Read, Write and Display a video using OpenCV (C++/ Python)

Learn OpenCV

JUNE 5, 2017 BY AVINAB SAHA (HTTPS://WWW.LEARNOPENCV.COM/AUTHOR/AVINABSAHA/)

In this post, we will learn how to read, write and display videos in OpenCV.

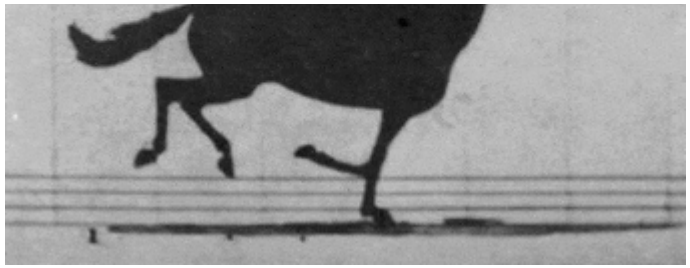
Before we do that, allow me a digression into a bit of history of video capture.

On June 15, 1898, in Palo Alto, California, a remarkable experiment was conducted to determine whether a galloping horse ever had all four feet off the ground at the same time. This historic experiment by photographer Eadweard Muybridge was the first time a motion sequence was captured in real time. It was financed by Leland Stanford of the Standford University fame.

Eadweard placed multiple cameras, 27 inches apart along the side of the race track. To every camera's shutter was connected a thread that ran across the track. When the horse ran on the track, it broke one thread after the other triggering the camera shutters in series and exposing the films for one-thousandth of a second!

(/wp-content/uploads/2017/05/The-Horse-in-Motion-anim.gif)

This remarkable story almost did not happen. Just a few years before this



achievement, Muybridge shot and killed his wife's lover. The jury acquited him on grounds of justifiable homicide!" But we have digressed a bit too far.

So, first up, what is a video? A video is a sequence of fast moving images. The obvious question that follows is how fast are the pictures moving? The measure of how fast the images are transitioning is given by a metric called **frames per second(FPS)**. When someone says that the video has an FPS of 40, it means that 40 images are being displayed every second. Alternatively, after every 25 milliseconds, a new frame is displayed.

The other important attributes are the width and height of the frame.

Reading a Video

In OpenCV, a video can be read either by using the feed from a camera connected to a computer or by reading a video file. The first step towards reading a video file is to create a **VideoCapture** object. Its argument can be either the device index or the name of the video file to be read.

In most cases, only one camera is connected to the system. So, all we do is pass '0' and OpenCV uses the only camera attached to the computer. When more than one camera is connected to the computer, we can select the second camera by passing '1', the third camera by passing '2' and so on.

Python

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```
# Create a VideoCapture object and read from input file
# If the input is taken from the camera, pass 0 instead of the video file name.

cap = cv2.VideoCapture('chaplin.mp4')
```

C++

```
// Create a VideoCapture object and open the input file
// If the input is taken from the camera, pass 0 instead of the video file name

VideoCapture cap("chaplin.mp4");
```

After the VideoCapture object is created, we can capture the video frame by frame.

Displaying a video

After reading a video file, we can display the video frame by frame. A frame of a video is simply an image and we display each frame the same way we display images, i.e., we use the function **imshow()**.

As in the case of an image, we use the **waitKey()** after imshow() function to pause each frame in the video. In the case of an image, we pass ‘0’ to the waitKey() function, but for playing a video, we need to pass a number greater than ‘0’ to the waitKey() function. This is because ‘0’ would pause the frame in the video for an infinite amount of

time and in a video we need each frame to be shown only for some finite interval of time, so we need to pass a number greater than '0' to the waitKey() function. This number is equal to the time in milliseconds we want each frame to be displayed.

While reading the frames from a webcam, using waitKey(1) is appropriate because the display frame rate will be limited by the frame rate of the webcam even if we specify a delay of 1 ms in waitKey.

While reading frames from a video that you are processing, it may still be appropriate to set the time delay to 1 ms so that the thread is freed up to do the processing we want to do.

In rare cases, when the playback needs to be at a certain framerate, we may want the delay to be higher than 1 ms.

The Python and C++ implementation of reading and displaying a video file follows.

Python

```
import cv2
import numpy as np

# Create a VideoCapture object and read from input file
# If the input is the camera, pass 0 instead of the video file name
cap = cv2.VideoCapture('chaplin.mp4')

```

```python
# Check if camera opened successfully
if (cap.isOpened()== False):
  print("Error opening video stream or file")

# Read until video is completed
while(cap.isOpened()):
  # Capture frame-by-frame
  ret, frame = cap.read()
  if ret == True:

    # Display the resulting frame
    cv2.imshow('Frame',frame)

    # Press Q on keyboard to  exit
    if cv2.waitKey(25) & 0xFF == ord('q'):
      break

  # Break the loop
  else:
    break

# When everything done, release the video capture object
cap.release()

# Closes all the frames
cv2.destroyAllWindows()
```

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C++

```cpp
#include "opencv2/opencv.hpp"
#include <iostream>

using namespace std;
using namespace cv;

int main(){
```

```
int main(){

  // Create a VideoCapture object and open the input file
  // If the input is the web camera, pass 0 instead of the video file name
  VideoCapture cap("chaplin.mp4");

  // Check if camera opened successfully
  if(!cap.isOpened()){
    cout << "Error opening video stream or file" << endl;
    return -1;
  }

  while(1){

    Mat frame;
    // Capture frame-by-frame
    cap >> frame;

    // If the frame is empty, break immediately
    if (frame.empty())
      break;

    // Display the resulting frame
    imshow( "Frame", frame );

    // Press  ESC on keyboard to exit
    char c=(char)waitKey(25);
    if(c==27)
      break;
  }

  // When everything done, release the video capture object
  cap.release();

  // Closes all the frames
  destroyAllWindows();

  return 0;
}
```


Writing a video

After we are done with capturing and processing the video frame by frame, the next step we would want to do is to save the video.

For images, it is straightforward. We just need to use cv2.imwrite(). But for videos, we need to toil a bit harder. We need to create a **VideoWriter** object. First, we should specify the output file name with its format (eg: output.avi). Then, we should specify the **FourCC** code and the number of frames per second (FPS). Lastly, the frame size should be passed.

Python

```
# Define the codec and create VideoWriter object.The output is stored in 'outpy.avi' file.
# Define the fps to be equal to 10. Also frame size is passed.

out = cv2.VideoWriter('outpy.avi',cv2.VideoWriter_fourcc('M','J','P','G'), 10, (frame_width,frame_height))
```

C++

```
// Define the codec and create VideoWriter object.The output is stored in 'outcpp.avi' file.
// Define the fps to be equal to 10. Also frame size is passed.

  VideoWriter video("outcpp.avi",CV_FOURCC('M','J','P','G'),10, Size(frame_width,frame_height));
```

FourCC (http://en.wikipedia.org/wiki/FourCC) is a 4-byte code used to specify the video codec. The list of available codes can be found at fourcc.org (http://www.fourcc.org/codecs.php). There are many FOURCC codes available, but in this post, we will work only with MJPG.

Note: Only a few of the FourCC codes listed above will work on your system based on the availability of the codecs on your system. Sometimes, even when the specific codec is available, OpenCV may not be able to use it. MJPG is a safe choice.

The Python and C++ implementation of capturing live stream from a camera and writing it to a file follows.

Python

```
import cv2
import numpy as np

# Create a VideoCapture object
cap = cv2.VideoCapture(0)

# Check if camera opened successfully
```

```
# Check if camera opened successfully
if (cap.isOpened() == False):
  print("Unable to read camera feed")

# Default resolutions of the frame are obtained.The default resolutions are system dependent.
# We convert the resolutions from float to integer.
frame_width = int(cap.get(3))
frame_height = int(cap.get(4))

# Define the codec and create VideoWriter object.The output is stored in 'outpy.avi' file.
out = cv2.VideoWriter('outpy.avi',cv2.VideoWriter_fourcc('M','J','P','G'), 10, (frame_width,frame_height))

while(True):
  ret, frame = cap.read()

  if ret == True:

    # Write the frame into the file 'output.avi'
    out.write(frame)

    # Display the resulting frame
    cv2.imshow('frame',frame)

    # Press Q on keyboard to stop recording
    if cv2.waitKey(1) & 0xFF == ord('q'):
      break

  # Break the loop
  else:
    break

# When everything done, release the video capture and video write objects
cap.release()
out.release()

# Closes all the frames
cv2.destroyAllWindows()
```


C++

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```
#include "opencv2/opencv.hpp"
#include <iostream>

using namespace std;
using namespace cv;

int main(){
```

```
int main(){

  // Create a VideoCapture object and use camera to capture the video
  VideoCapture cap(0);

  // Check if camera opened successfully
  if(!cap.isOpened())
  {
    cout << "Error opening video stream" << endl;
    return -1;
  }

  // Default resolution of the frame is obtained.The default resolution is system dependent.
  int frame_width = cap.get(CV_CAP_PROP_FRAME_WIDTH);
  int frame_height = cap.get(CV_CAP_PROP_FRAME_HEIGHT);

  // Define the codec and create VideoWriter object.The output is stored in 'outcpp.avi' file.
  VideoWriter video("outcpp.avi",CV_FOURCC('M','J','P','G'),10, Size(frame_width,frame_height));
  while(1)
  {
    Mat frame;

    // Capture frame-by-frame
    cap >> frame;

    // If the frame is empty, break immediately
    if (frame.empty())
      break;

    // Write the frame into the file 'outcpp.avi'
    video.write(frame);

    // Display the resulting frame
    imshow( "Frame", frame );

    // Press  ESC on keyboard to  exit
    char c = (char)waitKey(1);
    if( c == 27 )
      break;
  }

  // When everything done, release the video capture and write object
  cap.release();
  video.release();

```

```
52    // Closes all the windows
53    destroyAllWindows();
54    return 0;
55  }
```

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Mattia Personaggio Uno Ducci • 6 months ago

Very good tutorial! Thank you very much

1 • Reply • Share ›

Satya Mallick Mod → Mattia Personaggio Uno Ducci • 4 months ago

Thanks, Mattia.

• Reply • Share ›

Charles Plante • a year ago

Very great tutorial well explained !

1 • Reply • Share ›

Satya Mallick Mod → Charles Plante • 4 months ago

Thanks, Charles.

• Reply • Share ›

Eduardo Nzinga • 5 months ago

Hi, thanks for the tutorial.
One question: When reading the video from the file, I cannot reproduce the audio, it happens also when reading from a camera. How ca I fix this??
Regards,

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Satya Mallick Mod → Eduardo Nzinga • 5 months ago

OpenCV does not deal with audio.

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Vlad Lebedev • 19 days ago

Compilator can't find description of functions VideoCapture::read() and VideoCapture::imshow()
Where they described?

• Reply • Share ›

Satya Mallick Mod ➚ Vlad Lebedev • 18 days ago

You need to install OpenCV.

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Akhilesh Mishra • 2 months ago

Hi Everyone,

"Live Video Streaming" is working fine from below code:
But I want to audio after play the video. I hope that OpenCV does not allow the audio. So Kindly provide the another solution.

Thanks,
Pravin Yadav

```
import numpy as np
import cv2, time

cap = cv2.VideoCapture(0)

# Define the codec and create VideoWriter object
fourcc = cv2.VideoWriter_fourcc(*'MJPG')
out = cv2.VideoWriter('output.avi',fourcc, 5.0, (640,480))
while(cap.isOpened()):
```

```
ret, frame = cap.read()
```

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Nitish Moheeputh • 2 months ago

but what about the project file, is there anything that needs to be added for C++

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Socrates Krishnamurthy • 2 months ago

Hi Satya,

Thanks for this tutorial! I tried the above code and it works well in my local machine. But when I try to implement this on Heroku PaaS with Flask micro services using Python, I face challenges in spite of changing the IP to 0.0.0.0. Do you have any reference implementation of OpenCV with Flask and Heroku using Python?

Thanks!

• Reply • Share ›

Satya Mallick Mod ➚ Socrates Krishnamurthy • 2 months ago

Sorry, I don't, but I can't see how it would be related to OpenCV. It is some integration bug.

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Harsath Bill Gates • 3 months ago

What is the value will be stored in variable ret in line 20

• Reply • Share ›

Sima Adham • 3 months ago

Thanks for the tutorial.

I'm using Python 2.7 and opencv 3.4

I'm using Python 2.7 and opencv 3.4.
When I try reading video file It always shows "Error opening video stream or file" message
The video file is in the same path of the source code. I tried the absolute and the relative path,
and I tried to copy the .dll file "opencv_ffmpeg341_64.dll" to python directory but nothing seems to work.
Any help please??

▲ ▼ • Reply • Share ›

Степан Яковенко ➚ Sima Adham • 2 months ago

i have same problem

▲ ▼ • Reply • Share ›

lii ismail • 5 months ago

hi, how do we record video from 1 kinect and 2 portable camera simultaneously and store it as a training data (video_database) using python

▲ ▼ • Reply • Share ›

Satya Mallick Mod ➚ lii ismail • 4 months ago

If you have multiple USB cameras, cap0 = cv2.VideoCapture(0) and cap1 = cv2.VideoCapture(1) should give you access to the two cameras.

▲ ▼ • Reply • Share ›

Eduardo Nzinga • 5 months ago

Another question: Is it possible to connect my phone camera to this algorithm instead of a real camera??

▲ ▼ • Reply • Share ›

Satya Mallick Mod ➚ Eduardo Nzinga • 4 months ago

I have never tried it myself, but you can try this link

https://www.makeuseof.com/t

https://www.makeuseof.com/t...

to turn your camera into a USB or IP camera and it might just work.

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• Reply • Share ›

Robert Fairbrother • 7 months ago

Can this record raw video? Thanks so much.

• Reply • Share ›

Satya Mallick Mod ➚ Robert Fairbrother • 4 months ago

Do you mean video without any compression? If the webcam compresses the video on the device then it is not possible. However, if the webcam sends raw frames, you can simply collect the frames and write to disk in a non-lossy format like PNG.

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Robert Fairbrother ➚ Satya Mallick • 4 months ago

Hi Satya

Sorry, one more question - where exactly will I install this program to capture images from my camera?

Thanks so much.

• Reply • Share ›

Sevgi Dolunay • 7 months ago

Hi Satya Mallick,

Have you experienced with QT opencv videowrite from camera captured? I couldnt succed.. any idea?

• Reply • Share ›

Satya Mallick Mod ➚ Sevgi Dolunay • 4 months ago

Hi Sevgi

Hi Sevgi,

Yes, I have tried it before. Here is the link that may be helpful

https://www.learnopencv.com...

Satya

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rohit thakur • 10 months ago

Hello Sir, i have a question related to skip frames. How can be get only specific frames from a video for e.g. i have a 1280*720 video file with 25FPS and i want to apply skip frames to it means get frames after every 10 frames until the end of video? Take a look at the code below:

```
import cv2
vidcap = cv2.VideoCapture('video.mp4')
success,image = vidcap.read()
count = 0
success = True
while success:
success,image = vidcap.read()
cv2.imwrite("frame%d.jpg" % count, image)
count += 1
```

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सौरभ पटेल ➚ rohit thakur • 7 months ago

by using time or local counter to skip frame within while loop

```
if condition :
cv2.imwrite("frame%d.jpg" % count, image)
```

13 • Reply • Share ›

jan • 10 months ago

Hey, i have a question that is bugging me, i tried to define those functions as: start and end, so that i could control it automatically. for example:
vc.start #start's recording
... #some commands
vc.end #stop's recording

conclusion: i would like to know how to setup start and end of recording without pressing 'Q' (i would like to automatize the programme)

PS. Great tutorial !

• Reply • Share ›

Satya Mallick Mod ➚ jan • 4 months ago

Hi Jan,

The question is when would you like to trigger a start? For example, you can use motion detection to trigger video capture.

Satya

• Reply • Share ›

劉宇珉 • 10 months ago

Thanks a lot! But I still have some question. I just read a tutorial book about openCV. In the waitkey part on the book is:

if(cv::waitKey(33) >= 0) break;

It doesn't work. I replace it with your code:

char c=(char)waitKey(25);
if(c==27) break;

and it works. Why? Thanks a lot :)

• Reply • Share ›

Masque du Furet ➚ 劉宇珉 • 8 months ago

Have a look at https://stackoverflow.com/q...
a)better english than mine :
b) avoids implicit conversion
c) has a safe (typo preventing) way to test equality .....

• Reply • Share ›

Mara I • a year ago

How can I automatically extract the time of the video when I pause it?

• Reply • Share ›

Satya Mallick Mod ➚ Mara I • a year ago

```
cap.get(CV_CAP_PROP_POS_MSEC)
```

Should give you the current position in milliseconds.

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Deepak Gupta • a year ago

How to put any text on live video (on a live video I want add any text)how to do that:

```
import numpy as np
import cv2

capp = cv2.VideoCapture('Picture Maker')
cap = cv2.VideoCapture(0)
while(True):
# Capture frame-by-frame
ret, frame = cap.read()
```

```
# Our operations on the frame come here
gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)

# Display the resulting frame
cv2.putText(frame,"try try",(50, 50),cv2.FONT_HERSHEY_COMPLEX_SMALL, .7, (0, 0, 255))
cv2.imshow('frame',gray)
key = cv2.waitKey(1) & 0xFF
if key == ord('q'):
break

# When everything done, release the capture
cap.release()
```


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Satya Mallick Mod ➚ Deepak Gupta • 4 months ago

Why do you have

```
capp = cv2.VideoCapture('Picture Maker')
```

in the top?

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Leonardo Mantovani • a year ago

I have a question, if i want do something afer the end of the video (for example i want to create a caracter who can move in the screen) where i should write the other code?

Reply • Share ›

Satya Mallick Mod ➚ Leonardo Mantovani • a year ago

You can simply open the video, go to the last frame, create new frames with the character and append those frames to the end of the video.

Reply • Share ›

Leonardo Mantovani ➚ Satya Mallick • a year ago

You haven't understeand my question...
I want that when the video finishes I can write other code.
Where should I put it?

^ | v • Reply • Share ›

Satya Mallick Mod ➚ Leonardo Mantovani • a year ago

In the code above (for reading and displaying video file), you can put in on line 37 (C++) or line 28 (Python).

1 ^ | v • Reply • Share ›

JUV79500 ➚ Satya Mallick • a year ago

Hi I am trying to make a video from JPEG images. Is that the same procedure I will do (except for the video_capture object creation)?

14 ^ | v • Reply • Share ›

Satya Mallick Mod ➚ JUV79500 • a year ago

Yes, you can read in one image at a time using imread and then add that as a frame to the video.

^ | v • Reply • Share ›

Christopher Allen-Poole • a year ago

Why is it waitKey(25) in the first example and waitKey(1) in the second?

^ | v • Reply • Share ›

Satya Mallick Mod ➚ Christopher Allen-Poole • a year ago

You can use waitKey(1) everywhere. It is the pause / delay. Because your webcam most likely works at 30 FPS, any number less than that is fine.

^ | v • Reply • Share ›

Mathilde Monvoisin • a year ago

Hello,

Thank you very much for this code. It works perfectly with OpenCV 3.0.0 but when I'm using version 3.2.0, I get this error :

VIDEOIO ERROR: V4L2: Pixel format of incoming image is unsupported by OpenCV

Then it puts your sentence, line 10 : Error opening video stram or file.

How can it happen ?

Thank you in advance,
Mathilde

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Satya Mallick Mod ➚ Mathilde Monvoisin • a year ago

Is it possible you compiled OpenCV 3.2 without ffmpeg support ?

• Reply • Share ›

Mathilde Monvoisin ➚ Satya Mallick • a year ago

I just recompiled it, to be sure, and it doesn't change anything... Do you have any other idea of what might be the problem ?

• Reply • Share ›

Itai Dror • a year ago

Avinab,
Satya,

Great post as well as sense for history.
Is there any way to compile the Python + numpy + opencv into a standalone file over mac?
Tried several: http://python-guide-pt-br.r...
But they could compile only plain Python without numpy or opencv.

Thanks very much

Reply • Share ›

Satya Mallick Mod ➚ Itai Dror • a year ago

OpenCV has a C++ API and that is the right one to use if you want to create a standalone application.

Reply • Share ›

Khoa Đặng • a year ago

The tutorial is clean and clear.
But in the last piece of C++ code, line 14, you forgot to break the line after the comment.
Thanks for the post.

Reply • Share ›

Satya Mallick Mod ➚ Khoa Đặng • a year ago

Thanks a bunch. We have fixed the problem.

Reply • Share ›

Praveen V • 10 months ago

I tried to read a video(.mp4 file)from my pc but the output is always 'Error opening file'.The file is in C:\Python27 itself What should I do?

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Edward Yesid Villegas Pulgarin — Thanks so much Satya!

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4 comments • 2 months ago

Masque du Furet — I am somewhat sorry :

lava kafle — #wowwow incredible #computervision

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2 comments • 2 months ago

Saurabh Kumar Singh — Amazing!!!!! Kush....thanks for sharing..