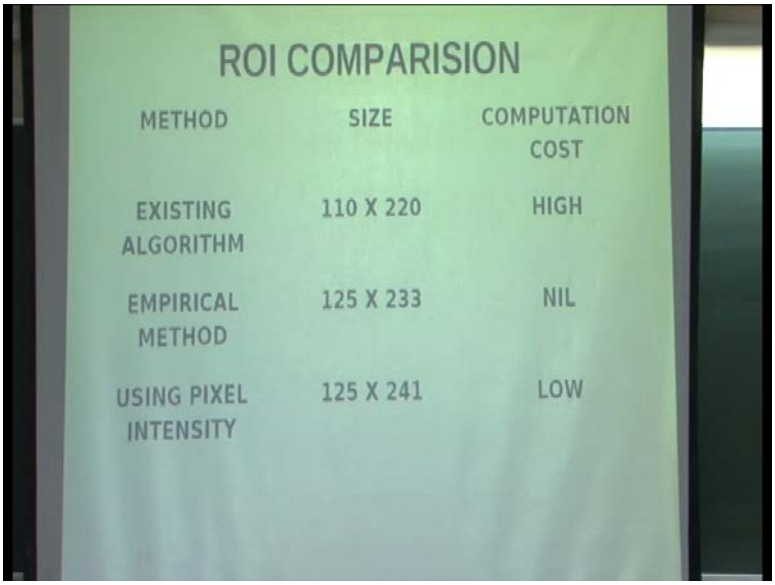

But I was suggesting that we have 1 approach that images are top r o i from the data.

He has also done the cropping and there are digital cropping. So, these are 3 different cropping and we have some. So, we 1 recognition algorithm on the 3 all these 3 different cropping

If he is saying that that thing is that then I want it in a different way. Now is finding out central line in a different way than the convex cooling than algorithm.

So, you will be able to do it.

I am doing the automatic nose-tip detection.

The problem statement is to automatically detect the nose tip from cropped grey scale 2 d images of the face without using any training and information and using main thing is that most of the images are frontal images. So, approach is first I take the complete.

What is adapted approach adapt or adopt.

I will be taking the human image and I will be collecting the candidates by whoever has the highest intensity as compared as compared to the neighbors that will be my first step to take the candidates.

So that is a mode

That those who have high compared to the reverse.

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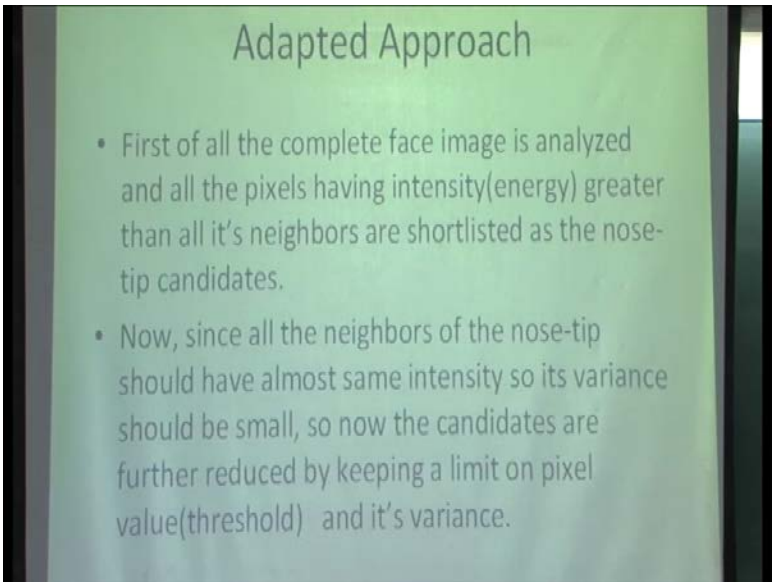

Then I will use a threshold and sense all the main intensity of the neighbors should be equal so variant should be small.

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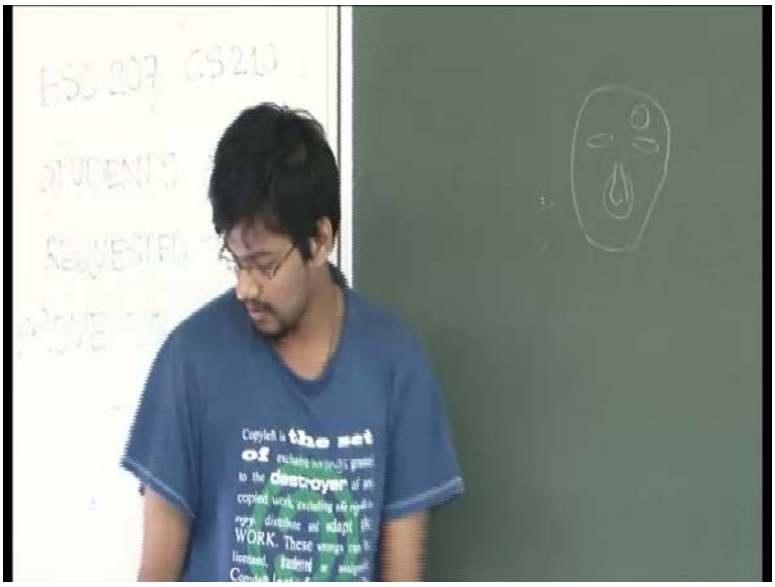

These neighbors will have similar intensity, so radius will be less. So Iwill be using a threshold also and limit on the variants to decrease the number of.

And no; I am giving you a draw an image draw a nose also intensity will be higher.

It does not matter then how are you going to detect that it is nose tip.

The nose tip will be detected by the centre of the image estimated area will also be taking.

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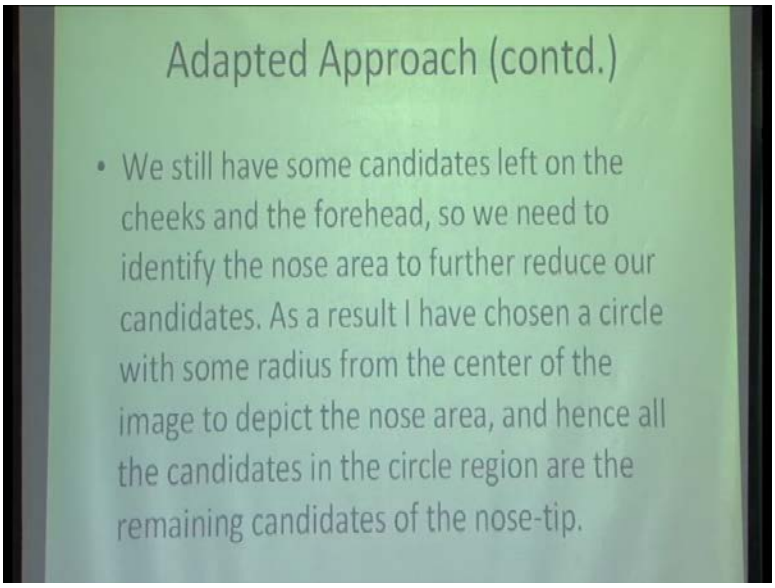

After the threshold and that, I have to ignore this area and so I will selecting the circle and radius.

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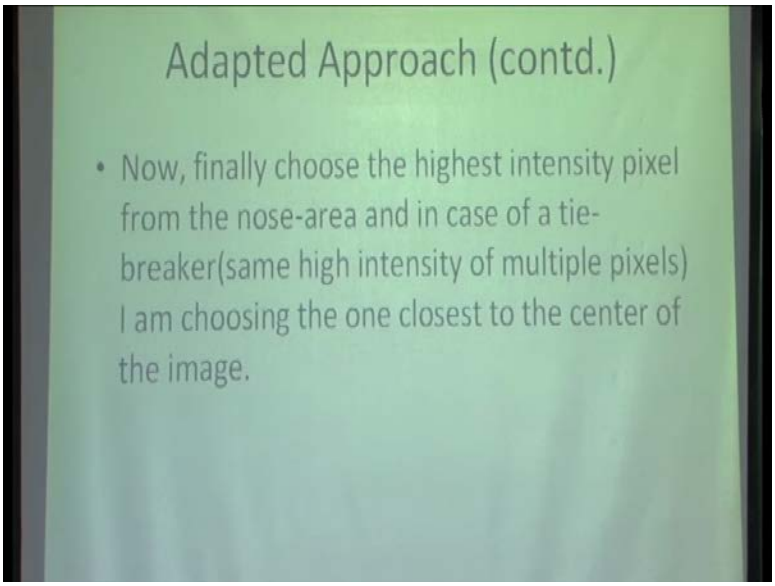

At the centre of the image that will keep the nose area and then after that I will choose the highest intensity pixel from the nose area that will be as. So, this is the example this is the real image, I will deduce the candidates than on threshold image then this will be the nose image and this will be the highest intensity nose tip pixel.

Scale actually, it is not exactly at the centre in certain cases you took the angular nose tip of the.

This is of the angle or the what;

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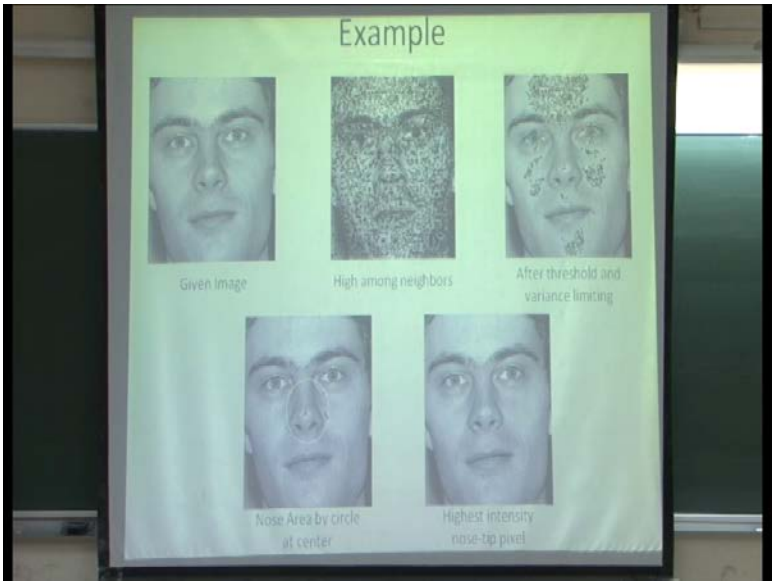

Because of the light coming here, that will be shifted here. So that is why I am trying to convert this image invert this image and use the nose tip area more so that I have too.

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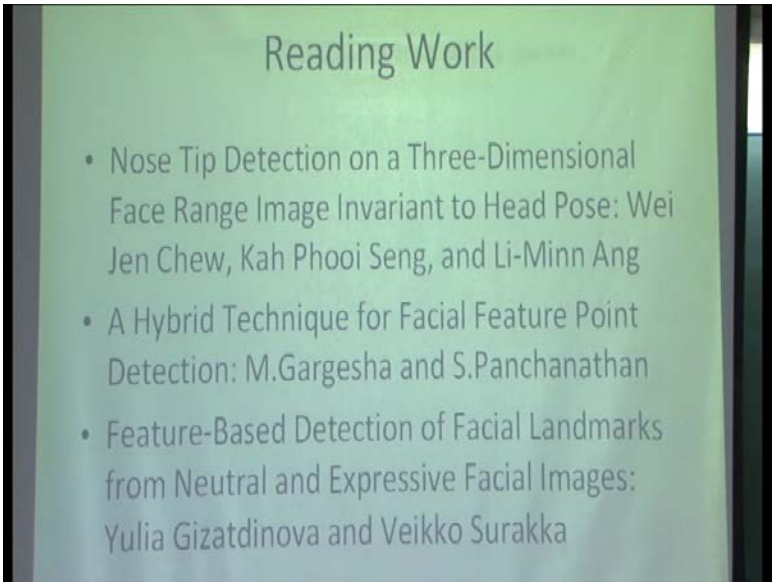

If I do not put the light source on the front assumption says that.

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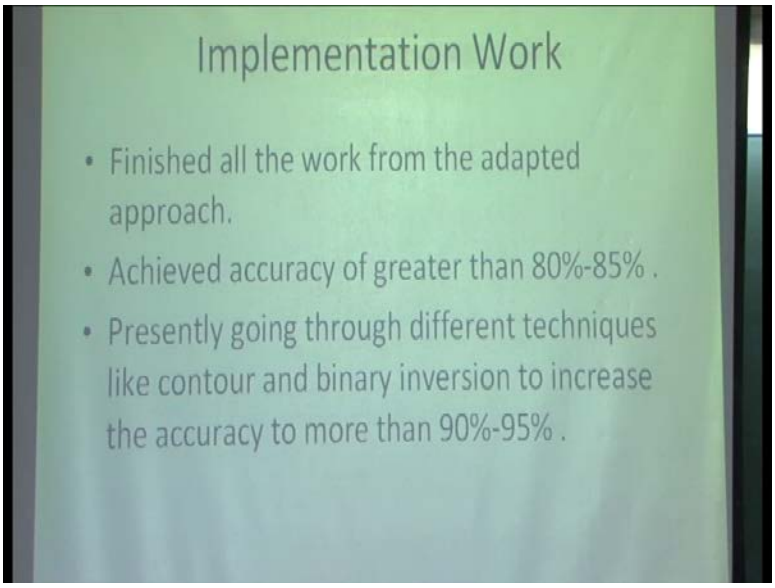

Nose intensity will be high the light is coming from the

From the front only so that intuition you have.

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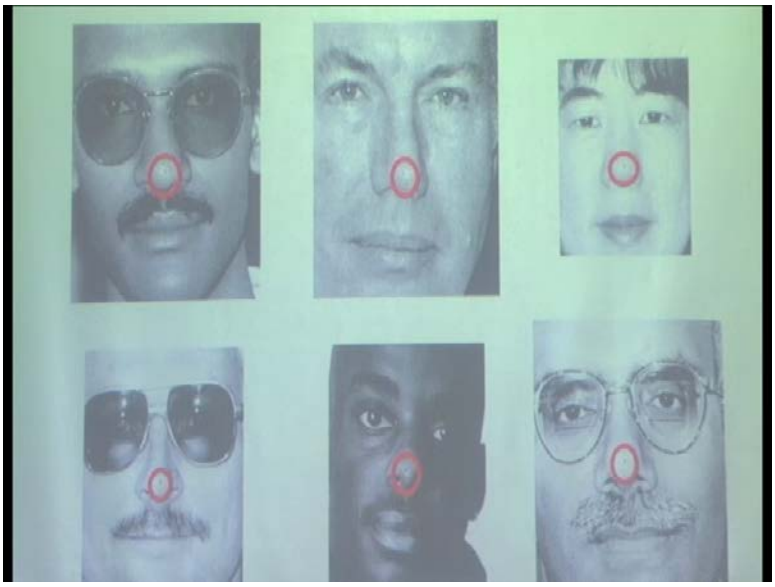

Only 1 thing is the frontal image is light source is on this is a required problem.

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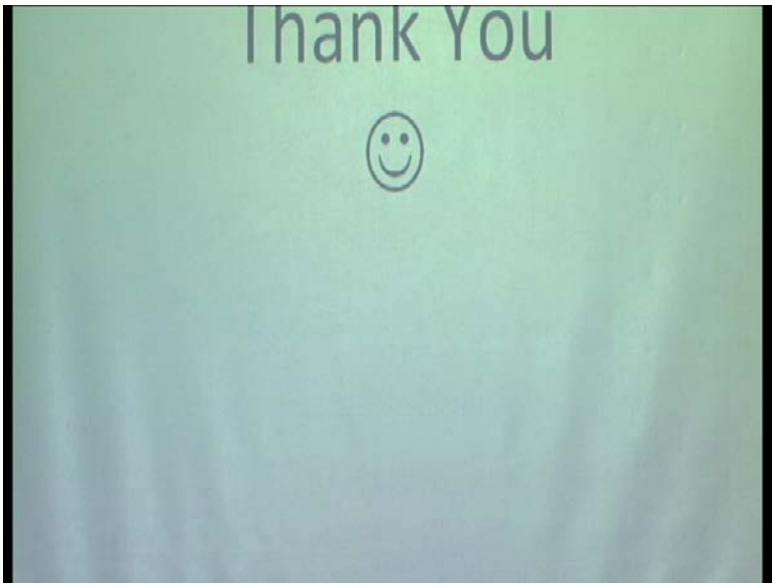

I will say that what whatever you have read, you have so what reading have you done.

Reading I have done on 3 d based so.

Three d face it would be easy.

So I wish that consulting, they are using the concept of energy there and I am using the concept of intensity.

The nose area and all are same component.

They may have 2 algorithms so those 2 you must take care of.

It works for people who wear spectacles or little tilted images are light as far as nose is the brightest 1. You have to put it up in the front statement and light source sometimes we say that image is taken without light source.

Assumption next is to increase the accuracy and at the same time what I want, you have that i d database so you can given in also the for testing, do not give the photographs or on 1 database where you can test more database .

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Extract region r o i from 4 slap finger print.

Four slap finger print so the first step, it is not he has rotated 90 images he has rotated and he the orientation of the image. It is not binarised, so the first step it is not first step is already binarised it binarised and downsized it and he has rotated 90 images rotated and he found out the word orientation problem.

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And is bounded with clusters,

Clusters are box here, It is not visible in this see and this is adjacent all these things are coming in clusters. So the entire thing is in box and then he had evaluated the boxes threshold this line is not given.

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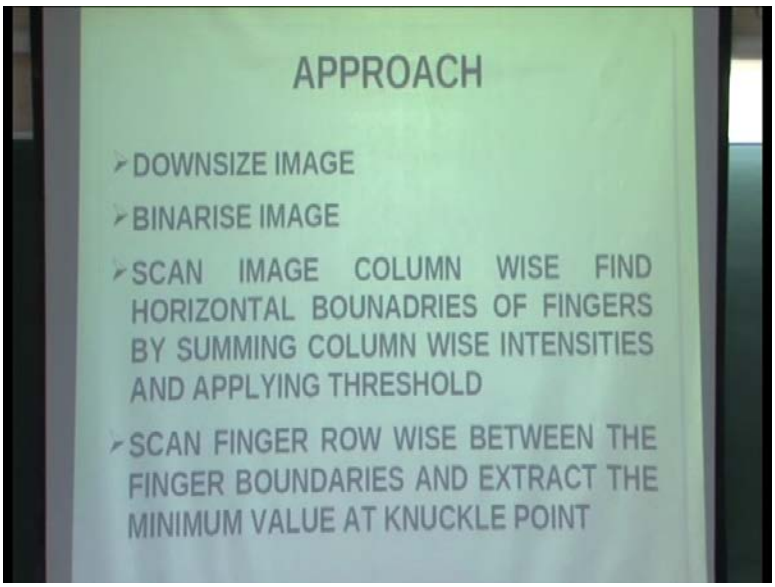

The problems would this 1 is that you assume that there exists only 1 problem. It has 5 percent of it takes lot of time, second problem is this, third problem is that 2 fingers are overlap then problem create faster than this. So, these are of the time overlaps the fingers and then and .

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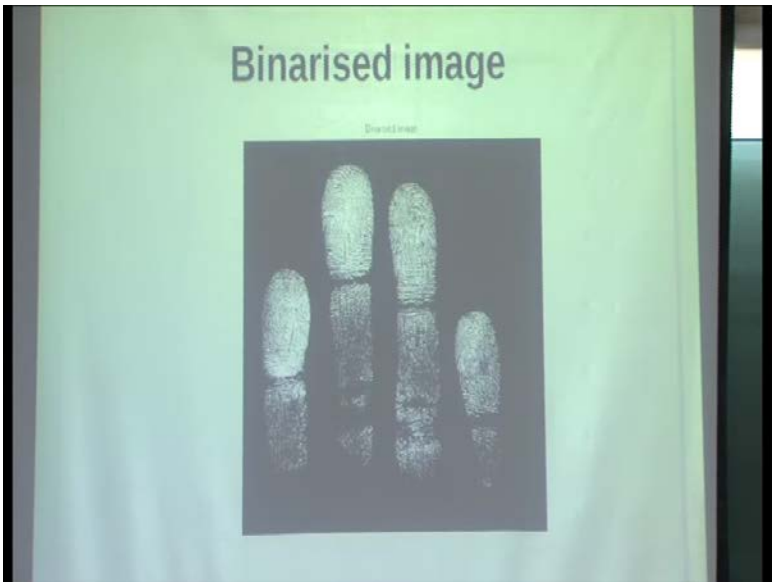

Binarised and the initially last time I explained it as scan it scan it row wise and the of intensity is column wise and whenever I get a 0 intensity.

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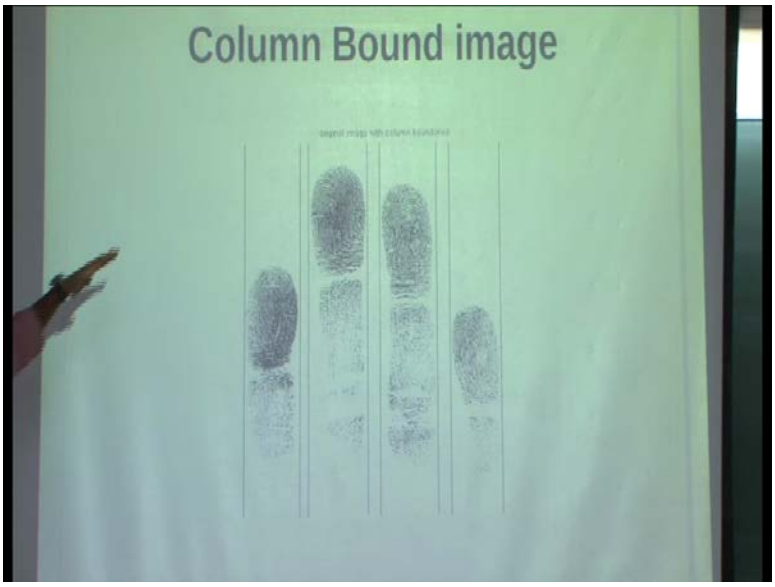

I take it to that, so that is this here we may and then each column this column is try to scan. This way and I and the intensity value has something with that. it is radius, there is a radiation, because this is the exact point of that.

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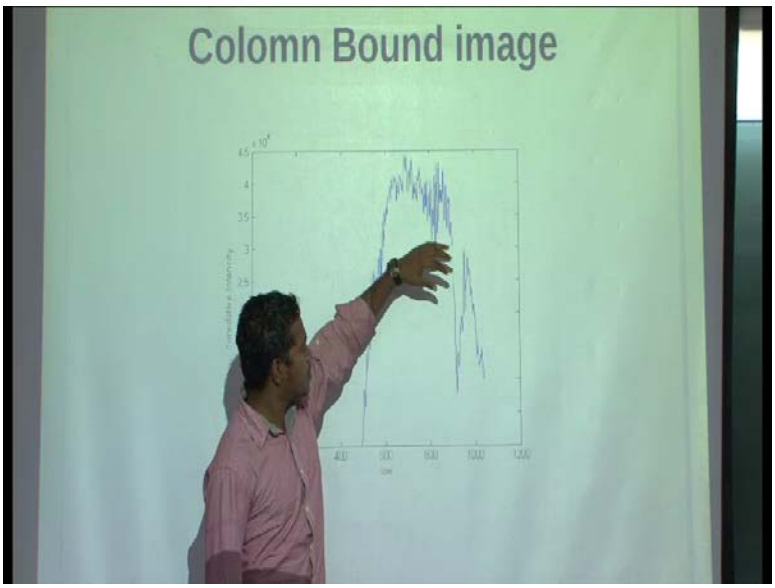

Exactly I have not connected with you.

I could not import database and segment.

You have to get it on database then you report by the segment accuracy compare it with that 1. You are not getting the other line radius testing is required just make now you have to work on that.

If you can save sometime that is important even, if it is a 4 finger duration 4 finger not but, check the size-check the size.

Check that how much nishant's 1 how much time is taking you will make that.

I have a question all the operating system is important it resembles face or lines face.

It is a window's space on quality of matching segmentation with the windows or that is why it is not working as it is used by that.

It is a windows and that also you can have at any is indirectly or on the segmentation or on the segmentation.

I will be using.

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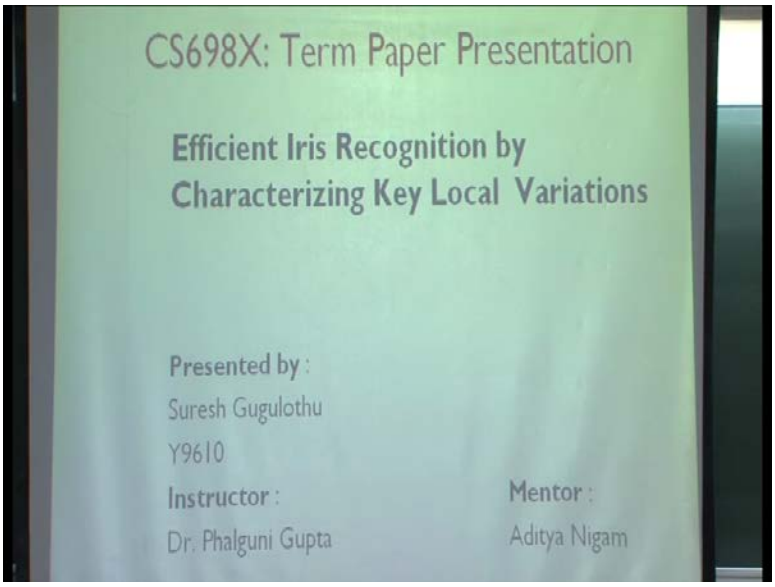

Iris recognition I will be using characterizing key local variations in the iris part.

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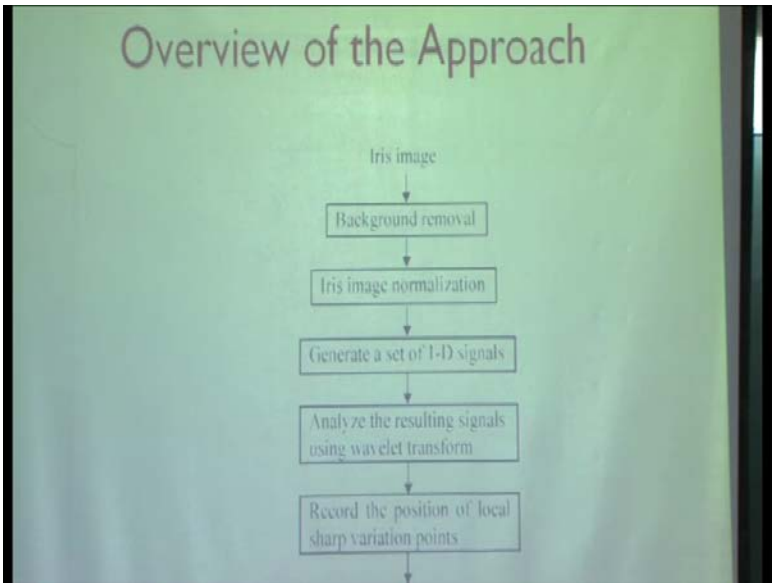

This is my paper and the approach of this up to and I am going to get up to normalized image. I have got the data from that and after that I will take the 1 day signals from the given data and I will extract the feature and I am going to match that. This is the core part of the implementation of my paper.

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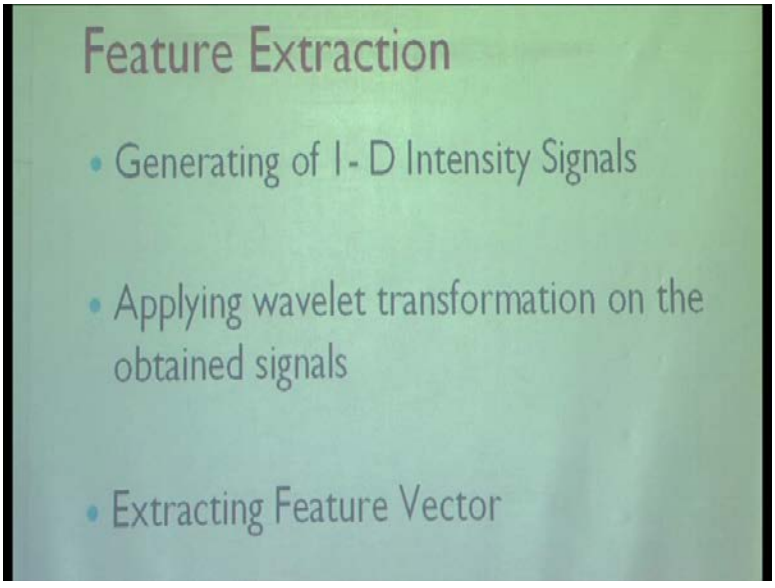

In 1 d I have generated that, 1 d signal and the paper was generally after the pictures. Generally someone some acquisition occurs, so in that paper they have considered only

78 percent of the portion is after the getting the non based image. So, in the paper they have taken 28 percent of the rolls this in order to extract the features from that image.

So, the signal generation is equals to 1 by m of sigma. So, I have to give a image, that is 64 cross 2 56. So, my signal sigma 1 will take of summation 1 by 5 bunch the images into 5 five rolls first 5 rolls divide it by or s of 1 will take ii 1 i 2 i 3 i 4 up to i 5 up to i5.

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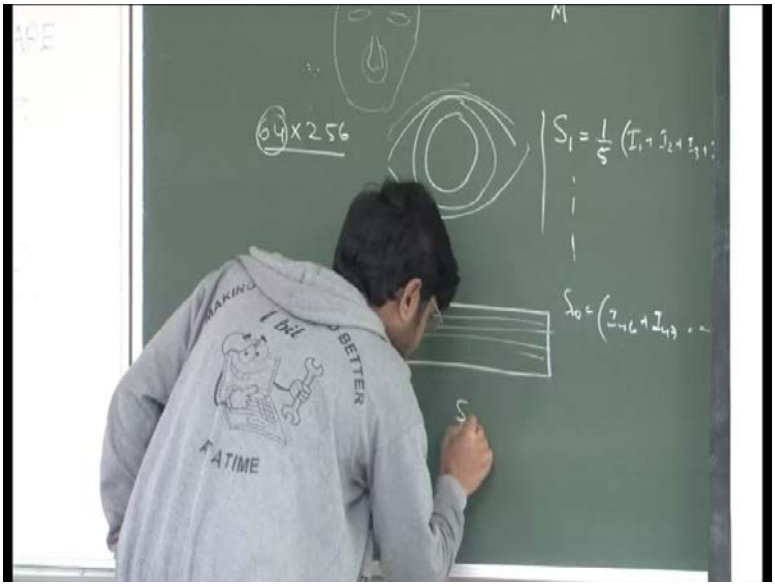
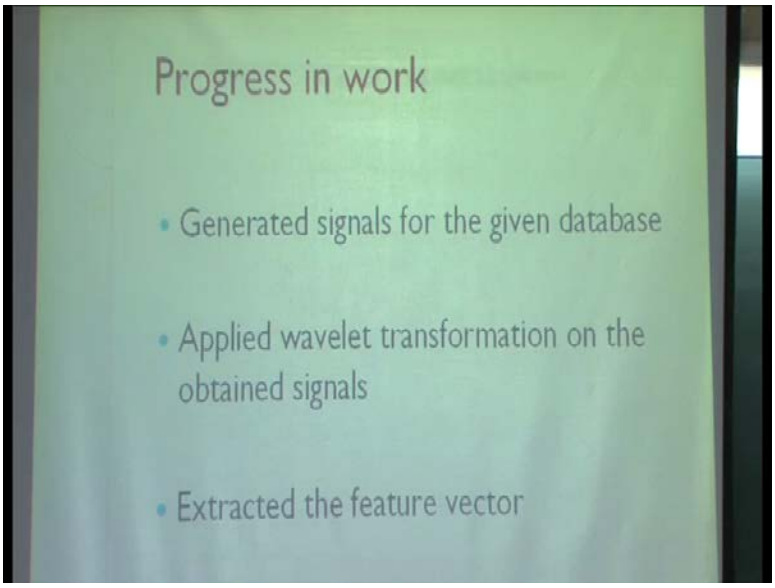


S 10 equal to i 46 plus i 47 till i 50 out of 64. I have considered 50 of them and I have the signal and I have got a signal matrix on the signal matrix. I have applied a wavelet transformation and I have extracted feature vector out of I have applied a wavelet signal and then extracted the feature vector.

(Refer Slide Time: 30:15)



So, in the wavelet transformation we are using the concept of, if there is any key radiation there exist 1 and 1 that thing in future I will take care of five rolls you have taken.

Yes sir;

And my how you'll use it in number.

Eliminating the faint radiations where.

Find the database.

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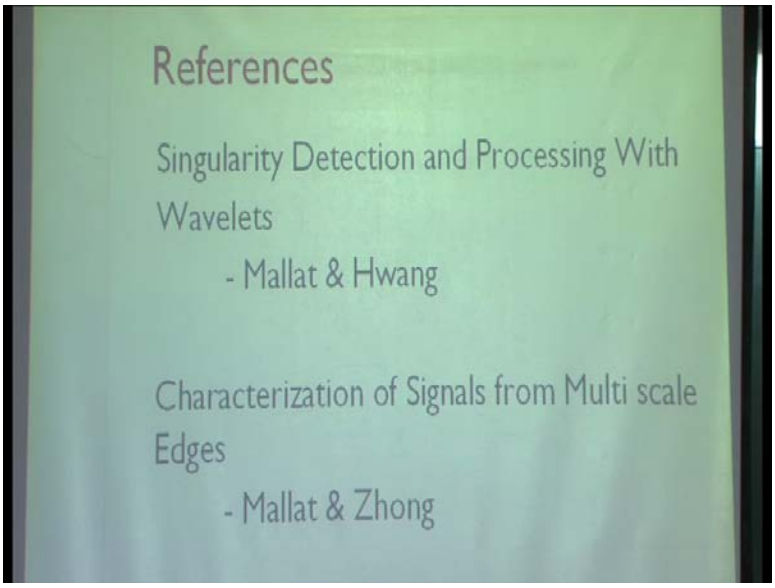

And they have taken as this and these are the papers that are related to rotation part as you are asking in the class last time since.

I am taking rotation first when the rotation is equivalent to translation, you have translated and shifted the match you have got the database.

Yes I have got the database and I have completed up to features that the rotation and my fingerprint ignition.

So what you have;

Sir have images segmented given segmented images.

So 4 finger prints you will get.

Four finger prints, I am getting problem. I got is first of all, I used minutiae points, I am not getting all the pictures from returning only the quality intension of each minutiae points but, I also need the number of ridges between that 2 minutiae points and which kind of minutiae points.

Someone told me it is quality that is why;

Who is someone?

No I took the minutiae, so I have used it in my to get the ridges even 2 minutiae points. Even I am having normal a grayscale image. So, I have converted to biometric image and-and it is a size of n points to 1 point and I between 2 minutiae points and this is 1 of my feature and some features I have like between difference between these 2 features minutiae points I have done.

Why and with a out of these 2 3 of them are 2 of them are not detected by the second 1 one of them is a new true minutiae point. Now how will you take that?

Sir actually that have gave me 2 papers and 1 paper is not considering and the second paper is taking care of that thing mean there are some minutiae points. Which are and there are some minutiae points which have some input image and they are ignoring that new ones and 1 more thing is taken care of this is some minutiae points are lying inside. The existing image but, some may be out of the region of interest and in the input image and all this minutiae here and image taken fingerprint like rotated and may not get this minutiae point here similarly, you will find some minutiae points in this but, this can be out of this region.

So, I will get the by the score, we are actually given some weight ages and also rotating.

Sir;

Rotating!

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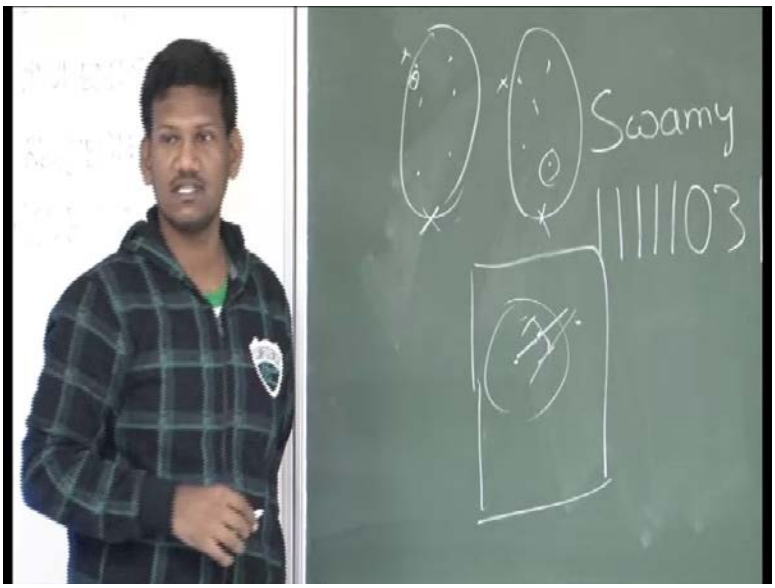

If you are taking fingerprint from you will get some. You will get more minutiae points and the fingerprint is given some. Yes sir; actual it is taken care of that second one.

No-no, you will solve that problem who is taking care of you want to try.

Yes I want I am trying that.

Partially what is that even segmented image earlier problem must be you want to add the matching score.

I am just trying to improve

Who is the tourist each?

Finger i will some scores an I am going to integrate it with 4 fingers.

Yes; this case if it is the case then you may think. It may create complicated things then it is a very difficult problem. You know, I do not know what you want, because you have give the pressure otherwise it is not possible to get the image and I will take care and can you take the like this.

Some-some changes will be there at least. So, all have to touch the area in the case of fingerprint, you can do this 1 that 1 however now you are telling between the 2 minutiae points. You have if 1 minutiae point is missing then you are in trouble.

I am this only for minutiae points' number of lines you are computing and in the second you need 1 minutiae point you are missing.

How you will know that 1 minutiae point is missing first of all the minutiae point is something like this as 1 more minutiae point is you have 2 or 3 minutiae point point next too. I will say these 3 are same and these are matching with this minutiae point when I check there is a rotation so this point is nonexistent here in this.

Somebody might say to whatever what you said that you have to calculate the system the 2 fingerprints then given the images.

You are talking about those that are complicated one.

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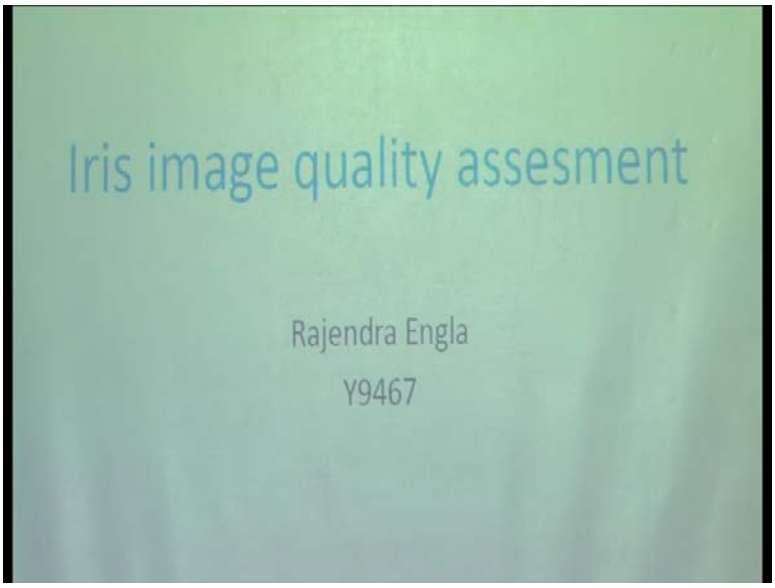
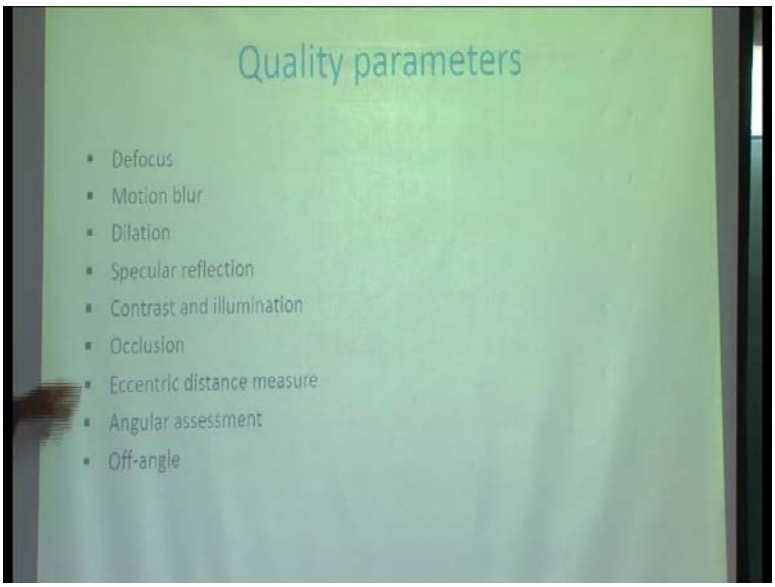


It is the matching score say very large get that of that. Suppose you got day 1 and so on what you are telling that you would not be able to solve as a but, if you tell but, if you can solve it then I do not have a problem you are working under that.

(Refer Slide Time: 45:11)



Sir iris image quality assessment;

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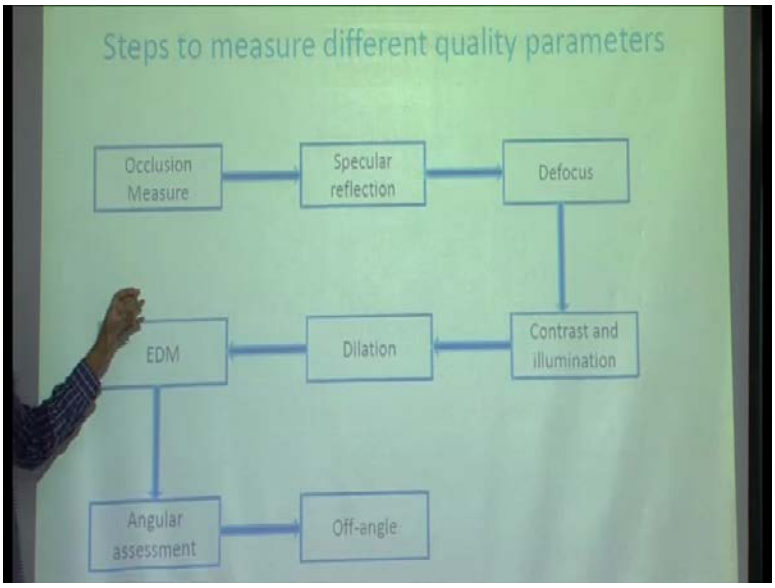

So, these are the different quality parameters. So I have these 3, I am also considering the order of the recognition different quality parameters.

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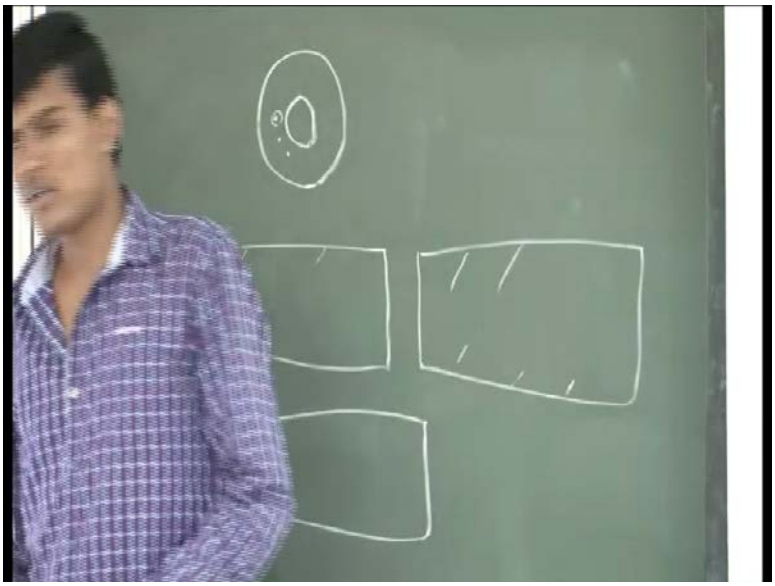

Because the secular reflection part effect the defocus, that is the iris image. There will be some very intensity ones and by considering the defocus I can I will not consider.

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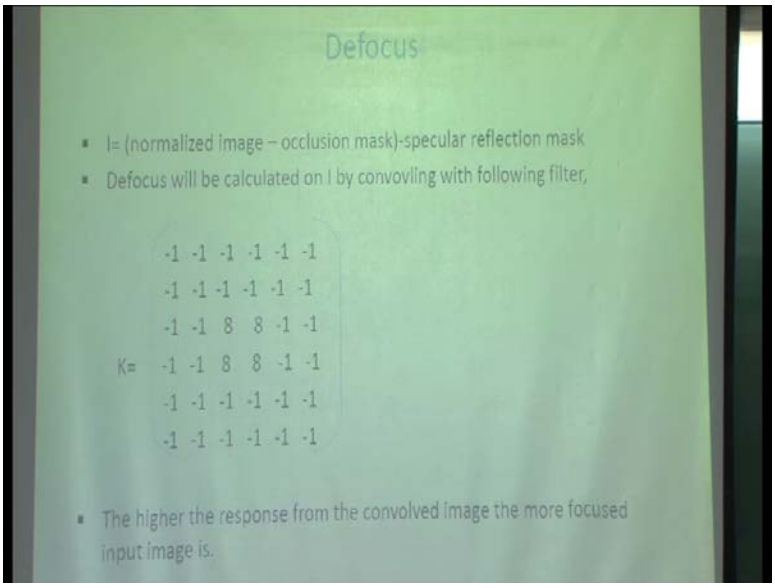

This part and also in the dilation contrast and illumination, it is that because of the specular reflection and say for the occlusion. I will use the occlusion mask, I am not the occlusion.

So even though I am input that and get the occlusion of I will subtract this image from this and I will. So I will ignore this point in this image and this image and this specular reflection can be occluded by this is a defocus order. I will this point but, I am considering the image after occlusion and this specular.

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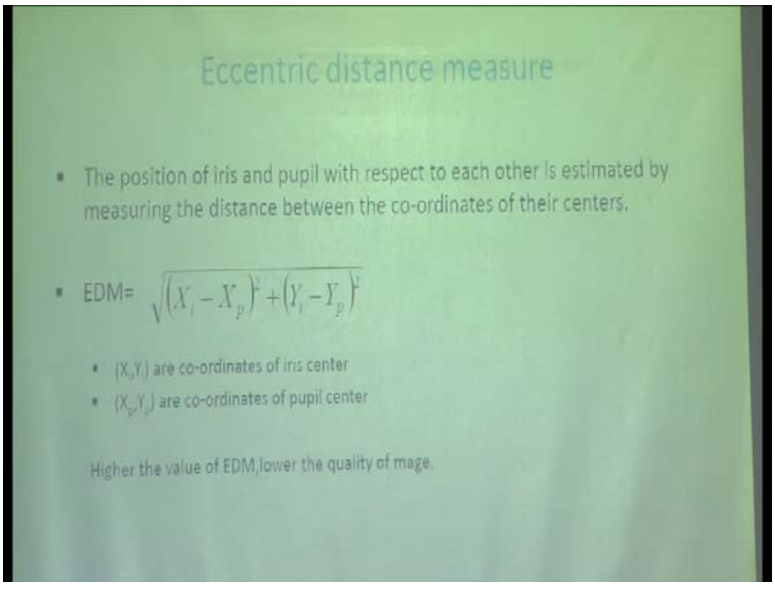

Algorithm is same but, the image is changed.

This part is different.

SO what you have.

The input image he has concerned is.

So, you are taking over the image, which is a image and marked by the and going to handling has gone to be done there you have considered because, the focus this half.

How do you show that your focus is 0 and you are using the same code? What data difference you take because you are proposing it will be better now. How are you sure that it will be better.

Because if there is some occlusion here.

That I understood that I understood that you are justifying this but; I am saying that at last you are previously having the results of. I will provide that is not a problem then you have to show that this 1 your thing is better than giving you the better results than that.

But I am,

But genetically you are saying that you are using all of those parameters but, applying it minus occlusion minus not minus.

Mass by the occlusion and also regular reflection also,

And circular reflection also rest of the thing,

We can also consider if, it is that these 3 can have 2 sectors to know sectors I have.

If you do not want to depend on occlusion masking you, can obtain only these 2 but, since we have occlusion the contrasting and this is a eccentric distance measure in case the iris is not always base the eye distance between the 2 points the lower this is that.

I did not know that you have 2 points there always be some distances now. You have to normalize you know say that higher is the quality the lower is the distance from higher

and lower these are the 2 terms related to what you have to find out. What is the maximum and what is the minimum?

While segmenting while identifying that will be the minimum and maximum,

So in this way, you can normalize this thing to 0 and 1 so you will be you will be saying that the if the distance between the pupil central and the iris central is this then.

In our segment i said cannot be greater than the ten.

So 0 to 10 so whatever you can divide it by 10 then you will be getting between 0 and 1.

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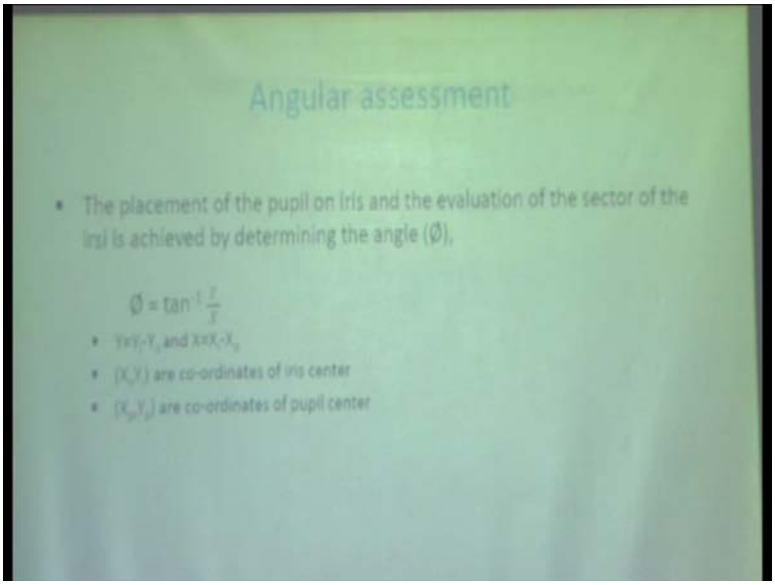
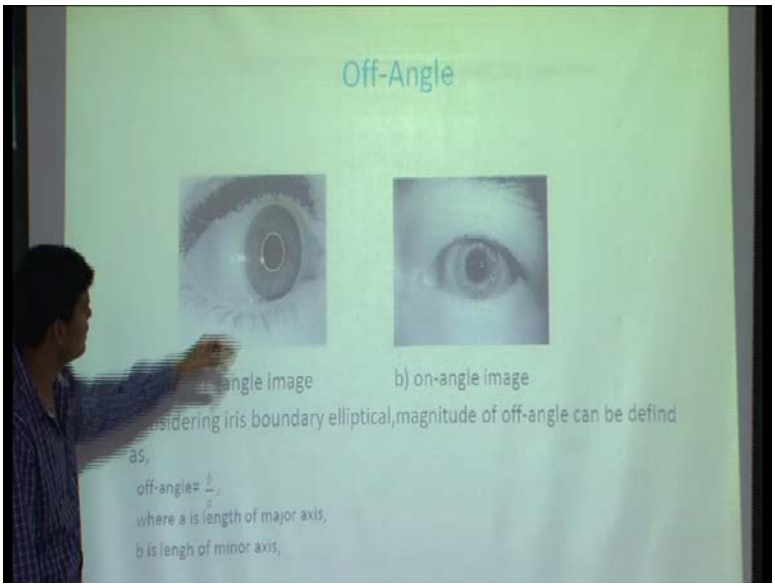


This is the angular assessment part, I am;

For this I wanted to see showing us that this 5 test images.

Minimum average and the maximum,

(Refer Slide Time: 54:50)



Yes.

This is the angular assessment,

See that distance between both of this say 5 or 6 and say 2 and you are saying that distance between 2 images are better but, visually if you see the full circular images full images would not be evident if you see the normalize.

It will affect the texture.

When you are taking the full image, it would not be affecting much but, when you are normalizing it but, that assumption this parameter so that is what i am saying that when you are the 5 press images show the full images will not be properly but, in for those images we are this x t minus x p and y t minus y p.

We can also that the recognition part, how will you it is affecting that.

Yes later it can be done but, visually as far as I am saying that visually if you wanted to say that this image is better than this that full image. You would not be able to say but, on normalize images you can say.

This is the angular assessment so the angle.

So how you quantize this angle that is the thing that you will have to think about that was you have got the pupil sentence you have got the iris sentence these are the 2 points.

I am reading about how it will affect.

How to quantize that is what I am saying that how to quantize you will get some value. Now you will have to quantize make it some value between 0 and so you will have to quantize and normalize it also.

This is that, I am considering the major axis of this image length of this part will be given so you are getting circular images.

Yes,

But elliptical images we will not be able to find the elliptical.

And by that you try to asses that it is off-angle.

Yes sir.

Off-angle then by what angle,

Yes you know angle it is not.

We assume that it is circular and then because of that.

So while segmentation I am writing the 2 sentence and 2 radiuses. Let us say it is that we should be getting but, let us say so this radius is known to us. So I will in this threshold it then I will in this radius step by step when that when that inner cell, we want to calculate the radius of inner cell. We want to calculate the inner radius inner circular inner circle and the outer circle fitting this image so.

Is that you have but, it is not correct so you implement it by.

Sir radius we have got from segmentation, it is the radius of the inner circle. It can be in between the inner. It can be higher than the major so if we threshold it since these points are high low intensity and I these all become 0 finalizing after finalizing. We calculate the number of points so the number of points which low-low intensity will be.

We have to formalize it properly, because that is the important thing. What are the images that you are suggesting?

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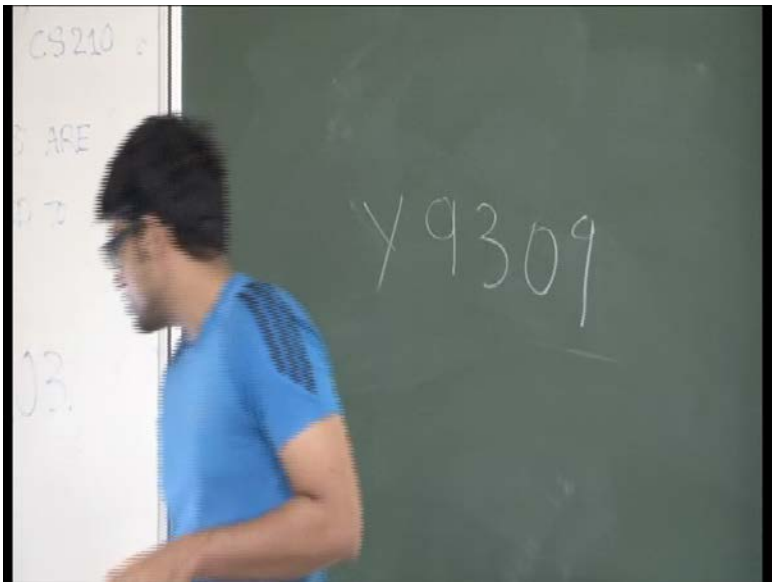

Good morning everyone, my project is on multi feature iris recognition scheme. So, this basically consists the paper basically advise of using 2 schemes 1 is the l b p or the local binary patterns and other 1 is b l o b or the binary large objects so.

So basically do I need to explain that.

No.

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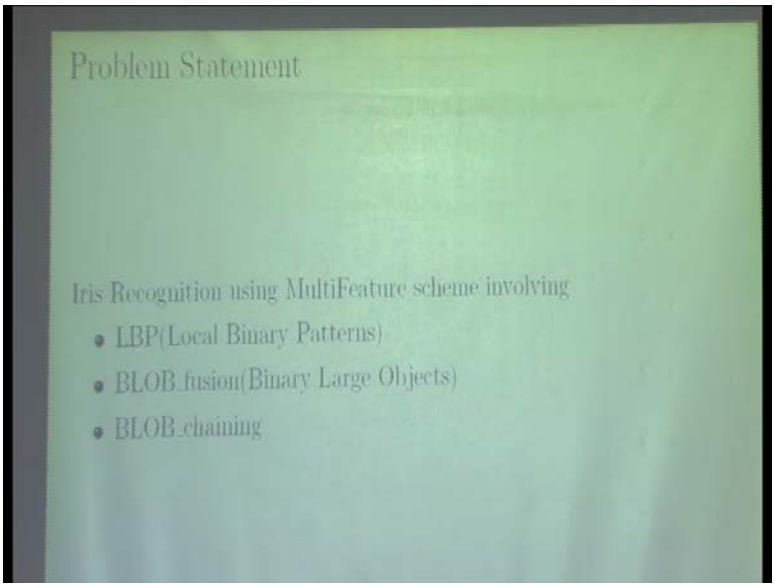

So the paper actually for b l o b the paper gives us 2 choices 1 is fusion and 1 is chain then fusion you create first multiple space scale pyramid and then take the maximum of each entry and then match this matrix with all other images and in chain what you do is. You chain all these matrixes and then for all the chain, you concatenate all the matrixes then compare it with other image.

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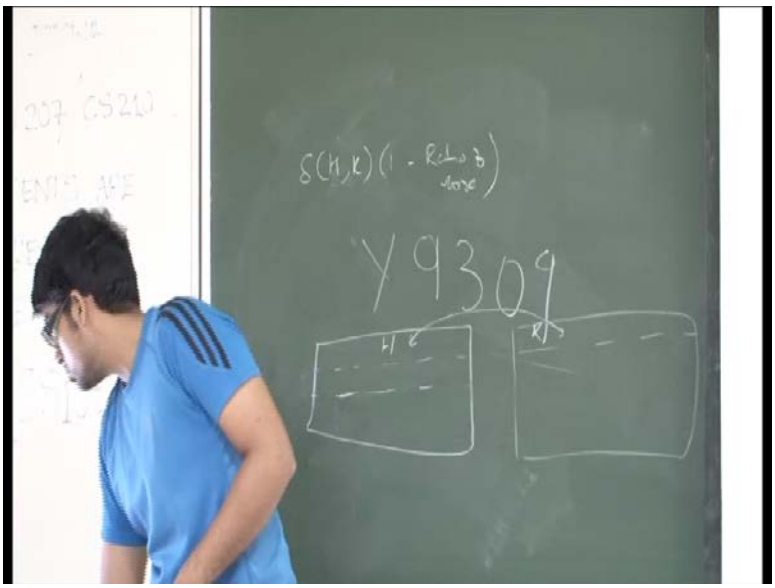

So this the approach which I have taken so first l b p histograms of image but, for in this paper it is advised that, this is the iris image you can spread strips and then for each

individual strip you compare it with. It will that only strip of other image and also the ratio of the noise pixels in this image so if this h histogram and then it will become into 1 minus ratio of noise pixels .

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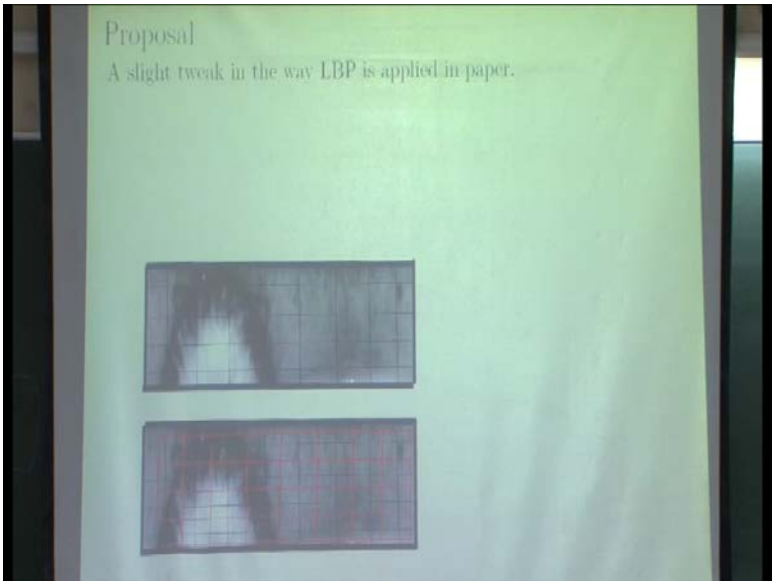

This is the basically that yes l b p histogram and then I have used uniform mapping and for blop fusion also. You take for the application of Gaussian the space you create a space scale pyramid and take maximum of feature in case of fusion and in case of chain. You just concatenate it and so I have read these 2 papers by noisy iris recognition scheme and local feature extraction for iris recognition. It is an automatic and I have implemented it but, just the curves are that wanted to propose that in this paper. They are breaking it into blocks and the individual blocks we are getting the l b p histograms and we are comparing this, where we are comparing all these blocks with other blocks or images.

So, what we can do is we can also from the midpoint of this. We can create these red blocks as we can see these blocks and the main advantage of this would be that for this part of. If that noise some noise is there in this part then it will be in this part in this part would not be neglected from that bigger block so this.

Rotating means taking image for shifting the pixels of the image and something like this like in by calculating the hamming distance. We always keep a offset that we can calculate correlation and anything like that also .

Now you will have to test that it will take time.

Yes,

And also you will have to give the parameters, because whatever parameter you have fixed now there are several parameters. So it will be giving you some accuracy but, if you change the accuracy.

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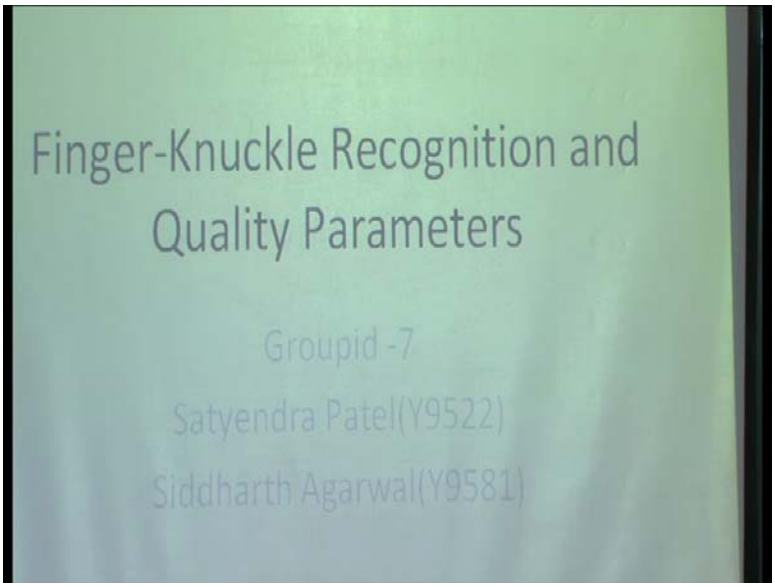

Good morning everyone, project topic is finger-knuckle recognition and quality parameters. So the approach is that we can use 6 bit approach, we will use 6 bits first 3 bits will be from the resize transform second order resize transform and the last 3 bits will be up will be generated, will be derive from comp code and then we calculate the hamming distance by extracting the features of that of that 6 bits and we haven't said the threshold yet less than the threshold then we can say that the image is match .

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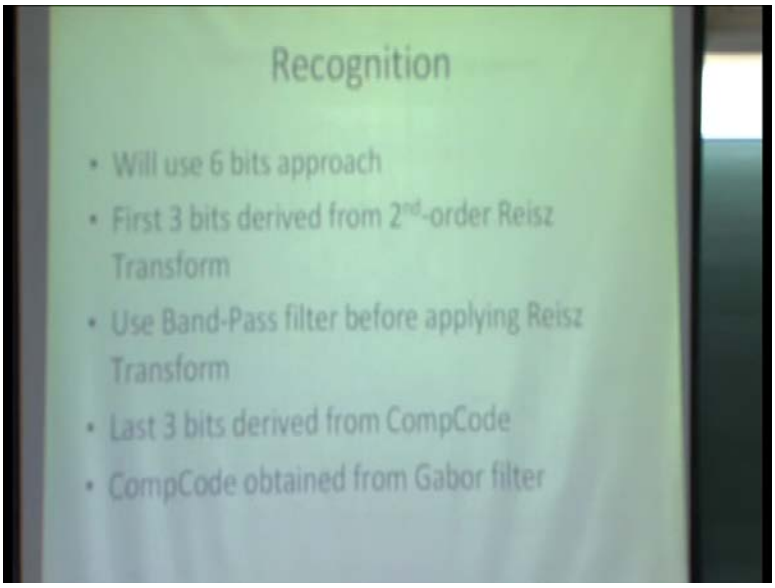

So, in the paper it is given that by using 6 bits the results the result we get is the best .

So you can say this entire thing in 6 bits structure so that is the optimization that you can do.

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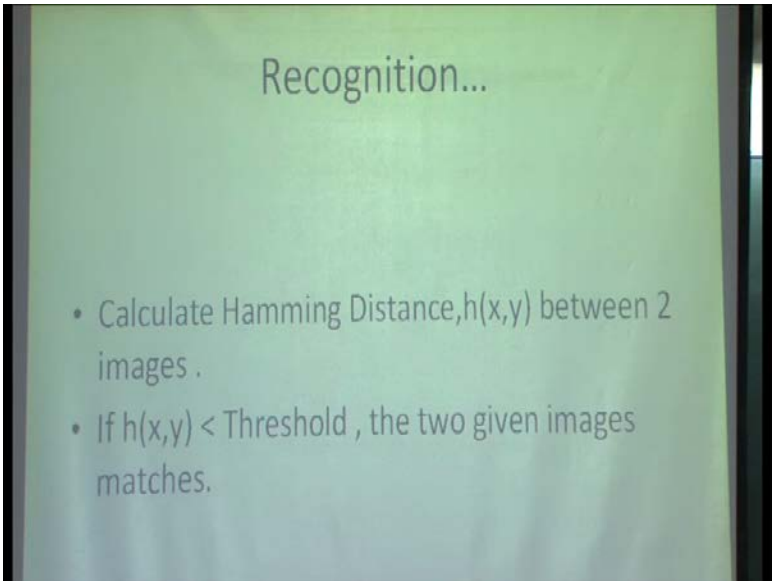

25 percent match am I, or not 2 bits zero's in everywhere.

For 1 pixel we have 6 value so we compare,

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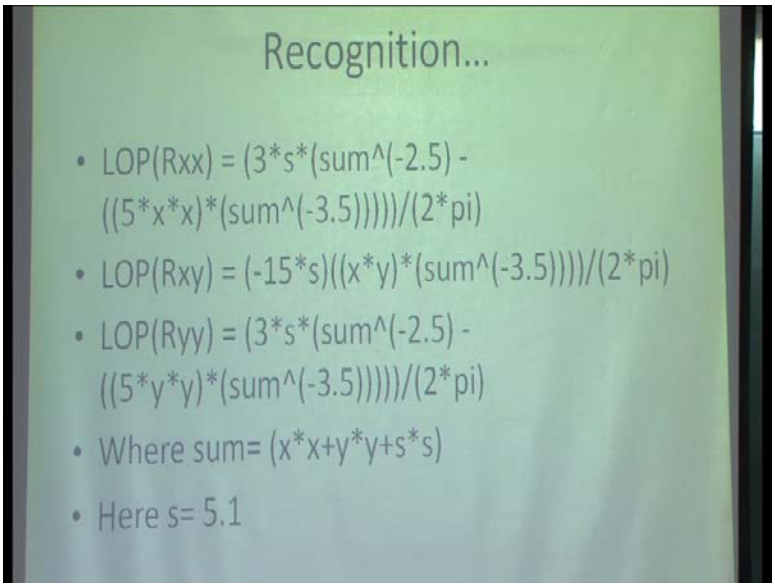

We are applying 6 bits we calculated from the image.

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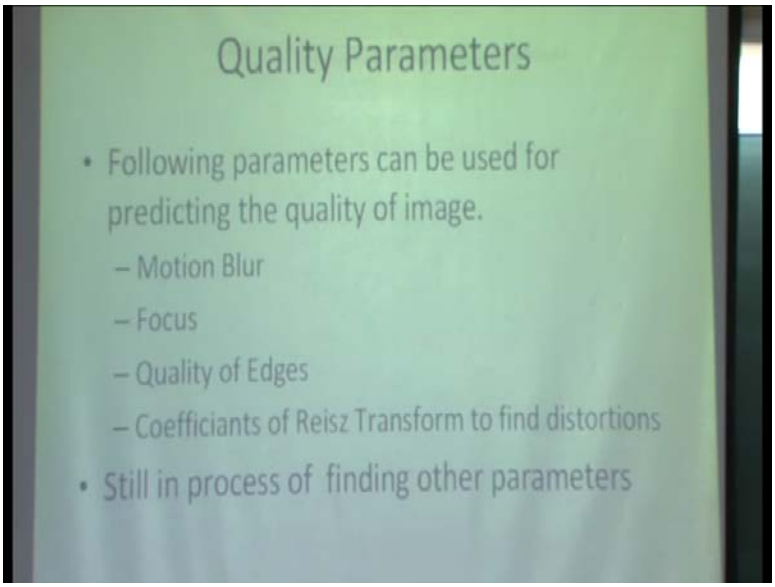

So it is a complete, so they are but, when they are absorbing they are.

We are doing it manually.

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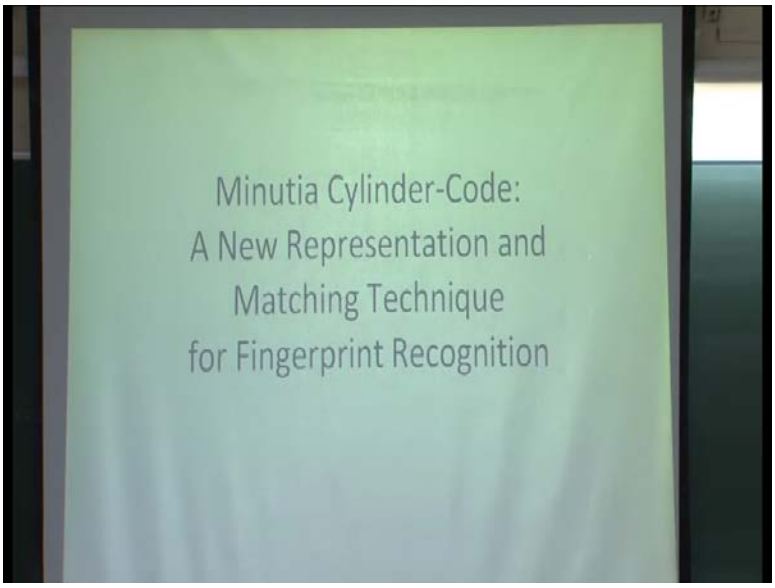

Sir what we do is that we find the average of them, yes sir there is a possibility but, what we do is that we set, we take a average of the data of the values 0 crossing for a maximum minimum value.

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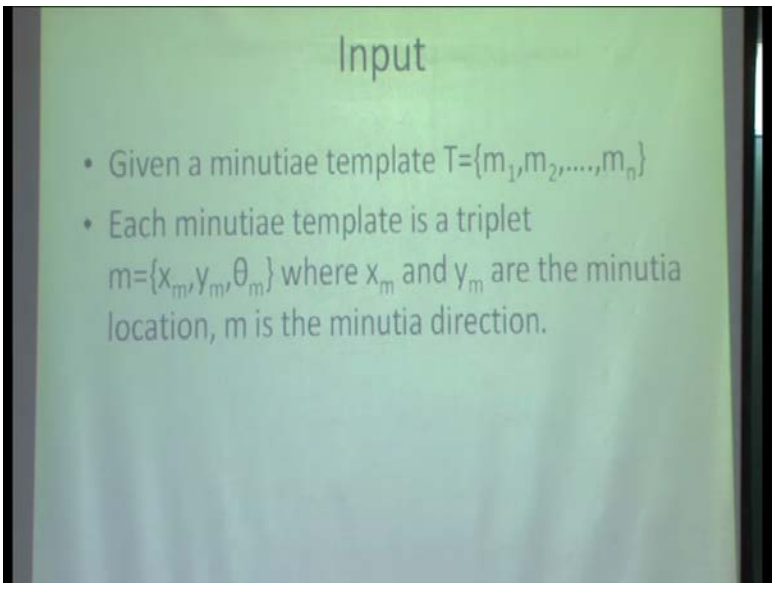

So, basically the code is running taking too much time so basically we are calculating this 3 into 3.

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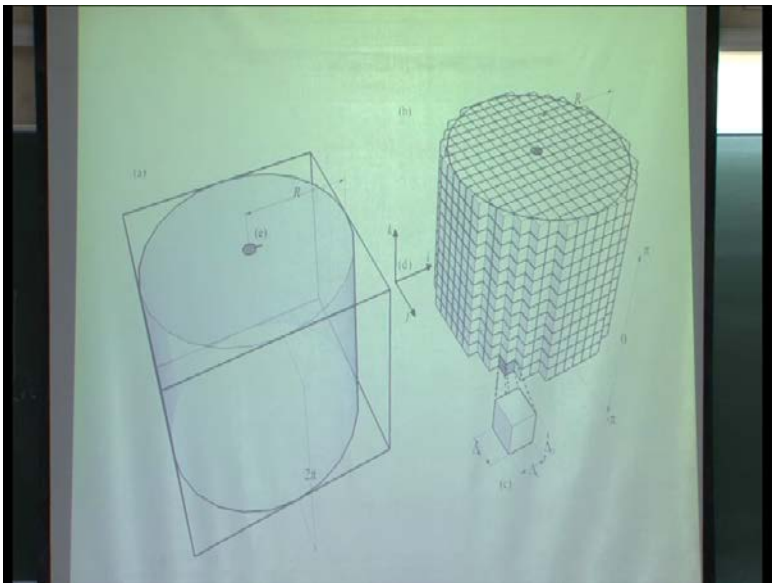

So, you can do 1 thing that you can say.

Sir we are storing that the value of the image.

Feature save all the features and then whenever you we are working in low data and also,.

Suppose we are given a set of image that is difference image and we are as given some other image, so basically we can compare those 2 images on the basis of.

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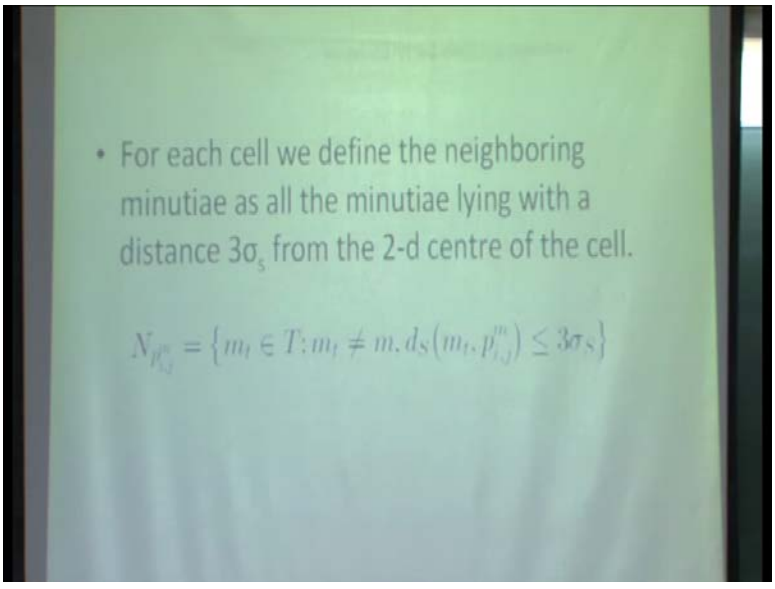

So you are saying that instead of finding out the quality depending upon the image you can also.

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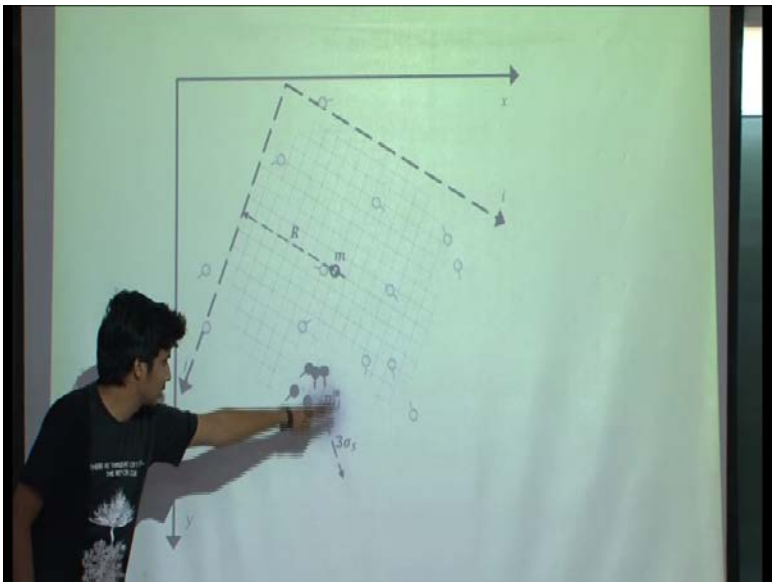

So, basically what the index is finally, we are obtaining is after a times of operation. We are taking multiplication-multiplication of all these coefficients and we are calculating. This coefficient as very, so basically at all crucial points and then we find index between 2 images. So we can basically check that how much basically we will apply in a and then we use.

Then how will you find out the intent.

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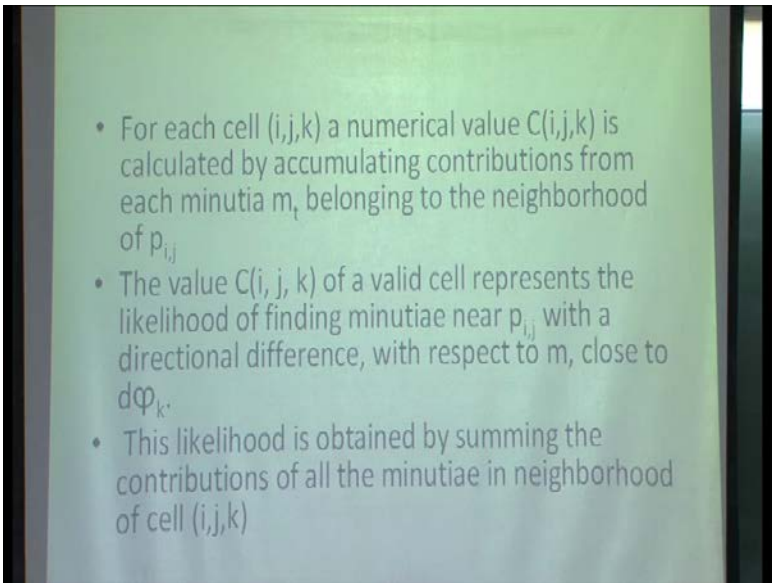
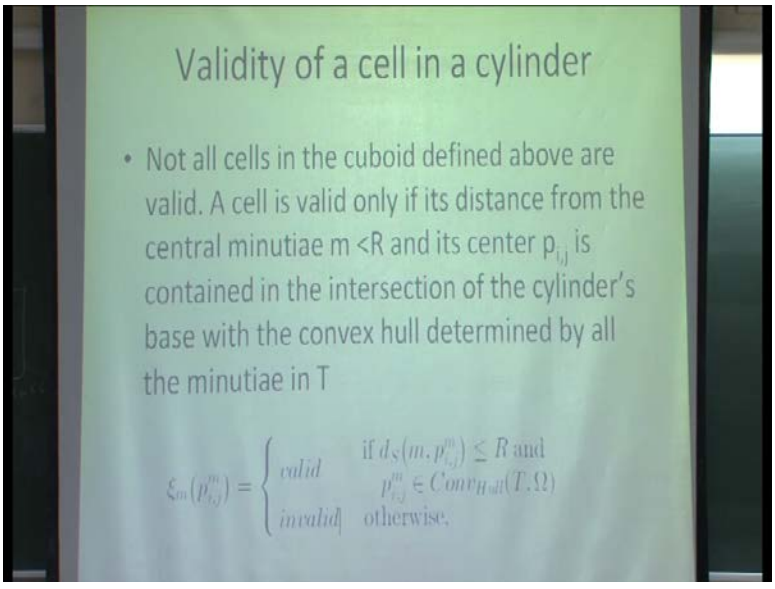


And then,

I think that in this way, you will also be contributing for what is the quality estimating. The quality of those for all these parameters at last we wanted to see that what the 5 best images are. What are the 5 worse images and what are the 5 medium level images with quality parameter. You have to show you are suggesting out of the whole database not, out of the whole database which are the 5 best image which are the 5 worse image which are that.

(Refer Slide Time: 1:28:04)



So you have to start coding all the.

You have got the data.

Yes sir;

Nine 0 zero two.

Nine 0 zero 2 please come.

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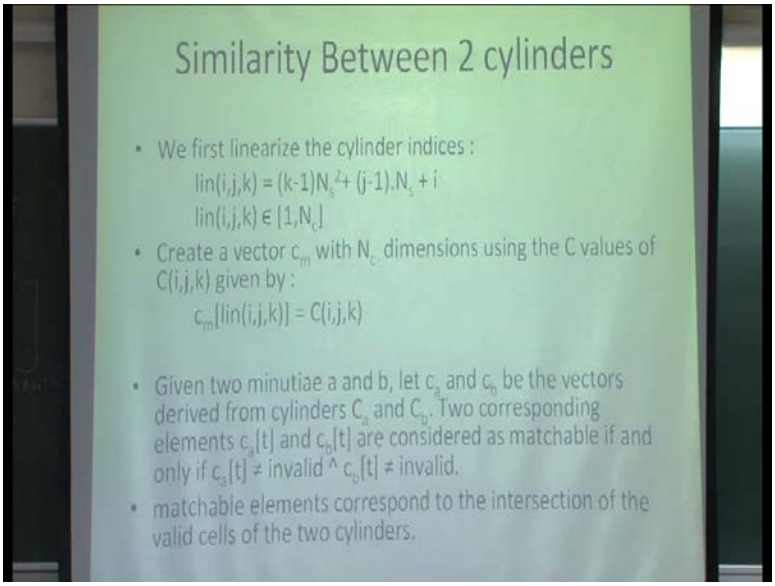

First part is finding out the minutiae points and second part is constructing cylinder and finding similarity. Yes I have presentation but, it is mainly based on second part on cylinders finding the true minutiae points such as straight some papers but, straight some paper and run the code which is available on the net. I am thinking I have to false minutiae points there are mainly, they will be located on the out boundary side's false minutiae points that is only 1 part, Himanshu forwarded.

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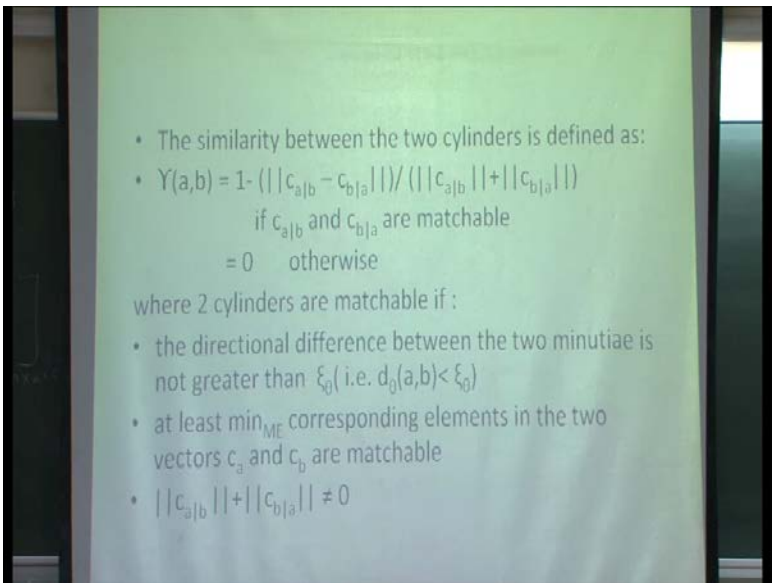
(Refer Slide Time: 1:29:34)



As I have said that you read that code and try to understand that what are the cases that code is handling and what are the more cases and then I think.

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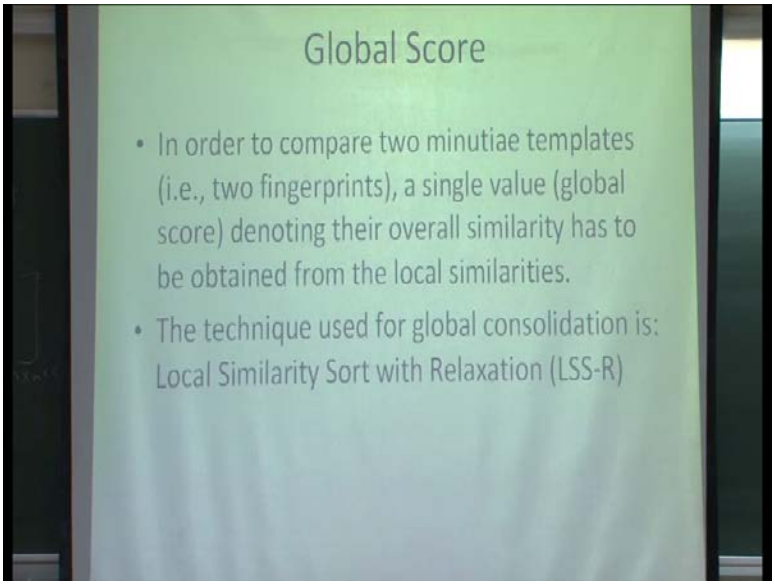

Cylinders coding I did not start.

You wanted to show them.

It is just the algorithm-algorithm that is present in the paper.

You have read that.

Yes I have read and Yes I have maintained its not still clear which I will do and which himanshu will do..

Find out the correct minutiae's.

Yes sir.

He will be coding the cylinders and matching.

Yes.

If it is means, I do not know if minutiae extractions will big or small if it is small. I will also work with him.

That is important, because you will be getting not only the previous minutiae on the boundary. So, from you will not be expected that even a fingerprint, you will be returning the minutiae's and now ensuring that these are the true minutiae's and after that he will be doing the minutiae cylinders and similarity himanshu singh agarwal.

Because sir I was not present in the first sir i have also studied the cylinders.

Sir what I am saying that now they both can work better that will be the thing. So you both work together and you have also go the database you have got that thing also, me rough.

For now we both have presentation of just cylinders.

So, the problem statement is that I will be given segmented images. It's basically that is why I am using the approach minutiae same approach minutiae template. The each minutiae point consist of and the orientation so first of all I calculate a local similarity between each pair of minutiae by constructing a cylinder around it and then I use a local similarity. So the local structure of the cylinder is of the minutiae is represented by cylinder cylinder-cylinder has radius r and the cylinder now we divide that. We can define the angle for each cell that is that.

Similarly we can calculate the center point of each cell now we define the neighborhood of each cell as the number of as the number minutiae points that lies in a distance of 3 sigmas from the center of the circle. So for example, this is that cell i j so the minutiae the minutiae points painted black are the neighborhood of that but, each cell we calculate a numerical value which represents the relationship between the cell and its neighboring minutiae.

So, this relationship is essentially the likelihood of finding the minutiae near p i j with a direction difference. Which is close to the angle of the cell, we do not need to consider all the cells need to consider only the cells which lie within that or determine or convex hull is basically in the smallest polygon within which we can enclose all the minutiae lying between the fingerprint template.

So finally, we get the index finally, we get a score corresponding to each of the cell of the cylinder. That is now each index will be represented by number between 0 to now we compute the similarity between 2 cylinders by subtracting the vectors obtain. That is a 2 arrays obtain from the 2 cylinders. We only consider those events for which both of the cells are valid.

And further we have signed similarity code 2 two cylinders if they are match able only if only if the direction difference between the 2 minutiaes not greater than a certain value as we are limiting the maximum possible orientation difference between the 2 cylinders second point is that at least a certain number of minutiae elements certain number of cells should be common in 2 cylinders otherwise we could have been matching based on the very small common area.

Finally we have obtained finally, we have obtained the local similarity between each pair of cylinders so finally, have it into a global score the technique local similarity sort with relaxation basic idea of this technique is that even a pair of minutiae a b if the global relationship between minutiae a is compatible with the global relationships between a and then the relationship between a and b is strengthened otherwise it is weakened.

So this algorithm basically describes, yes I have understood, I have understood but, sir it is too mathematical and hard to explain in the presentation finally, sir I will consulted the image score into global score.

I do not know you can do it.

These are the papers.