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Lecture - 41 Image processing – preliminaries

Hi, everyone. In this lecture we are going to start with some Image Processing. So, let me show you a quick video.

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So, this is a video I took with my mobile phone of a deflating balloon.

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So, it is a yellow coloured balloon ignore the light on the right, but essentially I fill the balloon with air and let it deflate and as trivial as it seems the question is how does the radius of the balloon change over time. And, I know what you are thinking I mean it is a very easy problem, but making the computer do this problem for you that is a bit of a challenge.

I have tried to make the video have a good contrast meaning visually speaking there has to be a good difference in the background and the foreground. So, obviously, the foreground consists of a bunch of things. It consists of my hand, it consists the balloon, it consists the switchboard, it consists the green light, it is a night lamp, but yeah it does consist of a bunch of things.

And visually we can clearly make out that the balloon is changing shape over time. And, additionally you can see the reflection of the tube light on the balloon as well over here. So, with all this the question is how do you make the computer do this? So, you may think ok I am going to find out the boundary of the balloon, find out the perimeter and do the thing like that.

But, let us see how we can achieve this using Python. Most likely for this lecture we will not have something in octave we will just keep things in Python because OpenCV is a

very robust library which helps us in image processing well. OpenCV originally is made for C++ once you require lot of speed you can start coding in C++, but in the end whatever you are doing in Python is actually calling the C++ routines or C++ programs in the backend.

So, it does not make a difference. And, this is just the starting of it I mean here it is a case of a balloon which is deflating. You could extend the same logic to for example, a vesicle. So, what is a vesicle? Vesicle is a membrane filled with fluid and if you have a solution which is hypertonic or hypotonic meaning the concentration of salt inside the in the fluid inside the membrane is different than the fluid outside.

Then either fluid will rush into the membrane causing it to swell or fluid will leave the membrane causing it to shrink such kinds of things. Once you observe under the microscope you can apply this kind of image processing techniques to analyze what their change of shape is and through this very simple example I will be demonstrating a bunch of image processing tools and I will leave it on to you to explore further.

And, such kinds of things are quite useful from the point of view of scientific computing because you know numeric's and experiments always go hand in hand. So, let me close this video. In this particular video we are not going to make use of the JupyterLab notebook environment, but rather we are going to directly write a code in Python.



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Many of you have been wondering whether JupyterLab is required for doing all this. The answer is no. We can directly do stuff with simple plain text file as well a simple ASCII encoded file as well.



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So, to create a new file I have navigated to my folder.

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So, I have opened up the command prompt over here and I have navigated to the folder in which I have all my files.

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So, it contains the file under question let me increase the size a bit so that you can ok. This is the local folder that we are working with alright fair enough. So, on the left I have opened up a new file. So, let us start writing the code.

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So, let us import cv2.

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So, cv2 is the name of the library. So, let me save it. I am going to save it in our folder lecture 41 like 41. py.

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So, we are going to save it as .py, which indicates it is a Python py, alright. So, import cv2. This helps in importing the modules which contain the image processing toolbox. This is for image processing then we are going to import numpy as numpy as np import mat well, we do not need my plot living in this particular case. So, never mind that. So, we are going to just need cv2 and numpy, right.

Then what do we do? So, first things first we have video we have a dot mp 4 file. Now, you could do many things you could use ffmpeg and export each frame of the mp 4 file to a single image. Yeah, that is the perfectly fine way of going about things. In fact, when you do high speed imaging that is how you would obtain your raw files. You would obtain each frame as you go.

You would not obtain a single video file, you will obtain a bunch of files. Those will be static images, but in Python if you have a mp 4 file you can read it like we had read the dot wave file in the case of audio processing. So, we have imported cv2, now we will use the cv2 video capture to load the file. So, we are going to do the vid = cv2.VideoCapture("balloon.mp4").

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So, the name of the file is ok VID, let me do one thing let me call it simply balloon, right.

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So, I will call this balloon.mp4. Now, once I have this what I need to do is, I need to sort of read each frame of this object vid. So, how do I do that? I say ret, img = vid.read() and this will help me acquire each frame. So, actually once I do this it will only read the first frame.

If I redo the same command over here it will read the second frame. So, it will read a read image and go to the next frame. Once I call this again it will again read it and go to the next image. So, each time I do this well now you can imagine you can do this in a loop to loop over all the frames, but yeah let me do that. Let me first show you how it is true.

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So, while TRUE meaning while it is True and while one I mean this loop will go on forever, then what you will do is you will capture the image and now you will display the image. So, how do you display the image? So, you would do cv2.imshow (i). So, you need to give it a title balloon deflate and then you will type down the name of the frame. So, the name of the frame is img.

So, once you execute this you have to do cv2.waitKey 1 which is to ask the computer to wait for a while 1 millisecond before going to the next. So, let me save this. Let me go over here. Let me do python lec41. py ok. So, there you go. So, now, you will say that ok wait there is a there is a error over here. So, why this error? And, the reason is once it runs out of frame to read the return value will throw an error. So, let us do that.

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Let me print the value of ret.

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So, you will realize that it is true and suddenly it goes false.

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So, then the loop exits that is a very hard way of stopping the loop, but in our case it checks out. It does not bother us in any way, it is fine ok. So, this is the basic loop that you will you are going to do. In case you want to increase the delay you can simply make it 100.

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So, then you will perceive the code running with a larger delay.

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So, let me run this. So, look, that there is a larger delay in the point.

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So, you can stop execution of this file by pressing control C. It sends a keyboard interrupt to the terminal and it close away. So, let me clear the screen, alright.

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So, we are going to keep it as 1. We are going to keep 1 millisecond delay. Now, whatever code has to be done is going to be inside this, alright. So, now, before going into the code section of it, we must sort of understand what an image is, right. So, let me make this while False, so that we do not go into this loop.

Now, I am going to do this; I am going to do this. So, I am reading one frame and after reading this frame I am going to print out what actually img is or np.shape (img), so that we know what this object actually is alright. So, I have saved this file let me execute this code. So, the shape of img is $720 \times 1280 \times 3$ meaning the camera that I have on my phone and I was recording it at 720p.

So, the frame size is 720×1280 and the 3 actually represent three channels. So, it has three channels, the three channels are b, g and r; blue, green and red. So, each image is composed of three stacks. So, one stack is the blue channel, one stack is the green channel and one stack is the red channel.

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So, if you have a photograph which is dominant in red, then the r channel will show 255. So, 255 means highest value of saturation. If you have something which is blue, the blue channel will show high degree of saturation; if you have intermediate colors you will have some linear combination of this colors, right.

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So, now let me show you what these individual channels look like.

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So, let me do this. So, b, g, r = cv2.split. So, this cv2 dot split command it splits the image into the three channels. So, img and astype float and the reason ok let me not do this first. Let me just do this and let me do cv2.imshow this will be blue channel, this will be b. cv2.waitKey 0, alright. So, let me execute this.

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So, this is the first frame and this shows the blue channel. So, in the blue channel, the yellow color appears as black, ok. In the blue channel, the yellow color appears as black ok.

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So, let me now print show the red channel. In the red channel the yellow color appears as white, alright.

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In the green channel, do not bother with the title of the frame. So, I have saved this. I am going to run this.

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It also appears as white, but notice how the bulb color has changed anyway.

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So, this is how we can split, but now what I want to do is I want to do some arithmetic on the image. So, what do I mean by doing some arithmetic on the image I will have some b, g and r. I would like to do some linear combination of b, g and r, so that the balloon is most prominent, the other things are not that prominent.

This means I am going to mix the channels and create a composite image. For that I must first export b, g and r as float this will help in doing the arithmetic later on. Now, once I have split the channels I am going to create a composite image. So, I am going to make isolated = c1*g + c2*b + c3*r, ok.

I am going to do this. Now, what is the purpose of doing this it will be clear. So, let me denote c1=1.5, c2 as 0 or I can write this c1 yeah, c1 = 1.5, c2 = 0, and c3 = 0.5. Now, what it is going to do it is going to take the blue channel amplified by 1.5 times and it is going to add it to the red channel by taking half of its magnitude.

And now, let us see how it looks. So, cv2.im cv2.imshow mixed channel isolated and in fact, before we show it as an image, well let us see I think this is going to throw an error. Yeah, it is not going to show anything and the reason is quite clear because this is. So, isolated is now of a data type float we must convert it from float to a data type. This is the data type image or integer.

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So, we must convert it. So, we will say isolate or we can simply say int. Let us see whether this works ok. So, it is not going to work. So, we have to do it the hard way that is isolated = isolated.astype(img.dtype). So, it is the data type of an image ok. So, this particular line means whatever the data type of an image is you typecast isolated back to it.

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Now, let us see whether it works.

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Perfect, it works. So, now, what have I done? I have removed the green channel completely and if you remove the green channel completely you are going to see a bunch of things loose fading out. So, there is no channel over here because this was predominantly green ok. So, you sort of see how mixing the channels kind of work.

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<pre>limpott mode and packing a characteristic dependence of the of pack limpott maps as np 3 4 vid = vc2.VideoQprore("halloon.mp4"); 5 ret, map = vid.read() 6 b, g, r = cv2.split(imp.astype(float)) 7 6 dislated = cl*b + c2*g + c3*r; isolated = isolated.astype 10 cv2.imbod*mixed charact*, isolated = isolated.astype 11 cv2.vaitKey(c) 13 14 while false: 15 ret, imp = vid.read() 16 cv2.imbod*fallon deflate*, img); 17 cv2.vaitKey(i) 19</pre>	d Manada Candingkan Cantan (base) C:Ubers\Admin\Dropbox((28, 128, 3) (base) C:Ubers\Admin\Dropbox((base) C:Ubers\Admin\Dropbox((108) C:Ubers\Admin\Dropbox((base) C:Ubers\Admin\Dropbox((base) C:Ubers\Admin\Dropbox((base) C:Ubers\Admin\Dropbox(Traceback (most recent call la file Teels(), iles 3, in isolated = int(c114 + c217 TypeEror: only iles1 arreys (base) C:Ubers\Admin\Dropbox((base) C:Ubers\Admin\Dropbox(nptal_codes\lec41>python lec41.py nptal_codes\lec41>python lec41.py nptal_codes\lec41>python lec41.py nptal_codes\lec41>python lec41.py nptal_codes\lec41>python lec41.py nptal_codes\lec41>python lec41.py nt): neobala> + c3rr); nb econverted to Python scalars nb econverted to Python scalars nptal_codes\lec41>python lec41.py nptal_codes\lec41>python lec41.py	
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So, now, let me do this let me do c3 as minus.

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Let me see how it looks. You see that we are slowly getting towards the edge ok. Forget about all this. The hand has become darker, but this is where the edge detection will going to work it is going to work really nicely.

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1 import cv2	Administrator: C/windowi byttemi2/cmd.exe	
2 import numpy as np		
3	(base) C:\Users\Admin\Dropbox\nptel_codes\lec41>python lec41.py	
<pre>4 vid = cv2.VideoCapture("balloon.mp4");</pre>	(720, 1200, 3)	
5 ret, img = vid.read()	(base) C:\Users\Admin\Dropbox\nptel codes\lec41>pvthon lec41.pv	
<pre>6 b, g, r = cv2.split(img.astype(float))</pre>		
7	(base) C:\Users\Admin\Dropbox\nptel_codes\lec41>python lec41.py	
8 c1 = 1.5; c2 = -2; c3 = -0.1;		
9 isolated = cl*b + c2*g + c3*r; isolated = isolated.astype(<pre>i(base) C:\Users\Admin\Dropbox\nptel_codes\lec41>python lec41.py</pre>	
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In fact, I have done the trial and error for this and if you do this, it is going to work out the best and this combination of channels was suggested to me by one of my students Shriyansh Darshan. He is a very talented person in all these kind of things and he helped me figure out the different biases of the channels ok.

(Refer Slide Time: 18:37)



So, now let me run this and show you how it will look. So, once you do this, it looks as if that edge is very distinct, alright.

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So, things are going in the right direction ok, alright.

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So, actually before converting into sorry, from the image what it seemed like there was some saturation in the image like these areas are saturated.

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1 2 3 4 5 6 7 8 9 9 10 11 12 13 14 15 16 17 18 19 20 21	<pre>import numpy as np vid = cv2.VideoCapture("balloon.mp4"); ret, img = vid.read() b, q, r = cr2.split(img.astype(float)) cl = 1.5; c2 = -2; c3 = -0.1; isolated = ocilify isolated (b, 255) isolated = isolated.astype(img.astype) cr2.imshow("mixed channel", isolated) cr2.imshow("mixed channel", isolated) cr2.withey(0) maile False: rc2.withey(ballon deflate", img); cr2.withey(i)</pre>	(base) C:\Users\Ad (720, 1280, 3) (base) C:\Users\Ad (base) C:\Users\Ad	<pre>Main[Dropbox\nptel_codes\lec41>python lec41.py main[Dropbox\nptel_codes\lec41>python lec41.py dein[Dropbox\nptel_codes\lec41>python lec41.py dein[Dropbox\nptel_codes]lec41>python lec41.py dein[Dropbox]nptel_codes]lec41>python lec41.py</pre>	
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So, we can always clip the image to something between 0 and 255. So, typically the images the integer values are going from 0 to 255 meaning there is 256 levels of information ok. So, we are going to do that. So, isolated = np.clip(isolated, 0, 255) and we are going to clip isolated actually we are going to clip it before type casting it to the data type. So, we are going to clip it between 0 and 255. So, let us see what this gives us

and this should give this gives nothing. I have put in the coefficients incorrectly. So g, b ok.

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So, let us see.

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Yeah, ok. So, once you mix those channels up this is what you obtain. You obtain an image where everything is sort of darkened out accepting for the balloon and the small light shadow of the fluorescent tube onto the image. Well, that is not going to be of a lot of concern to us because in the end it is going to work out quite well.

So, as you can see in that such a channel mixing gives you a nice sort of binary feel to it. This is not yet binary because the data type varies from 0 to 255 we have clipped it like this, but the important thing is once you threshold this image it is going to look much better.

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8 c1 = 1.5; c2 = -2; c3 = -0.1;	(base) C:\Users\Admin\Dropbox\nptel_codes\lec41>python lec41	
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So, what I am going to do is I am going to remove this for now or I am going to keep it over here because we will require it later on. So, I have obtained an image which is which seems like it can help even a blind person figure out what the two things are. You can see white and you can see black.

So, that the boundary is the balloon. Now, what you need to do is you need to do two things first is you need to threshold an image. So, what is thresholding an image? So, let me (Refer Time: 22:05) show you what thresholding means.

(Refer Slide Time: 22:08)



So, imagine you have and a signal like this ok and you say that this is my threshold value. So, what it will do is all the values below this it will put to 0, all the values above this threshold it will put to 1. So, this is effectively binarizing your image. It is going to convert whatever image you have to either low or high ok.

So, if you have a smooth variation like this, it will convert it into something which is sharp ok. So, imagine you have an image or earth signal that goes like this and if this is the threshold value ok, then what will happen? The signal will be looking like this ok that is what it is. You are going to convert it into binary, alright. So, let us go over here.

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11	isolated = isolated.astype(img.dtype)	
12		<pre>in\Dropbox\nptel_codes\lec41>python lec41.py </pre>
13	ret, imgth = cv2.threshold(isolated, 50, 255, cv2.THRESH_BINARY)	line 9 in (module)
14		c1*b + c2*g + c3*r);
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Now, let us do that thresholding. So, we are going to have ret, imgth = cv2.threshold. Now, you are going to pass isolated to it; the image that on which you want to apply the thresholding and you are going to give the lower value of the threshold and the where you want to threshold it to.

So, if I want to threshold it all the way to the top I can do that. I can say any value which is larger than 50 is going to be thresholded to 255 and the type of thresholding. So, we can have various kinds of thresholding and the type of thresholding is going to be THRESH BINARY meaning it is one eventually converted to 0s and 1s.

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ours : Ge	tting Started		
	Gaal		
	Understand what contours are.		
	Learn to find contours, draw contours etc.		
	You will see these functions : cx.findContours(), cv.drawContours()		
	What are contours?		
	Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful		
	tool for shape analysis and object detection and recognition.		
	 For better accuracy, use binary images. So before finding contours, apply threshold or canny edge detection. 		
	 Since OpenCV 3.2, findContours() no longer modifies the source image but returns a modified image as the first of three return parameters. 		
	. In OpenCV, finding contours is like finding white object from black background. So remember, object to be found should be white and background		
	should be black.		
	Let's see how to find contours of a binary image:		
	import numpy as no		
	Jagort cv2 as cv		
	im = cv.inread('test.jpg')		
	ret, thresh = cv.threshold(imgray, 127, 255, 0)		
	<pre>im2, contours, hierarchy = cv.findContours(thresh, cv.RETR_TREE, cv.CHAUN_APPROX_SIMPLE)</pre>		
	See, there are three arguments in cw.findContours() function, first one is source image, second is contour retrieval mode, third is contour approximation		-
	method. And it outputs a modified image, the contours and hierarchy, contours is a Python list of all the contours in the image. Each individual contour is a		
	Numpy array of (x,y) coordinates of boundary points of the object.		
	Note	6	
	We will discuss second and third arguments and about hierarchy in details later. Until then, the values given to them in code sample will work fine for all	4	2
	images.	P	-
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So, let me show you how they look.

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	Introduction to OpenCV	
	Learn how to setup OpenCV-Python on your computer!	
	Gui Features in OpenCV	
	Here you will learn how to display and save images and videos, control mouse events and create trackbar.	
	Core Operations	
	In this section you will learn basic operations on image like pixel editing, geometric transformations, code optimization, some mathematical tools etc.	
	Image Processing in OpenCV	
	In this section you will learn different image processing functions inside OpenCV.	
	Feature Detection and Description	
	In this section you will learn about feature detectors and descriptors	
	Video analysis (video module)	
	In this section you will learn different techniques to work with videos like object tracking etc.	× 1
	Camera Calibration and 3D Reconstruction	
	In this section we will learn about camera calibration, stereo imaging etc.	
	Machine Learning	
	In this section you will learn different image processing functions inside OpenCV.	
	Computational Photography	
	In this section you will learn different computational photography techniques like image denoising etc.	
	Object Detection (objdetect module)	ē
ecs.opercy.org/3.4/67/dH	Interial sy table of content, content is service unit will learn object detection techniques like face detection etc	

So, let me just show you the documentation of this so that it is clear what thresholding means.

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	For example, consider the below sample:	
	<pre>>>> x = np.sint8([250]) >>> y = np.sint8([10])</pre>	
	>>> print(cv.add(x,y)) # 250+10 = 200 => 255 [[255]]	
	>>> print(xey) # 250+10 = 200 % 256 = 4 [4]	1
	This will be more visible when you add two images. Slick with OpenCV functions, because they will provide a better result.	
	Image Blending	
	This is also image addition, but different weights are given to images in order to give a feeling of blending or transparency. Images are added as per the equation below:	
	$g(x)=(1-\alpha)f_0(x)+\alpha f_1(x)$	
	By varying α from $0 \to 1$, you can perform a cool transition between one image to another.	
	Here I took two images to blend together. The first image is given a weight of 0.7 and the second image is given 0.3. cv.addWeighted() applies the following equation to the image:	
	$dst = \alpha \cdot img1 + \beta \cdot img2 + \gamma$ b	
	Here γ is taken as zero.	
	<pre>img1 = cv.imread('ml.png') img2 = cv.imread('opency-logo.png')</pre>	
	dst = cv.addeighted(img1,0.7,img2,0.3,0)	
	(v. issha('6t', 6t') (v. witter(0) (v. detroyAlkindow()	
	Check the result below:	ē
		40

So, this is the channel mixing that we spoke about it is called as image blending. So, this is a bitwise operation we do not need that ok.

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So, this is what we are doing. So, if this is the original image. If you do it as a binary thresholding, if this is the threshold gray scale then all the gray scales below that will be put to white and all the gray scales above that will be put to black. This is what is going on and there is also a mode called binary inverted. So, it is going to take that threshold and invert it.

So, it is quite, it is quite useful in case you want to make masks or whatever. So, in order to make masks the useful threshold functions are TRUNC, TOZERO and TOZERO inverse, meaning if you put TOZERO it will put everything below a certain threshold to black, but above it is going to leave the image unchanged ok. These are also quite important in case you want to make masks. Well, so, here we going to convert it to binary.

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And, let me show you the image after converting it to binary, alright. So, let me execute the file. Oops I forgot to write the name this should be waitKey, alright.

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So, this is the thresholded image.

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This was the original image.

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<pre>6 b, g, r = cv2.split(img.astype(float))</pre>			
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In fact, let me remove this, so that the two windows are open side by side.

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So, this is the mixed channel thing and this is when it is converted into binary, alright.

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So, let me close the two windows. Let me in-fact, show you what the value of image threshold will be or the maximum value. So, let us say print np.max imgth. So, let me run this.

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So, it is 255. So, it is converted it to max and taken the other thing to 0. It is binary because there is only two levels that is 0 or 255 great.

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So, well there is a small thing I would like you to look over here is this little hazy boundary. We do not; we do not want that hazy boundary; we want it to be nice and smooth. So, in case you want to do that you must do what is called as a blurring operation on the image ok.

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So, let me keep it like this, let me blur the image, alright. So, this is the thresholded image. Before thresholding we are going to apply a median blur where there is various

kinds of blurs that exist. There is a Gaussian blur, there is a median blur. So, let me show you all the functions.

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So, I am showing it through this because it is easier to show all the functions.

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So, if this is the original image the blurring will cause it to become like this.

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I am trying to show you the workflow how you go around doing it.

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So, Gaussian blur is a very popular way of doing it and it takes a Gaussian kernel and does the blurring for you, ok.

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So, we are going to say imgblur = cv2.GaussianBlur. We are going to pass the image, we are going to pass the kernel size. So, what all things you need to pass? You need to pass the image on which you want to do it, you want to also do the GaussianBlur the kernel the size of the blur ok.

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→ C [*] ⁽²⁾	🛛 🛔 https://doc.gpencerg/3.4/4/4/6/group_impror_floe/httm/#pade663/6671159/uf13980011ac2arti	IN E 0 1	
	+ GaussianBlur()		
	void cv::GaussianBlur (InputArray src,		
	OutputArray dst,		
	Size ksize,		
	double sigmaX,		
	double sigmaY = e ,		
	int borderType = sorber_perault		
)		
	Python:		
	dst = cv.GaussianBlur(src, ksize, sigmaXI, dslf, sigmaYI, borderType]]])		
	Hinclude: (spenol/Jappres.hyp) Buss an image usion a Gaussian filter.		
	The function convolves the source image with the specified Gaussian kernel, in-place filtering is supported.		
	Parameters		
	src input image; the image can have any number of channels, which are processed independently, but the depth should be CV_8U, CV_16U, CV_16S, CV_32F or CV_64F.		
	dst D output image of the same size and type as src.		
	ksize Gaussian kernel size, ksize width and ksize,height can differ but they both must be positive and odd. Or; they can be zero's and then they are computed from sigma.		
	sigmaX Gaussian kernel standard deviation in X direction.		
	sigmaY Gaussian kernel standard deviation in Y direction; if sigmaY is zero, it is set to be equal to sigmaX, if both sigmas are zeros, they are computed from sizes with and size.height, respectively (see gridGaussian/ment for details); to Migrowind the result spatiaties of possible future monitoriations of all this semantis, its recommended to specify all sites, sigmaX, and sizen X.		X.
	borderType pixel extrapolation method, see BorderTypes. BORDER_WRAP is not supported.		0
			ALC: NOT

So, the parameters. So, this is the C++ version of it.

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But, the C version also works in a similar fashion ok, alright. So, based on the kernel size it is going to figure out what the standard deviations are going to be and typically we keep it 0 to keep everything normalized, alright.

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So, isolated, (5,5), 0. So, once it is done we going to well we can show the blurred image also. So, let me do that. So, let me say cv2.imshow("After blurring", imgblur). Let me take this over here makes channel before blurring this is after blurring, this is after threshold. Now, a threshold will be actually applied on imgblur, alright. So, let me go over here. This g should be a capital G ok, yeah.

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So, look at the two images. So, this is before blurring and this is after blurring. So, the edges seem to have smoothened out.

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In fact, let me increase the size of the kernel to 10×10 . So, you have a larger area of blurring I have to close the windows you need to give it an odd number.

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Entering and a state of Entering	Flag 🖸 🙀 Administrative Covindence System Direct anne - pyttern (ar Flag)
1 import cv2	255
2 import numpy as np	
3	(base) C:\Users\Admin\Dropbox\nptel codes\lec41>pvthon lec41.pv
<pre>4 vid = cv2.VideoCapture("balloon.mp4");</pre>	255
<pre>5 ret, img = vid.read()</pre>	
<pre>6 b, g, r = cv2.split(img.astype(float))</pre>	(base) C:\Users\Admin\Dropbox\nptel_codes\lec41>python lec41.py
7	Traceback (most recent call last):
8 c1 = 1.5; c2 = -2; c3 = -0.1;	File "lec41.py", line 14, in <module></module>
<pre>9 isolated = cl*g + c2*b + c3*r;</pre>	<pre>imgblur = cv2.gaussianBlur(isolated, (5,5), 0);</pre>
10 isolated = np.clip(isolated, 0, 255)	AttributeError: module 'cv2' has no attribute 'gaussianBlur'
11 isolated = isolated.astype(img.dtype)	
12 cv2.imshow("mixed channel: before blurring", isolated)	<pre>(base) C:\Users\Admin\Dropbox\nptel_codes\lec41>python lec41.py</pre>
13	255
14 implur = cv2.GaussianBlur(isolated, (9.9), 0);	Traceback (most recent call last):
15 cv2.imshow("After blurring", imphlur)	File "lec41.py", line 23, in (module)
16	cv2.waitKey(0)
17 ret. imath = cv2.threshold(imchlur, 50, 255, cv2.THRESH	Keydoardinterrupt
18 cv2 imphow("Thresholded image", imoth)	(bace) C:\Urant\Admin\Dranbax\antal_coder\lacdlamthon_locd1_nv
19	(base) C: (Users (womin Uropoox (npice_codes (lec41/pychon lec41.py Transhark (most recent call last):
20 print(pp max(imsth)):	File "lec41 pv" line 14 in (module)
21	imeblur = cv2.GaussianBlur(isolated, (10.10), 0):
22	cv2.error: OpenCV(4.0.1) C:\ci\opencv-suite 1573470242804\work\modules\imgproc\src\smoot
22 an2 unitKey(0)	40: error: (-215:Assertion failed) ksize.width > 0 && ksize.width % 2 == 1 && ksize.heig
25 CV2.Walckey(0)	& ksize.height % 2 == 1 in function 'cv::createGaussianKernels'
25 Contribution Proban	
25 Swhile False:	
<pre>26 ret, img = vid.read() 27 m2 imphase(Thelling deflets = imphase)</pre>	(base) C:\Users\Admin\Dropbox\nptel_codes\lec41>python lec41.py
27 CV2.1mSnow("Dallon deriate", img);	255
28 CV2.Waitkey(1)	
29 5	
30	(D.G.)
	A A
Poteon File Innet: 10 Inn: 14 Coll-42 Sel: 010	Vindex (317) UT-3 16 the central element is replaced with this median value. This is

So, you need to give it an odd number, you cannot give it an even number because it is going to center and so, if it is 1 it is centered, if it is 3, then the nearest neighbours are taken if it is 5 then two on this side, two on this side, two above, two below ok that is why it needs to be an odd number ok.

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So, this is the original image, this is the blurred image. So, all those freckles on the boundary because of the bad lighting sort of smoothened out.

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Once it is smoothened out you get a nice contour well there are some things going on, but anyway you can actually do a medium blur and get rid of that as well but, we do not bother so much about that. We will get a good answer regardless ok.

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So, so far we have seen the following. We have seen this is the channel mixing, once we have mixed the channels we have performed a gaussian blur. After doing a gaussian blur, we have thresholded the image.

These are the three basic things we have done. In the next video, we are going to move ahead on this and we are going to combine all this in the form of a continuous evaluation of all the frames. So, with this I end this particular lecture, I will see you next time. Bye.