

```
# Import necessary libraries
```

```
!apt-get install ffmpeg -y
```

```
!pip install ffmpeg-python matplotlib Pillow opencv-python moviepy
```

```
Reading package lists... Done
```

```
Building dependency tree... Done
```

```
Reading state information... Done
```

```
ffmpeg is already the newest version (7:4.4.2-0ubuntu0.22.04.1).
```

```
0 upgraded, 0 newly installed, 0 to remove and 45 not upgraded.
```

```
Collecting ffmpeg-python
```

```
  Downloading ffmpeg_python-0.2.0-py3-none-any.whl.metadata (1.7 kB)
```

```
Requirement already satisfied: matplotlib in
```

```
/usr/local/lib/python3.10/dist-packages (3.7.1)
```

```
Requirement already satisfied: Pillow in
```

```
/usr/local/lib/python3.10/dist-packages (9.4.0)
```

```
Requirement already satisfied: opencv-python in
```

```
/usr/local/lib/python3.10/dist-packages (4.10.0.84)
```

```
Requirement already satisfied: moviepy in
```

```
/usr/local/lib/python3.10/dist-packages (1.0.3)
```

```
Requirement already satisfied: future in
```

```
/usr/local/lib/python3.10/dist-packages (from ffmpeg-python) (1.0.0)
```

```
Requirement already satisfied: contourpy>=1.0.1 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.2.1)
```

```
Requirement already satisfied: cycler>=0.10 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (0.12.1)
```

```
Requirement already satisfied: fonttools>=4.22.0 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (4.53.1)
```

```
Requirement already satisfied: kiwisolver>=1.0.1 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.4.5)
```

```
Requirement already satisfied: numpy>=1.20 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.26.4)
```

```
Requirement already satisfied: packaging>=20.0 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (24.1)
```

```
Requirement already satisfied: pyparsing>=2.3.1 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (3.1.2)
```

```
Requirement already satisfied: python-dateutil>=2.7 in
```

```
/usr/local/lib/python3.10/dist-packages (from matplotlib) (2.8.2)
```

```
Requirement already satisfied: decorator<5.0,>=4.0.2 in
```

```
/usr/local/lib/python3.10/dist-packages (from moviepy) (4.4.2)
```

```
Requirement already satisfied: tqdm<5.0,>=4.11.2 in
```

```
/usr/local/lib/python3.10/dist-packages (from moviepy) (4.66.4)
```

```
Requirement already satisfied: requests<3.0,>=2.8.1 in
```

```
/usr/local/lib/python3.10/dist-packages (from moviepy) (2.31.0)
```

```
Requirement already satisfied: proglog<=1.0.0 in
```

```
/usr/local/lib/python3.10/dist-packages (from moviepy) (0.1.10)
```

```
Requirement already satisfied: imageio<3.0,>=2.5 in
```

```
/usr/local/lib/python3.10/dist-packages (from moviepy) (2.34.2)
```

```
Requirement already satisfied: imageio-ffmpeg>=0.2.0 in
```

```
/usr/local/lib/python3.10/dist-packages (from moviepy) (0.5.1)
```

```
Requirement already satisfied: setuptools in
```

```
/usr/local/lib/python3.10/dist-packages (from imageio-ffmpeg>=0.2.0-
>moviepy) (71.0.4)
Requirement already satisfied: six>=1.5 in
/usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7-
>matplotlib) (1.16.0)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests<3.0,>=2.8.1-
>moviepy) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in
/usr/local/lib/python3.10/dist-packages (from requests<3.0,>=2.8.1-
>moviepy) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from requests<3.0,>=2.8.1-
>moviepy) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests<3.0,>=2.8.1-
>moviepy) (2024.7.4)
Downloading ffmpeg_python-0.2.0-py3-none-any.whl (25 kB)
Installing collected packages: ffmpeg-python
Successfully installed ffmpeg-python-0.2.0
```

#### *# Install FFmpeg*

```
!apt-get update
!apt-get install -y ffmpeg
```

#### *# Install ffmpeg-python*

```
!pip install ffmpeg-python
```

```
0% [Working]          Get:1
https://cloud.r-project.org/bin/linux/ubuntu jammy-cran40/ InRelease
[3,626 B]
Get:2
https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/
x86_64 InRelease [1,581 B]
Get:3
https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/
x86_64 Packages [908 kB]
Hit:4 http://archive.ubuntu.com/ubuntu jammy InRelease
Get:5 http://security.ubuntu.com/ubuntu jammy-security InRelease [129
kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [128
kB]
Ign:7 https://r2u.stat.illinois.edu/ubuntu jammy InRelease
Get:8 https://r2u.stat.illinois.edu/ubuntu jammy Release [5,713 B]
Hit:9 https://ppa.launchpadcontent.net/deadsnakes/ppa/ubuntu jammy
InRelease
Get:10 https://r2u.stat.illinois.edu/ubuntu jammy Release.gpg [793 B]
Hit:11 https://ppa.launchpadcontent.net/graphics-drivers/ppa/ubuntu
jammy InRelease
Hit:12 https://ppa.launchpadcontent.net/ubuntugis/ppa/ubuntu jammy
```

```
InRelease
Hit:13 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:14 https://r2u.stat.illinois.edu/ubuntu jammy/main amd64 Packages
[2,552 kB]
Get:15 http://security.ubuntu.com/ubuntu jammy-security/restricted
amd64 Packages [2,787 kB]
Get:16 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64
Packages [1,421 kB]
Get:17 http://security.ubuntu.com/ubuntu jammy-security/main amd64
Packages [2,118 kB]
Get:18 http://security.ubuntu.com/ubuntu jammy-security/universe amd64
Packages [1,131 kB]
Get:19 https://r2u.stat.illinois.edu/ubuntu jammy/main all Packages
[8,218 kB]
Fetched 19.4 MB in 4s (4,360 kB/s)
Reading package lists... Done
W: Skipping acquire of configured file 'main/source/Sources' as
repository 'https://r2u.stat.illinois.edu/ubuntu jammy InRelease' does
not seem to provide it (sources.list entry misspelt?)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ffmpeg is already the newest version (7:4.4.2-0ubuntu0.22.04.1).
0 upgraded, 0 newly installed, 0 to remove and 48 not upgraded.
Requirement already satisfied: ffmpeg-python in
/usr/local/lib/python3.10/dist-packages (0.2.0)
Requirement already satisfied: future in
/usr/local/lib/python3.10/dist-packages (from ffmpeg-python) (1.0.0)

# Install ffmpeg and ffmpeg-python
!apt-get install ffmpeg
!pip install ffmpeg-python
!pip install opencv-python
!pip install matplotlib

Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ffmpeg is already the newest version (7:4.4.2-0ubuntu0.22.04.1).
0 upgraded, 0 newly installed, 0 to remove and 48 not upgraded.
Requirement already satisfied: ffmpeg-python in
/usr/local/lib/python3.10/dist-packages (0.2.0)
Requirement already satisfied: future in
/usr/local/lib/python3.10/dist-packages (from ffmpeg-python) (1.0.0)
Requirement already satisfied: opencv-python in
/usr/local/lib/python3.10/dist-packages (4.10.0.84)
Requirement already satisfied: numpy>=1.21.2 in
/usr/local/lib/python3.10/dist-packages (from opencv-python) (1.26.4)
Requirement already satisfied: matplotlib in
/usr/local/lib/python3.10/dist-packages (3.7.1)
```

```
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.2.1)
Requirement already satisfied: cyclor>=0.10 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (4.53.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.4.5)
Requirement already satisfied: numpy>=1.20 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.26.4)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (24.1)
Requirement already satisfied: pillow>=6.2.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (9.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (3.1.2)
Requirement already satisfied: python-dateutil>=2.7 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in
/usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7-
>matplotlib) (1.16.0)
```

```
# Remove existing installation of ffmpeg
```

```
!apt-get remove ffmpeg -y
```

```
# Download and install the latest version of ffmpeg
```

```
!add-apt-repository ppa:savory1/ffmpeg4 -y
```

```
!apt-get update
```

```
!apt-get install ffmpeg -y
```

```
Reading package lists... Done
```

```
Building dependency tree... Done
```

```
Reading state information... Done
```

```
The following packages will be REMOVED:
```

```
  ffmpeg
```

```
0 upgraded, 0 newly installed, 1 to remove and 48 not upgraded.
```

```
After this operation, 2,288 kB disk space will be freed.
```

```
(Reading database ... 123598 files and directories currently
installed.)
```

```
Removing ffmpeg (7:4.4.2-0ubuntu0.22.04.1) ...
```

```
Processing triggers for man-db (2.10.2-1) ...
```

```
Repository: 'deb
```

```
https://ppa.launchpadcontent.net/savory1/ffmpeg4/ubuntu/ jammy main'
```

```
Description:
```

```
FFmpeg 4.4.5 builds (& associated multimedia packages) for Xenial &
newer.
```

```
*** Anyone interested in full builds of FFmpeg 4.4.x including all
"bells and whistles" needs to have donated, after which access to the
new private PPA can be requested. See my Launchpad page linked below
```

for details. \*\*\*

\*\*\* Please always see <https://launchpad.net/~savoury1> for general updates about this Launchpad site before contacting me or reporting any bugs! \*\*\*

\*\*\* Big thanks to all those who have donated to support this project, you are very directly helping to keep it alive! To all who have not donated: please do so if you can afford it, this project depends on donations. \*\*\*

If software at this site is useful to you then please consider a donation:

\*\*\* Donations: <https://paypal.me/Savoury1> & <https://ko-fi.com/Savoury1>

\*\*\*

\*\*\* Also <https://patreon.com/Savoury1> & <https://liberapay.com/Savoury1>

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FFmpeg 4 - media tool (Xenial & newer)

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abseil (20240116.2), alsa-{lib,plugins,tools,topology-conf,ucm-conf,utils} (1.2.{5,6}), aom (3.9.1), aribb24 (1.0.3+git20160115), chafa (1.12.4), chromaprint (1.5.1), cJSON (1.7.17), codec2 (1.2.0), cppzmq (4.10.0), dav1d (1.4.3), ffmpeg (4.4.5), ffms2 (2.23), flac (1.4.3), fluidsynth (2.3.5), fontconfig (2.13.1), freeglut (3.4.0), freetype (2.11.1), glib2.0 (2.72.4), gmp (6.3.0), gnutls28 (3.7.3), gobject-introspection (1.72.0), gpac (2.2.1), gst-{libav,python}1.0 (1.24.5 for gst\*), gst-plugins-{bad,base,good,ugly}1.0, gst-plugins-rtp (1.18.1.2), gstreamer{-vaapi,1.0}, harfbuzz (8.3.0), ilmbase (3.1.11 = imath), intel-gmmlib (22.4.1), intel-media-driver{-non-free} (24.2.5), intel-mediasdk (23.2.2), json-glib (1.6.6), lensfun (0.3.3), libass (0.17.3), libavtp (0.2.0), libbluray (1.3.4), libbs2b (3.1.0), libcamera (0.3.0), libcdio (2.1.0), libcdio-paranoia (10.2+2.0.1), libdeflate (1.20), libdvdnav (6.1.1), libdvdread (6.1.3), libevent (2.1.12-stable), libffado (2.4.9), libfreeaptx (0.1.1), libgcrypt20 (1.10.3), libgsm (1.0.22), libinstpatch (1.1.6), liblc3 (1.1.1), libldac (2.0.2.3+git20200429), libmysofa (1.3.2), libnice (0.1.21), libopenaptx (0.2.0), libopenmpt (0.7.8), libpng1.6 (1.6.43), librabbitmq (0.11.0), libSDL2 (2.30.4), libshout (2.4.6), libsodium (1.0.21~git20240801), libsrtp2 (2.5.0), libssh (0.10.6), libtasn1-6 (4.18.0), libudfread (1.1.2), libunistring (1.0), libunwind (1.3.2), libva{-utils} (2.22.0), libvpx (1.14.1), libwebm (1.0.0.31), libwebp (1.4.0), libxfixes (6.0.0), libyaml (0.2.5), libyuv (0.0.1888.20240522), lua5.4 (5.4.6), mbedtls (2.28.8), mpg123 (1.32.5), nettle (3.7.3), norm (1.5.9), openal-soft (1.22.2),

opencore-amr (0.1.6), openexr (3.2.4), openfec (1.4.2.9),openh264 (2.4.1), openjpeg2 (2.5.0), opus (1.5.2), orc (0.4.38), pipewire (1.2.1), pipewire-media-session (0.4.2), qpwrap (0.6.2), roc-toolkit (0.3.0), rubberband (3.1.2), sbc (2.0), snappy (1.1.10), sndio (1.9.0), soundtouch (2.3.2), speex{dsp} (1.2.1), srt (1.5.3), timgm6mb-soundfont, unbound (1.17.1), ust (2.13.4), vulkan-{headers,loader,tools} (1.3.283.0), wavpack (5.7.0), webrtc-audio-processing (1.3), wireplumber (0.5.5), x264 (0.164.3191 = libx264-164), x265 (3.5 = libx265-199), zeromq3 (4.3.5), zimg (3.0.5), zlib (1.3.1), zvbi (0.2.42), zxing-cpp (2.2.1)

Focal & Jammy: libdecor-0 (0.2.2 for libsdl2 >= 2.0.20)

Focal only: autogen (= abseil 20240116.2 / renamed source for i386), gnome-keyring (3.36.0 rebuild for compat with new GLib), libdbf-perl (1.20 = libdeflate / renamed source for i386)

Bionic & Focal: snapd-glib (1.60 for PipeWire >= 1.0.1-lubuntu3~)

Xenial & Bionic: alsa-oss (1.1.8), alsa-plugins-extra (1.1.0), alsaequal (0.6), fftw3 (3.3.8), fribidi (1.0.8), gnome-keyring (3.28.2), lcms2 (2.9), leptonlib (1.79.0), libgpg-error, libvidstab (1.1.0), pll-kit, tesseract (4.1.1), wayland-protocols (1.18), wildmidi (0.4.3)

Xenial only: autogen, curl, gcc-7 (7.5.0), lame (3.100), libdrm (2.4.99), libidn2, libpsl, lm-sensors (3.6.0), mesa (18.0.5 rebuild for newer Wayland), nghttp2, openssl, pysimplesoap, python-{boto,httplib2,imaplib2} (compat with newer openssl), readline (7.0), unbound, wayland (1.16.0)

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\*\*\* Install \*\*\*

FFmpeg can be installed from this PPA alone, as the required packages to satisfy minimum versions have been copied here (notify me if any missing). However, if all newest versions of graphics and multimedia packages are desired then two additional PPAs can be added before installing FFmpeg:

```
sudo add-apt-repository ppa:savouryl/graphics
sudo add-apt-repository ppa:savouryl/multimedia
sudo add-apt-repository ppa:savouryl/ffmpeg4
sudo apt-get update
sudo apt-get upgrade && sudo apt-get dist-upgrade
sudo apt-get install ffmpeg
```

Notes: GStreamer 1.24.x packages are copied here

(ppa:savouryl/multimedia) as FFmpeg and GStreamer must both be built against the Debian SRT package version with renamed libsr1.5-gnutls or they cannot both be installed at the same time. GStreamer is on basically every Ubuntu-based system so this means it is necessary to upgrade GStreamer packages when upgrading FFmpeg.

Also, PipeWire 1.2.x packages are copied here from the PipeWire PPA, due PipeWire now being commonly used by various software. As the FFmpeg 4 PPA is required by numerous PPAs at this Launchpad site it makes the latest PipeWire readily available to all users. PipeWire is built with ALSA 1.2.5 minimum (Jammy, backported to earlier series) which is then required to run, so base ALSA packages are now also copied here for earlier series.

GLib will be upgraded to 2.72.4 by adding this PPA as it is required by WirePlumber >= 0.5.0 (and various other new software versions also). This version of GLib causes problems with certain features of GNOME Keyring, so rebuilds of GNOME Keyring for compatibility with GLib >= 2.70.0 are found here as well. These upgrades should be fully backwards compatible and are not known to cause any issues, based on testing a wide range of software.

\* Xenial systems: As of FFmpeg 4.3 the installation requires GCC >= 7 as the Intel-MediaSDK is enabled, with libmfx1 requiring GCC >= 7 (package fails to build with GCC 5.4.0). So GCC 7.5.0 (ppa:savouryl/toolchain) for Xenial has been copied here, making it easier to install FFmpeg 4.x on Xenial (so adding this FFmpeg 4 PPA will bring a few GCC 7.5.0 upgrades).

\* Focal systems: Builds of FFmpeg are now also available for i386 whereas they were not available initially. Launchpad does not build most packages for i386 architecture for Focal and newer series (Launchpad only builds i386 packages on a whitelist managed by the Launchpad team) including for dav1d and pocketsphinx, so these features are not enabled for Focal i386.

### \*\*\* Updates \*\*\*

Update (5 Apr 2023): FFmpeg 4.4 builds from today onwards are now generic, in that they are similar to current Ubuntu 22.04 Jammy FFmpeg builds. All of the dated updates below still apply to the FFmpeg 4.x builds available at a private "subscriber only" PPA (ppa:savouryl/ffmpeg) for supporters.

Update (24 Jan 2023): FFmpeg 4.4 builds now have AMD AMF (Advanced Media Framework) support, using latest headers from AMF 1.4.29 (released today).

Update (23 Oct 2022): FFmpeg 4.4 builds now have rav1e (new Rust-based AV1 encoder) support & are also built with nv-codec-headers 11.1.5.1

(latest).

Update (6 Apr 2022): FFmpeg 4.4 builds now have Netflix VMAF support, with thanks to Frank B. (equal #1 patron of these PPAs) for suggesting/testing!

Update (8 May 2021): FFmpeg 4.4 uploads from today onwards are built with these additional optional libraries: glslang (shader support), SVT-AV1 (scalable AV1 encoder), zimg (scaling, colorspace conversion, dithering), Vulkan (GPU acceleration on supported hardware), and SMB (Samba sharing).

\*\*\* Build \*\*\*

This PPA has build dependencies on:

```
ppa:savoueryl/build-tools
ppa:savoueryl/backports
ppa:savoueryl/fonts
ppa:savoueryl/graphics
ppa:savoueryl/multimedia
```

Additionally, for Xenial builds only:

```
ppa:savoueryl/perl-xenial
```

\*\*\* Credits \*\*\*

- Creators of FFmpeg: Michael Niedermayer and the entire FFmpeg team  
<https://github.com/FFmpeg/FFmpeg/graphs/contributors>

- Package code: Debian Multimedia Maintainers  
<https://tracker.debian.org/pkg/ffmpeg>

More info: <https://launchpad.net/~savoueryl/+archive/ubuntu/ffmpeg4>  
Adding repository.

Adding deb entry to /etc/apt/sources.list.d/savoueryl-ubuntu-ffmpeg4-jammy.list

Adding disabled deb-src entry to /etc/apt/sources.list.d/savoueryl-ubuntu-ffmpeg4-jammy.list

Adding key to /etc/apt/trusted.gpg.d/savoueryl-ubuntu-ffmpeg4.gpg with fingerprint E996735927E427A733BB653E374C7797FB006459

Hit:1 <https://cloud.r-project.org/bin/linux/ubuntu> jammy-cran40/InRelease

Hit:2

[https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86\\_64](https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64) InRelease

Hit:3 <http://archive.ubuntu.com/ubuntu> jammy InRelease

Get:4 <http://archive.ubuntu.com/ubuntu> jammy-updates InRelease [128 kB]

Get:5 <http://security.ubuntu.com/ubuntu> jammy-security InRelease [129



```
kB]
Ign:6 https://r2u.stat.illinois.edu/ubuntu jammy InRelease
Hit:7 https://r2u.stat.illinois.edu/ubuntu jammy Release
Hit:9 https://ppa.launchpadcontent.net/deadsnakes/ppa/ubuntu jammy
InRelease
Hit:10 https://ppa.launchpadcontent.net/graphics-drivers/ppa/ubuntu
jammy InRelease
Hit:11 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:12 https://ppa.launchpadcontent.net/savory1/ffmpeg4/ubuntu jammy
InRelease [18.1 kB]
Hit:13 https://ppa.launchpadcontent.net/ubuntugis/ppa/ubuntu jammy
InRelease
Get:14 https://ppa.launchpadcontent.net/savory1/ffmpeg4/ubuntu
jammy/main amd64 Packages [95.2 kB]
Fetched 370 kB in 3s (147 kB/s)
Reading package lists... Done
W: Skipping acquire of configured file 'main/source/Sources' as
repository 'https://r2u.stat.illinois.edu/ubuntu jammy InRelease' does
not seem to provide it (sources.list entry misspelt?)
Hit:1 https://cloud.r-project.org/bin/linux/ubuntu jammy-cran40/
InRelease
Hit:2
https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/
x86_64 InRelease
Hit:3 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:4 http://archive.ubuntu.com/ubuntu jammy InRelease
Ign:5 https://r2u.stat.illinois.edu/ubuntu jammy InRelease
Hit:6 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:7 https://ppa.launchpadcontent.net/deadsnakes/ppa/ubuntu jammy
InRelease
Hit:8 https://r2u.stat.illinois.edu/ubuntu jammy Release
Hit:9 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:10 https://ppa.launchpadcontent.net/graphics-drivers/ppa/ubuntu
jammy InRelease
Hit:12 https://ppa.launchpadcontent.net/savory1/ffmpeg4/ubuntu jammy
InRelease
Hit:13 https://ppa.launchpadcontent.net/ubuntugis/ppa/ubuntu jammy
InRelease
Reading package lists... Done
W: Skipping acquire of configured file 'main/source/Sources' as
repository 'https://r2u.stat.illinois.edu/ubuntu jammy InRelease' does
not seem to provide it (sources.list entry misspelt?)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer
required:
  libcodec2-1.0 libmfx1 libsrt1.4-gnutls libva-drm2 libva-x11-2 libva2
  libvpx7 libx264-163
```

Use 'apt autoremove' to remove them.

The following additional packages will be installed:

libavcodec-dev libavcodec58 libavdevice58 libavfilter7 libavformat-dev libavformat58

libavutil-dev libavutil56 libcodec2-1.2 libfftw3-double3

libpostproc55 librubberband2

libsharpvuv-dev libsharpvuv0 libsnappy1v5 libsndio7 libsndio7.0

libsrt1.5-gnutls

libswresample-dev libswresample3 libswscale-dev libswscale5 libvpx9

libwebp-dev libwebp7

libwebpdecoder3 libwebpdemux2 libwebpmux3 libx264-164 libx265-209

Suggested packages:

ffmpeg-doc libcuda1 libnvcuvid1 libnvidia-encode1 libfftw3-bin

libfftw3-dev sndiod

The following NEW packages will be installed:

ffmpeg libcodec2-1.2 libfftw3-double3 libsharpvuv-dev libsharpvuv0

libsndio7 libsrt1.5-gnutls

libvpx9 libwebpdecoder3 libx264-164 libx265-209

The following packages will be upgraded:

libavcodec-dev libavcodec58 libavdevice58 libavfilter7 libavformat-dev libavformat58

libavutil-dev libavutil56 libpostproc55 librubberband2 libsnappy1v5

libsndio7.0 libswresample-dev

libswresample3 libswscale-dev libswscale5 libwebp-dev libwebp7

libwebpdemux2 libwebpmux3

20 upgraded, 11 newly installed, 0 to remove and 108 not upgraded.

Need to get 32.7 MB of archives.

After this operation, 44.4 MB of additional disk space will be used.

Get:1 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libfftw3-double3 amd64 3.3.8-2ubuntu8 [770 kB]

Get:2 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu> jammy/main amd64 libavformat-dev amd64 7:4.4.5-0ubuntu1~22.04.sav0 [1,355 kB]

Get:3 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu> jammy/main amd64 libavcodec-dev amd64 7:4.4.5-0ubuntu1~22.04.sav0 [6,004 kB]

Get:4 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu> jammy/main amd64 libswresample-dev amd64 7:4.4.5-0ubuntu1~22.04.sav0 [96.1 kB]

Get:5 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu> jammy/main amd64 libavdevice58 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [102 kB]

Get:6 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu> jammy/main amd64 libavfilter7 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [1,453 kB]

Get:7 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu> jammy/main amd64 libavformat58 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [1,112 kB]

Get:8 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>

jammy/main amd64 libavcodec58 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [5,391 kB]  
Get:9 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libswresample3 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [80.6 kB]  
Get:10 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libpostproc55 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [79.0 kB]  
Get:11 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libswscale-dev amd64 7:4.4.5-0ubuntu1~22.04.sav0 [222 kB]  
Get:12 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libswscale5 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [197 kB]  
Get:13 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libavutil-dev amd64 7:4.4.5-0ubuntu1~22.04.sav0 [418 kB]  
Get:14 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libavutil56 amd64 7:4.4.5-0ubuntu1~22.04.sav0 [280 kB]  
Get:15 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libsndio7.0 amd64 1.9.0-0.3~22.04.sav0 [4,380 B]  
Get:16 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libsndio7 amd64 1.9.0-0.3~22.04.sav0 [30.5 kB]  
Get:17 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 librubberband2 amd64 3.3.0+dfsg-1~22.04.sav0 [128 kB]  
Get:18 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libsrt1.5-gnutls amd64 1.5.3-0ubuntu1~22.04.sav0 [326 kB]  
Get:19 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libcodec2-1.2 amd64 1.2.0-2~22.04.sav0 [8,997 kB]  
Get:20 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libsnappy1v5 amd64 1.1.10-1~22.04.sav0 [30.2 kB]  
Get:21 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libvpx9 amd64 1.14.1-1ubuntu1~22.04.sav0 [1,115 kB]  
Get:22 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libwebp-dev amd64 1.4.0-0ubuntu1~22.04.sav0 [517 kB]  
Get:23 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libwebpdemux2 amd64 1.4.0-0ubuntu1~22.04.sav0 [17.0 kB]  
Get:24 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libwebpmux3 amd64 1.4.0-0ubuntu1~22.04.sav0 [30.2 kB]  
Get:25 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libwebpdecoder3 amd64 1.4.0-0ubuntu1~22.04.sav0 [115 kB]  
Get:26 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>  
jammy/main amd64 libsharpyuv0 amd64 1.4.0-0ubuntu1~22.04.sav0 [19.4 kB]  
Get:27 <https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu>

```
jammy/main amd64 libsharpvuv-dev amd64 1.4.0-0ubuntu1~22.04.sav0 [23.8
kB]
Get:28 https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu
jammy/main amd64 libwebp7 amd64 1.4.0-0ubuntu1~22.04.sav0 [230 kB]
Get:29 https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu
jammy/main amd64 libx264-164 amd64 2:0.164.3191+git4613ac3-
0ubuntu1~22.04.sav0 [598 kB]
Get:30 https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu
jammy/main amd64 libx265-209 amd64 3.6-3~22.04.sav1 [1,265 kB]
Get:31 https://ppa.launchpadcontent.net/savoury1/ffmpeg4/ubuntu
jammy/main amd64 ffmpeg amd64 7:4.4.5-0ubuntu1~22.04.sav0 [1,711 kB]
Fetched 32.7 MB in 5s (6,309 kB/s)
Extracting templates from packages: 100%
(Reading database ... 123564 files and directories currently
installed.)
Preparing to unpack .../00-libavformat-dev_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavformat-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../01-libavcodec-dev_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavcodec-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../02-libswresample-dev_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libswresample-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../03-libavdevice58_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavdevice58:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../04-libavfilter7_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavfilter7:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../05-libavformat58_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavformat58:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../06-libavcodec58_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavcodec58:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../07-libswresample3_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libswresample3:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../08-libpostproc55_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
```

```
Unpacking libpostproc55:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../09-libswscale-dev_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libswscale-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../10-libswscale5_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libswscale5:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../11-libavutil-dev_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavutil-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../12-libavutil56_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libavutil56:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) over
(7:4.4.2-0ubuntu0.22.04.1) ...
Preparing to unpack .../13-libsndio7.0_1.9.0-
0.3~22.04.sav0_amd64.deb ...
Unpacking libsndio7.0:amd64 (1.9.0-0.3~22.04.sav0) over (1.8.1-
1.1) ...
Selecting previously unselected package libsndio7:amd64.
Preparing to unpack .../14-libsndio7_1.9.0-
0.3~22.04.sav0_amd64.deb ...
Unpacking libsndio7:amd64 (1.9.0-0.3~22.04.sav0) ...
Selecting previously unselected package libfftw3-double3:amd64.
Preparing to unpack .../15-libfftw3-double3_3.3.8-
2ubuntu8_amd64.deb ...
Unpacking libfftw3-double3:amd64 (3.3.8-2ubuntu8) ...
Preparing to unpack .../16-librubberband2_3.3.0+dfsg-
1~22.04.sav0_amd64.deb ...
Unpacking librubberband2:amd64 (3.3.0+dfsg-1~22.04.sav0) over (2.0.0-
2) ...
Selecting previously unselected package libsrt1.5-gnutls:amd64.
Preparing to unpack .../17-libsrt1.5-gnutls_1.5.3-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libsrt1.5-gnutls:amd64 (1.5.3-0ubuntu1~22.04.sav0) ...
Selecting previously unselected package libcodec2-1.2:amd64.
Preparing to unpack .../18-libcodec2-1.2_1.2.0-
2~22.04.sav0_amd64.deb ...
Unpacking libcodec2-1.2:amd64 (1.2.0-2~22.04.sav0) ...
Preparing to unpack .../19-libsnappy1v5_1.1.10-
1~22.04.sav0_amd64.deb ...
Unpacking libsnappy1v5:amd64 (1.1.10-1~22.04.sav0) over (1.1.8-
1build3) ...
Selecting previously unselected package libvpx9:amd64.
Preparing to unpack .../20-libvpx9_1.14.1-
1ubuntu1~22.04.sav0_amd64.deb ...
```

```
Unpacking libvpx9:amd64 (1.14.1-1ubuntu1~22.04.sav0) ...
Preparing to unpack .../21-libwebp-dev_1.4.0-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libwebp-dev:amd64 (1.4.0-0ubuntu1~22.04.sav0) over (1.2.2-
2ubuntu0.22.04.2) ...
Preparing to unpack .../22-libwebpdemux2_1.4.0-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libwebpdemux2:amd64 (1.4.0-0ubuntu1~22.04.sav0) over (1.2.2-
2ubuntu0.22.04.2) ...
Preparing to unpack .../23-libwebpmux3_1.4.0-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libwebpmux3:amd64 (1.4.0-0ubuntu1~22.04.sav0) over (1.2.2-
2ubuntu0.22.04.2) ...
Selecting previously unselected package libwebpdecoder3:amd64.
Preparing to unpack .../24-libwebpdecoder3_1.4.0-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libwebpdecoder3:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Selecting previously unselected package libsharpvuv0:amd64.
Preparing to unpack .../25-libsharpvuv0_1.4.0-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libsharpvuv0:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Selecting previously unselected package libsharpvuv-dev:amd64.
Preparing to unpack .../26-libsharpvuv-dev_1.4.0-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libsharpvuv-dev:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Preparing to unpack .../27-libwebp7_1.4.0-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libwebp7:amd64 (1.4.0-0ubuntu1~22.04.sav0) over (1.2.2-
2ubuntu0.22.04.2) ...
Selecting previously unselected package libx264-164:amd64.
Preparing to unpack .../28-libx264-164_2%3a0.164.3191+git4613ac3-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking libx264-164:amd64 (2:0.164.3191+git4613ac3-
0ubuntu1~22.04.sav0) ...
Selecting previously unselected package libx265-209:amd64.
Preparing to unpack .../29-libx265-209_3.6-3~22.04.sav1_amd64.deb ...
Unpacking libx265-209:amd64 (3.6-3~22.04.sav1) ...
Selecting previously unselected package ffmpeg.
Preparing to unpack .../30-ffmpeg_7%3a4.4.5-
0ubuntu1~22.04.sav0_amd64.deb ...
Unpacking ffmpeg (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libsharpvuv0:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Setting up libx264-164:amd64 (2:0.164.3191+git4613ac3-
0ubuntu1~22.04.sav0) ...
Setting up libcodec2-1.2:amd64 (1.2.0-2~22.04.sav0) ...
Setting up libwebpdecoder3:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Setting up libavutil56:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libsnappy1v5:amd64 (1.1.10-1~22.04.sav0) ...
Setting up libx265-209:amd64 (3.6-3~22.04.sav1) ...
Setting up libpostproc55:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
```

```
Setting up libfftw3-double3:amd64 (3.3.8-2ubuntu8) ...
Setting up libwebp7:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Setting up librubberband2:amd64 (3.3.0+dfsg-1~22.04.sav0) ...
Setting up libvpx9:amd64 (1.14.1-1ubuntu1~22.04.sav0) ...
Setting up libsrt1.5-gnutls:amd64 (1.5.3-0ubuntu1~22.04.sav0) ...
Setting up libswscale5:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libsndio7:amd64 (1.9.0-0.3~22.04.sav0) ...
Setting up libsharpvuv-dev:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Setting up libwebpmux3:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Setting up libavutil-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libwebpdemux2:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Setting up libswresample3:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libwebp-dev:amd64 (1.4.0-0ubuntu1~22.04.sav0) ...
Setting up libswscale-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libsndio7.0:amd64 (1.9.0-0.3~22.04.sav0) ...
Setting up libavcodec58:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libswresample-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libavformat58:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libavcodec-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libavformat-dev:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libavfilter7:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up libavdevice58:amd64 (7:4.4.5-0ubuntu1~22.04.sav0) ...
Setting up ffmpeg (7:4.4.5-0ubuntu1~22.04.sav0) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for libc-bin (2.35-0ubuntu3.4) ...
/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is
not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_opencl.so.0 is not a
```

symbolic link

```
!pip install ffmpeg-python
```

Requirement already satisfied: ffmpeg-python in

/usr/local/lib/python3.10/dist-packages (0.2.0)

Requirement already satisfied: future in

/usr/local/lib/python3.10/dist-packages (from ffmpeg-python) (1.0.0)

```
import ffmpeg
import matplotlib.pyplot as plt
import numpy as np
from PIL import Image
import cv2
from moviepy.editor import ImageSequenceClip
import os
from google.colab import files
import io
```

```
import ffmpeg
```

```
# Path to your video file
```

```
video_file = '/content/Produce.mp4'
```

```
# Extract all frames from the video
```

```
!ffmpeg -i {video_file} image%2d.png
```

```
# Verification step to list the extracted frames
```

```
import glob
frames = glob.glob('image*.png')
print(f'Extracted {len(frames)} frames from {video_file}')
```

ffmpeg version 4.4.5-0ubuntu1~22.04.sav0 Copyright (c) 2000-2024 the FFmpeg developers

built with gcc 11 (Ubuntu 11.4.0-1ubuntu1~22.04)

configuration: --prefix=/usr --extra-version='0ubuntu1~22.04.sav0'

--toolchain=hardened --libdir=/usr/lib/x86\_64-linux-gnu

--incdir=/usr/include/x86\_64-linux-gnu --arch=amd64 --enable-gpl --

disable-stripping --enable-gnutls --enable-ladspa --enable-libaom --

enable-libass --enable-libbluray --enable-libbs2b --enable-libcaca --

enable-libcdio --enable-libcodec2 --enable-libflite --enable-

libfontconfig --enable-libfreetype --enable-libfribidi --enable-libgme

--enable-libgsm --enable-libjack --enable-libmp3lame --enable-

libmysofa --enable-libopenjpeg --enable-libopenmpt --enable-libopus --

enable-libpulse --enable-librabbitmq --enable-librubberband --enable-

libshine --enable-libsnappy --enable-libsoxr --enable-lspeek --

enable-libsrt --enable-libssh --enable-libtheora --enable-libtwolame

--enable-libvidstab --enable-libvorbis --enable-libvpx --enable-

libwebp --enable-libx265 --enable-libxml2 --enable-libxvid --enable-

libzimg --enable-libzmq --enable-libzvbi --enable-lv2 --enable-omx --



```
enable-openal --enable-openc1 --enable-opengl --enable-sdl2 --enable-
pocketsphinx --enable-librsvg --enable-libdc1394 --enable-libdrm --
enable-libiec61883 --enable-chromaprint --enable-frei0r --enable-
libx264 --enable-shared
```

```
libavutil      56. 70.100 / 56. 70.100
libavcodec     58.134.100 / 58.134.100
libavformat    58. 76.100 / 58. 76.100
libavdevice    58. 13.100 / 58. 13.100
libavfilter    7.110.100 /  7.110.100
libswscale     5.  9.100 /  5.  9.100
libswresample  3.  9.100 /  3.  9.100
libpostproc   55.  9.100 / 55.  9.100
```

```
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '/content/Produce.mp4':
```

```
Metadata:
```

```
major_brand      : mp42
minor_version    : 16786688
compatible_brands: MSNVisommp42
creation_time    : 2024-08-04T13:36:39.000000Z
```

```
Duration: 00:00:01.00, start: 0.000000, bitrate: 15313 kb/s
```

```
Stream #0:0(eng): Video: h264 (High) (avc1 / 0x31637661),
yuv420p(tv, bt709), 1280x720 [SAR 1:1 DAR 16:9], 15113 kb/s, 29.97
fps, 29.97 tbr, 30k tbn, 59.94 tbc (default)
```

```
Metadata:
```

```
creation_time    : 2024-08-04T13:36:39.000000Z
handler_name     : Video Media Handler
vendor_id        : [0][0][0][0]
encoder          : AVC Coding
```

```
Stream #0:1(eng): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz,
stereo, fltp, 192 kb/s (default)
```

```
Metadata:
```

```
creation_time    : 2024-08-04T13:36:39.000000Z
handler_name     : Sound Media Handler
vendor_id        : [0][0][0][0]
```

```
Stream mapping:
```

```
Stream #0:0 -> #0:0 (h264 (native) -> png (native))
```

```
Press [q] to stop, [?] for help
```

```
Output #0, image2, to 'image%2d.png':
```

```
Metadata:
```

```
major_brand      : mp42
minor_version    : 16786688
compatible_brands: MSNVisommp42
encoder          : Lavf58.76.100
```

```
Stream #0:0(eng): Video: png, rgb24(pc, gbr/bt709/bt709,
progressive), 1280x720 [SAR 1:1 DAR 16:9], q=2-31, 200 kb/s, 29.97
fps, 29.97 tbn (default)
```

```
Metadata:
```

```
creation_time    : 2024-08-04T13:36:39.000000Z
handler_name     : Video Media Handler
vendor_id        : [0][0][0][0]
```

```

        encoder          : Lavc58.134.100 png
frame= 31 fps=8.5 q=-0.0 Lsize=N/A time=00:00:01.03 bitrate=N/A
dup=1 drop=0 speed=0.284x
video:33428kB audio:0kB subtitle:0kB other streams:0kB global
headers:0kB muxing overhead: unknown
Extracted 31 frames from /content/Produce.mp4

# Ensure ffmpeg-python and matplotlib libraries are installed
!pip install ffmpeg-python
!pip install matplotlib

Requirement already satisfied: ffmpeg-python in
/usr/local/lib/python3.10/dist-packages (0.2.0)
Requirement already satisfied: future in
/usr/local/lib/python3.10/dist-packages (from ffmpeg-python) (1.0.0)
Requirement already satisfied: matplotlib in
/usr/local/lib/python3.10/dist-packages (3.7.1)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.2.1)
Requirement already satisfied: cycler>=0.10 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (4.53.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.4.5)
Requirement already satisfied: numpy>=1.20 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (1.26.4)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (24.1)
Requirement already satisfied: pillow>=6.2.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (9.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (3.1.2)
Requirement already satisfied: python-dateutil>=2.7 in
/usr/local/lib/python3.10/dist-packages (from matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in
/usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7-
>matplotlib) (1.16.0)

import subprocess
import json
import matplotlib.pyplot as plt

# Function to get frame types using ffprobe
def get_frame_types(video_file):
    try:
        # Use ffprobe to extract frame information
        result = subprocess.run(
            [
                'ffprobe',

```

```

        '-v', 'error',
        '-select_streams', 'v:0',
        '-show_entries', 'frame=pict_type',
        '-of', 'json',
        video_file
    ],
    stdout=subprocess.PIPE,
    stderr=subprocess.PIPE,
    text=True
)

frames = json.loads(result.stdout)['frames']

# Count frame types
frame_count = {'I': 0, 'P': 0, 'B': 0}
for frame in frames:
    pict_type = frame['pict_type']
    frame_count[pict_type] += 1

    return frame_count
except subprocess.CalledProcessError as e:
    print("Error occurred while running ffprobe:", e.stderr)
    return None

# Analyze frame types
video_file = '/content/Produce.mp4' # Ensure this path is correct
frame_count = get_frame_types(video_file)

if frame_count:
    # Calculate percentages
    total_frames = sum(frame_count.values())
    percentages = {ftype: (count / total_frames) * 100 for ftype,
count in frame_count.items()}

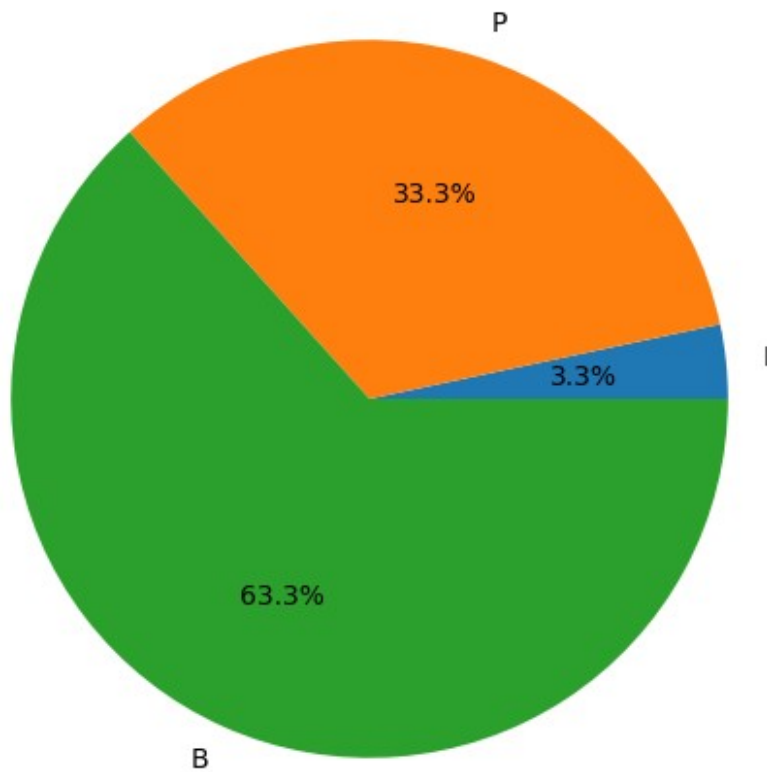
    # Print frame counts and percentages
    print(f"Frame counts: {frame_count}")
    print(f"Percentages: {percentages}")

    # Plot frame distribution
    plt.figure(figsize=(8, 6))
    plt.pie(percentages.values(), labels=percentages.keys(),
autopct='%1.1f%%')
    plt.title('Frame Type Distribution')
    plt.show()
else:
    print("Failed to analyze frame types.")

Frame counts: {'I': 1, 'P': 10, 'B': 19}
Percentages: {'I': 3.3333333333333335, 'P': 33.33333333333333, 'B':
63.33333333333333}

```

Frame Type Distribution



```
import subprocess
import json
import matplotlib.pyplot as plt

# Function to get bitrate information using ffprobe
def get_bitrate_info(video_file):
    try:
        # Use ffprobe to extract frame information
        result = subprocess.run(
            [
                'ffprobe',
                '-v', 'error',
                '-select_streams', 'v:0',
                '-show_entries', 'frame=pkt_size',
                '-of', 'json',
                video_file
            ],
            stdout=subprocess.PIPE,
            stderr=subprocess.PIPE,
            text=True
        )
```

```

    )

    # Print the entire JSON output for debugging
    print("FFprobe Output:\n", result.stdout)

    frames = json.loads(result.stdout).get('frames', [])

    if not frames:
        print("No frames found in the video file.")
        return None

    # Calculate bitrate for each frame
    bitrates = []
    for i, frame in enumerate(frames):
        if i == 0:
            bitrates.append(0)
        else:
            bitrates.append(int(frame['pkt_size']) * 8) # Convert
size from bytes to bits

    return bitrates
except subprocess.CalledProcessError as e:
    print("Error occurred while running ffprobe:", e.stderr)
    return None

# Analyze bitrate information
video_file = '/content/Produce.mp4' # Ensure this path is correct
bitrates = get_bitrate_info(video_file)

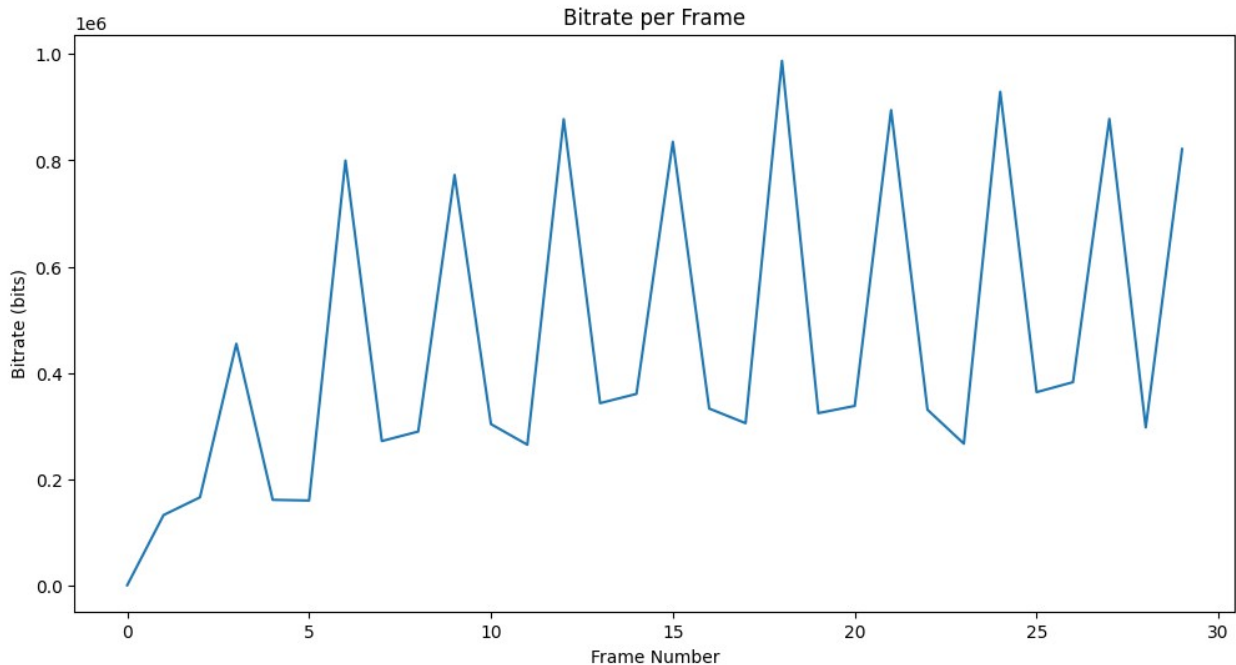
if bitrates:
    # Plot bitrate information
    plt.figure(figsize=(12, 6))
    plt.plot(bitrates)
    plt.xlabel('Frame Number')
    plt.ylabel('Bitrate (bits)')
    plt.title('Bitrate per Frame')
    plt.show()
else:
    print("Failed to analyze bitrate information.")

FFprobe Output:
{
  "frames": [
    {
      "pkt_size": "185951"
    },
    {
      "pkt_size": "16524"
    },
    {

```

```
    "pkt_size": "20691"  
  },  
  {  
    "pkt_size": "56852"  
  },  
  {  
    "pkt_size": "20110"  
  },  
  {  
    "pkt_size": "19945"  
  },  
  {  
    "pkt_size": "99962"  
  },  
  {  
    "pkt_size": "33936"  
  },  
  {  
    "pkt_size": "36179"  
  },  
  {  
    "pkt_size": "96573"  
  },  
  {  
    "pkt_size": "37925"  
  },  
  {  
    "pkt_size": "33081"  
  },  
  {  
    "pkt_size": "109707"  
  },  
  {  
    "pkt_size": "42857"  
  },  
  {  
    "pkt_size": "45040"  
  },  
  {  
    "pkt_size": "104382"  
  },  
  {  
    "pkt_size": "41586"  
  },  
  {  
    "pkt_size": "38143"  
  },  
  {  
    "pkt_size": "123432"
```

```
    },
    {
      "pkt_size": "40513"
    },
    {
      "pkt_size": "42209"
    },
    {
      "pkt_size": "111834"
    },
    {
      "pkt_size": "41315"
    },
    {
      "pkt_size": "33322"
    },
    {
      "pkt_size": "116154"
    },
    {
      "pkt_size": "45448"
    },
    {
      "pkt_size": "47800"
    },
    {
      "pkt_size": "109767"
    },
    {
      "pkt_size": "37153"
    },
    {
      "pkt_size": "102669"
    }
  ]
}
```



```
# Specify the path to the video file
video_path = '/content/Produce.mp4'

import os

# Create directories for each frame type
os.makedirs('I_frames', exist_ok=True)
os.makedirs('P_frames', exist_ok=True)
os.makedirs('B_frames', exist_ok=True)

# Extract I-frames
!ffmpeg -i {video_path} -vf "select='eq(pict_type,I)'" -vsync vfr
I_frames/I_frame_%03d.png

# Extract P-frames
!ffmpeg -i {video_path} -vf "select='eq(pict_type,P)'" -vsync vfr
P_frames/P_frame_%03d.png

# Extract B-frames
!ffmpeg -i {video_path} -vf "select='eq(pict_type,B)'" -vsync vfr
B_frames/B_frame_%03d.png

ffmpeg version 4.4.5-0ubuntu1~22.04.sav0 Copyright (c) 2000-2024 the
FFmpeg developers
  built with gcc 11 (Ubuntu 11.4.0-1ubuntu1~22.04)
  configuration: --prefix=/usr --extra-version='0ubuntu1~22.04.sav0'
--toolchain=hardened --libdir=/usr/lib/x86_64-linux-gnu
--incdir=/usr/include/x86_64-linux-gnu --arch=amd64 --enable-gpl --
disable-stripping --enable-gnutls --enable-ladspa --enable-libaom --
```



```
enable-libass --enable-libbluray --enable-libbs2b --enable-libcaca --
enable-libcdio --enable-libcodec2 --enable-libflite --enable-
libfontconfig --enable-libfreetype --enable-libfribidi --enable-libgme
--enable-libgsm --enable-libjack --enable-libmp3lame --enable-
libmysofa --enable-libopenjpeg --enable-libopenmpt --enable-libopus --
enable-libpulse --enable-librabbitmq --enable-librubberband --enable-
libshine --enable-libsndio --enable-libsoxr --enable-libspeex --
enable-libsrt --enable-libssh --enable-libtheora --enable-libtwolame
--enable-libvidstab --enable-libvorbis --enable-libvpx --enable-
libwebp --enable-libx265 --enable-libxml2 --enable-libxvid --enable-
libzimg --enable-libzmq --enable-libzvbi --enable-lv2 --enable-omx --
enable-opengl --enable-opencore --enable-openssl --enable-sdl2 --enable-
pocketsphinx --enable-librsync --enable-libdc1394 --enable-libdrm --
enable-libiec61883 --enable-chromaprint --enable-frei0r --enable-
libx264 --enable-shared
```

```
libavutil      56. 70.100 / 56. 70.100
libavcodec     58.134.100 / 58.134.100
libavformat    58. 76.100 / 58. 76.100
libavdevice    58. 13.100 / 58. 13.100
libavfilter    7.110.100 /  7.110.100
libswscale     5.  9.100 /  5.  9.100
libswresample  3.  9.100 /  3.  9.100
libpostproc   55.  9.100 / 55.  9.100
```

Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '/content/Produce.mp4':

Metadata:

```
major_brand      : mp42
minor_version    : 16786688
compatible_brands: MSNVisommp42
creation_time    : 2024-08-04T13:36:39.000000Z
```

Duration: 00:00:01.00, start: 0.000000, bitrate: 15313 kb/s

Stream #0:0(eng): Video: h264 (High) (avc1 / 0x31637661), yuv420p(tv, bt709), 1280x720 [SAR 1:1 DAR 16:9], 15113 kb/s, 29.97 fps, 29.97 tbr, 30k tbn, 59.94 tbc (default)

Metadata:

```
creation_time    : 2024-08-04T13:36:39.000000Z
handler_name     : Video Media Handler
vendor_id        : [0][0][0][0]
encoder          : AVC Coding
```

Stream #0:1(eng): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz, stereo, fltp, 192 kb/s (default)

Metadata:

```
creation_time    : 2024-08-04T13:36:39.000000Z
handler_name     : Sound Media Handler
vendor_id        : [0][0][0][0]
```

Stream mapping:

Stream #0:0 -> #0:0 (h264 (native) -> png (native))

Press [q] to stop, [?] for help

Output #0, image2, to 'I\_frames/I\_frame\_%03d.png':

Metadata:

```
major_brand      : mp42
minor_version    : 16786688
compatible_brands: MSNVisommp42
encoder         : Lavf58.76.100
Stream #0:0(eng): Video: png, rgb24(pc, gbr/bt709/bt709,
progressive), 1280x720 [SAR 1:1 DAR 16:9], q=2-31, 200 kb/s, 29.97
fps, 29.97 tbn (default)
Metadata:
  creation_time   : 2024-08-04T13:36:39.000000Z
  handler_name    : Video Media Handler
  vendor_id       : [0][0][0][0]
  encoder        : Lavc58.134.100 png
frame=      1 fps=0.0 q=-0.0 Lsize=N/A time=00:00:00.06 bitrate=N/A
speed=0.106x
video:999kB audio:0kB subtitle:0kB other streams:0kB global
headers:0kB muxing overhead: unknown
ffmpeg version 4.4.5-0ubuntu1~22.04.sav0 Copyright (c) 2000-2024 the
FFmpeg developers
  built with gcc 11 (Ubuntu 11.4.0-1ubuntu1~22.04)
  configuration: --prefix=/usr --extra-version='0ubuntu1~22.04.sav0'
--toolchain=hardened --libdir=/usr/lib/x86_64-linux-gnu
--incdir=/usr/include/x86_64-linux-gnu --arch=amd64 --enable-gpl --
disable-stripping --enable-gnutls --enable-ladspa --enable-libaom --
enable-libass --enable-libbluray --enable-libbs2b --enable-libcaca --
enable-libcdio --enable-libcodec2 --enable-libflite --enable-
libfontconfig --enable-libfreetype --enable-libfribidi --enable-libgme
--enable-libgsm --enable-libjack --enable-libmp3lame --enable-
libmysofa --enable-libopenjpeg --enable-libopenmpt --enable-libopus --
enable-libpulse --enable-librabbitmq --enable-librubberband --enable-
libshine --enable-libsnappp --enable-libsoxr --enable-libspeex --
enable-libsrt --enable-libssh --enable-libtheora --enable-libtwolame
--enable-libvidstab --enable-libvorbis --enable-libvpx --enable-
libwebp --enable-libx265 --enable-libxml2 --enable-libxvid --enable-
libzimg --enable-libzmq --enable-libzvbi --enable-lv2 --enable-omx --
enable-openal --enable-openc1 --enable-opengl --enable-sdl2 --enable-
pocketsphinx --enable-libsvg --enable-libdc1394 --enable-libdrm --
enable-libiec61883 --enable-chromaprint --enable-frei0r --enable-
libx264 --enable-shared
  libavutil      56. 70.100 / 56. 70.100
  libavcodec     58.134.100 / 58.134.100
  libavformat    58. 76.100 / 58. 76.100
  libavdevice    58. 13.100 / 58. 13.100
  libavfilter    7.110.100 /  7.110.100
  libswscale     5.  9.100 /  5.  9.100
  libswresample  3.  9.100 /  3.  9.100
  libpostproc   55.  9.100 / 55.  9.100
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '/content/Produce.mp4':
Metadata:
  major_brand    : mp42
```

```
minor_version      : 16786688
compatible_brands: MSNVisommp42
creation_time      : 2024-08-04T13:36:39.000000Z
Duration: 00:00:01.00, start: 0.000000, bitrate: 15313 kb/s
Stream #0:0(eng): Video: h264 (High) (avc1 / 0x31637661),
yuv420p(tv, bt709), 1280x720 [SAR 1:1 DAR 16:9], 15113 kb/s, 29.97
fps, 29.97 tbr, 30k tbn, 59.94 tbc (default)
Metadata:
  creation_time      : 2024-08-04T13:36:39.000000Z
  handler_name       : Video Media Handler
  vendor_id          : [0][0][0][0]
  encoder            : AVC Coding
Stream #0:1(eng): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz,
stereo, fltp, 192 kb/s (default)
Metadata:
  creation_time      : 2024-08-04T13:36:39.000000Z
  handler_name       : Sound Media Handler
  vendor_id          : [0][0][0][0]
Stream mapping:
  Stream #0:0 -> #0:0 (h264 (native) -> png (native))
Press [q] to stop, [?] for help
Output #0, image2, to 'P_frames/P_frame_%03d.png':
Metadata:
  major_brand        : mp42
  minor_version      : 16786688
  compatible_brands: MSNVisommp42
  encoder            : Lavf58.76.100
Stream #0:0(eng): Video: png, rgb24(pc, gbr/bt709/bt709,
progressive), 1280x720 [SAR 1:1 DAR 16:9], q=2-31, 200 kb/s, 29.97
fps, 29.97 tbn (default)
Metadata:
  creation_time      : 2024-08-04T13:36:39.000000Z
  handler_name       : Video Media Handler
  vendor_id          : [0][0][0][0]
  encoder            : Lavc58.134.100 png
frame= 10 fps=5.1 q=-0.0 Lsize=N/A time=00:00:01.03 bitrate=N/A
speed=0.529x
video:10874kB audio:0kB subtitle:0kB other streams:0kB global
headers:0kB muxing overhead: unknown
ffmpeg version 4.4.5-0ubuntu1~22.04.sav0 Copyright (c) 2000-2024 the
FFmpeg developers
  built with gcc 11 (Ubuntu 11.4.0-1ubuntu1~22.04)
  configuration: --prefix=/usr --extra-version='0ubuntu1~22.04.sav0'
--toolchain=hardened --libdir=/usr/lib/x86_64-linux-gnu
--incdir=/usr/include/x86_64-linux-gnu --arch=amd64 --enable-gpl --
disable-stripping --enable-gnutls --enable-ladspa --enable-libaom --
enable-libass --enable-libbluray --enable-libbs2b --enable-libcaca --
enable-libcdio --enable-libcodec2 --enable-libflite --enable-
libfontconfig --enable-libfreetype --enable-libfribidi --enable-libgme
```

```
--enable-libgsm --enable-libjack --enable-libmp3lame --enable-
libmysofa --enable-libopenjpeg --enable-libopenmpt --enable-libopus --
enable-libpulse --enable-librabbitmq --enable-librubberband --enable-
libshine --enable-libsnappy --enable-libsoxr --enable-libspeex --
enable-libsrt --enable-libssh --enable-libtheora --enable-libtwolame
--enable-libvidstab --enable-libvorbis --enable-libvpx --enable-
libwebp --enable-libx265 --enable-libxml2 --enable-libxvid --enable-
libzimg --enable-libzmq --enable-libzvbi --enable-lv2 --enable-omx --
enable-openal --enable-openc1 --enable-opengl --enable-sdl2 --enable-
pocketsphinx --enable-librsvg --enable-libdc1394 --enable-libdrm --
enable-libiec61883 --enable-chromaprint --enable-frei0r --enable-
libx264 --enable-shared
libavutil      56. 70.100 / 56. 70.100
libavcodec     58.134.100 / 58.134.100
libavformat    58. 76.100 / 58. 76.100
libavdevice    58. 13.100 / 58. 13.100
libavfilter    7.110.100 /  7.110.100
libswscale     5.  9.100 /  5.  9.100
libswresample  3.  9.100 /  3.  9.100
libpostproc   55.  9.100 / 55.  9.100
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '/content/Produce.mp4':
Metadata:
  major_brand      : mp42
  minor_version    : 16786688
  compatible_brands: MSNVisommp42
  creation_time    : 2024-08-04T13:36:39.000000Z
Duration: 00:00:01.00, start: 0.000000, bitrate: 15313 kb/s
Stream #0:0(eng): Video: h264 (High) (avc1 / 0x31637661),
yuv420p(tv, bt709), 1280x720 [SAR 1:1 DAR 16:9], 15113 kb/s, 29.97
fps, 29.97 tbr, 30k tbn, 59.94 tbc (default)
Metadata:
  creation_time    : 2024-08-04T13:36:39.000000Z
  handler_name     : Video Media Handler
  vendor_id        : [0][0][0][0]
  encoder          : AVC Coding
Stream #0:1(eng): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz,
stereo, fltp, 192 kb/s (default)
Metadata:
  creation_time    : 2024-08-04T13:36:39.000000Z
  handler_name     : Sound Media Handler
  vendor_id        : [0][0][0][0]
Stream mapping:
  Stream #0:0 -> #0:0 (h264 (native) -> png (native))
Press [q] to stop, [?] for help
Output #0, image2, to 'B_frames/B_frame_%03d.png':
Metadata:
  major_brand      : mp42
  minor_version    : 16786688
  compatible_brands: MSNVisommp42
```

```
encoder          : Lavf58.76.100
Stream #0:0(eng): Video: png, rgb24(pc, gbr/bt709/bt709,
progressive), 1280x720 [SAR 1:1 DAR 16:9], q=2-31, 200 kb/s, 29.97
fps, 29.97 tbn (default)
```

```
Metadata:
```

```
creation_time    : 2024-08-04T13:36:39.000000Z
handler_name     : Video Media Handler
vendor_id        : [0][0][0][0]
encoder          : Lavc58.134.100 png
```

```
frame= 19 fps=8.9 q=-0.0 Lsize=N/A time=00:00:01.00 bitrate=N/A
speed=0.468x
```

```
video:20557kB audio:0kB subtitle:0kB other streams:0kB global
headers:0kB muxing overhead: unknown
```

```
import cv2
import numpy as np
from google.colab.patches import cv2_imshow
```

```
# Paths to the first extracted frames
```

```
i_frame_path = 'I_frames/I_frame_001.png'
p_frame_path = 'P_frames/P_frame_001.png'
b_frame_path = 'B_frames/B_frame_001.png'
```

```
# Load the frames
```

```
i_frame = cv2.imread(i_frame_path)
p_frame = cv2.imread(p_frame_path)
b_frame = cv2.imread(b_frame_path)
```

```
# Check if frames are loaded properly
```

```
if i_frame is None:
    print(f"Error loading frame from {i_frame_path}")
if p_frame is None:
    print(f"Error loading frame from {p_frame_path}")
if b_frame is None:
    print(f"Error loading frame from {b_frame_path}")
```

```
# Resize frames to the same height (optional, for consistent display)
```

```
# This is only needed if the frames are of different sizes
```

```
height = min(i_frame.shape[0], p_frame.shape[0], b_frame.shape[0])
i_frame = cv2.resize(i_frame, (int(i_frame.shape[1] * height /
i_frame.shape[0]), height))
p_frame = cv2.resize(p_frame, (int(p_frame.shape[1] * height /
p_frame.shape[0]), height))
b_frame = cv2.resize(b_frame, (int(b_frame.shape[1] * height /
b_frame.shape[0]), height))
```

```
# Concatenate frames horizontally
```

```
concatenated_frames = np.concatenate((i_frame, p_frame, b_frame),
axis=1)
```

```
# Display the concatenated frames
cv2_imshow(concatenated_frames)
```



```
import cv2
import numpy as np

def calculate_psnr(img1, img2):
    # Ensure the images are in the same shape and type
    img1 = cv2.resize(img1, (img2.shape[1], img2.shape[0]))
    mse = np.mean((img1 - img2) ** 2)
    if mse == 0: # MSE is zero means no noise is present in the
        signal.
        return float('inf')
    PIXEL_MAX = 255.0
    psnr = 20 * np.log10(PIXEL_MAX / np.sqrt(mse))
    return psnr

# Paths to the first extracted frames
i_frame_path = 'I_frames/I_frame_001.png'
p_frame_path = 'P_frames/P_frame_001.png'
b_frame_path = 'B_frames/B_frame_001.png'

# Load the frames
i_frame = cv2.imread(i_frame_path)
p_frame = cv2.imread(p_frame_path)
b_frame = cv2.imread(b_frame_path)

# Check if frames are loaded properly
if i_frame is None:
    print(f"Error loading frame from {i_frame_path}")
if p_frame is None:
    print(f"Error loading frame from {p_frame_path}")
if b_frame is None:
    print(f"Error loading frame from {b_frame_path}")

# PSNR between I-frame and P-frame
psnr_ip = calculate_psnr(i_frame, p_frame)
print(f"PSNR between I-frame and P-frame: {psnr_ip} dB")

# PSNR between I-frame and B-frame
psnr_ib = calculate_psnr(i_frame, b_frame)
print(f"PSNR between I-frame and B-frame: {psnr_ib} dB")
```

PSNR between I-frame and P-frame: 30.65501650439912 dB  
PSNR between I-frame and B-frame: 32.37271174917757 dB

```
import os

def calculate_average_frame_size(directory):
    total_size = 0
    num_files = 0

    for filename in os.listdir(directory):
        filepath = os.path.join(directory, filename)
        if os.path.isfile(filepath):
            total_size += os.path.getsize(filepath)
            num_files += 1

    if num_files == 0:
        return 0
    return total_size / num_files

# Calculate average file sizes in bytes
average_i_frame_size = calculate_average_frame_size('I_frames')
average_p_frame_size = calculate_average_frame_size('P_frames')
average_b_frame_size = calculate_average_frame_size('B_frames')

# Convert to kilobytes (KB)
average_i_frame_size_kb = average_i_frame_size / 1024
average_p_frame_size_kb = average_p_frame_size / 1024
average_b_frame_size_kb = average_b_frame_size / 1024

print(f"Average I-frame size: {average_i_frame_size_kb:.2f} KB")
print(f"Average P-frame size: {average_p_frame_size_kb:.2f} KB")
print(f"Average B-frame size: {average_b_frame_size_kb:.2f} KB")

Average I-frame size: 998.77 KB
Average P-frame size: 1087.40 KB
Average B-frame size: 1081.92 KB

import os
import subprocess

# Create a directory to save I-frames
i_frame_dir = "I_frames_reconstructed"
os.makedirs(i_frame_dir, exist_ok=True)

# Extract I-frames using ffmpeg
input_video = "path_to_your_video.mp4"
subprocess.run([
    "ffmpeg", "-i", input_video, "-vf", "select='eq(pict_type\\,I)'",
    "-vsync", "vfr",
    f"{i_frame_dir}/I_frame_%03d.png"
])
```

```
print(f"I-frames have been saved to the directory: {i_frame_dir}")
I-frames have been saved to the directory: I_frames_reconstructed
# Define the path for the output reconstructed video
output_video = "reconstructed_video.mp4"

# Reconstruct video using the extracted I-frames
subprocess.run([
    "ffmpeg", "-framerate", "1", "-i", f"{i_frame_dir}/I_frame_
%03d.png", "-c:v", "libx264",
    "-pix_fmt", "yuv420p", "-r", "30", output_video
])

print(f"The reconstructed video has been saved as: {output_video}")
The reconstructed video has been saved as: reconstructed_video.mp4

from google.colab import drive
drive.mount('/content/drive')

Mounted at /content/drive
```