

# 컴퓨터 비전

## OpenCV 설치

국민대학교 HCI Lab

최 정 우

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# 실습 환경

- Ubuntu 18.04.3 LTS
- OpenCV 3.4.2.16 + OpenCV contrib 3.4.2.16
  - 지정된 버전으로 설치
  - 업데이트된 버전 설치시 추후 실습에 문제 발생 가능
- Python 3.6.8 (기본설치)

# OpenCV 설치

- Colab
  - `!pip install opencv-python==3.4.2.16`  
`&& pip install opencv-contrib-python==3.4.2.16`
  - 설치 상세 설명
    - <http://bit.ly/2zHKnWi>
  - 참고사항
    - `cv2.imshow` 동작 안됨, `matplotlib`를 이용하여 그림 출력

```
1 !python --version
Python 3.6.8

1 !pip install opencv-python==3.4.2.16 && pip install opencv-contrib-python==3.4.2.16
Collecting opencv-python==3.4.2.16
  Downloading https://files.pythonhosted.org/packages/fa/7d/5042b668a8ed41d2a/opencv-python-3.4.2.16-cp36-cp36m-macosx_10_10_universal2.whl (25.0MB)
Requirement already satisfied: numpy>=1.11.3 in /usr/local/lib/python3.6/dist
ERROR: alumentations 0.1.12 has requirement imgaug<0.2.7,>=0.2.5, but you'll
Installing collected packages: opencv-python
  Found existing installation: opencv-python 3.4.5.20
  Uninstalling opencv-python-3.4.5.20:
    Successfully uninstalled opencv-python-3.4.5.20
  Successfully installed opencv-python-3.4.2.16
Collecting opencv-contrib-python==3.4.2.16
  Downloading https://files.pythonhosted.org/packages/08/f1/66330f4042c4fb3b2/opencv-contrib-python-3.4.2.16-cp36-cp36m-macosx_10_10_universal2.whl (30.6MB)
Requirement already satisfied: numpy>=1.11.3 in /usr/local/lib/python3.6/dist
Installing collected packages: opencv-contrib-python
  Found existing installation: opencv-contrib-python 3.4.3.18
  Uninstalling opencv-contrib-python-3.4.3.18:
    Successfully uninstalled opencv-contrib-python-3.4.3.18
  Successfully installed opencv-contrib-python-3.4.2.16

1 import cv2
2 cv2.__version__
'3.4.2'
```

# OpenCV 설치

- Ubuntu

- pip 설치

- \$ sudo apt install python3-pip

```
nickname@ubuntu:~$ sudo apt install python3-pip
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  build-essential dh-python dpkg-dev fakeroot g++ g++-7 gcc gcc-7 libalgorithm-diff-perl libalgorithm-d
  libasan4 libatomic1 libc-dev-bin libc6-dev libcilkrts5 libexpat1-dev libfakeroot libgcc-7-dev libitm1
  libpython3.6-dev libquadmath0 libstdc++-7-dev libtsan0 libubsan0 linux-libc-dev make manpages-dev pyt
  python3-setuptools python3-wheel python3.6-dev
Suggested packages:
  debian-keyring g++-multilib g++-7-multilib gcc-7-doc libstdc++6-7-dbg gcc-multilib autoconf automake
  gcc-7-locales libgcc1-dbg libgomp1-dbg libitm1-dbg libatomic1-dbg libasan4-dbg liblsan0-dbg libtsan0-
  libmpx2-dbg libquadmath0-dbg libc-dev-bin libc6-dev libcilkrts5 libexpat1-dev libfakeroot libgcc-7-dev libitm1
  libpython3.6-dev libquadmath0 libstdc++-7-dev libtsan0 libubsan0 linux-libc-dev make manpages-dev pyt
  python3-setuptools python3-wheel python3.6-dev
The following NEW packages will be installed:
  build-essential dh-python dpkg-dev fakeroot g++ g++-7 gcc gcc-7 libalgorithm-diff-perl libalgorithm-d
  libasan4 libatomic1 libc-dev-bin libc6-dev libcilkrts5 libexpat1-dev libfakeroot libgcc-7-dev libitm1
  libpython3.6-dev libquadmath0 libstdc++-7-dev libtsan0 libubsan0 linux-libc-dev make manpages-dev pyt
  python3-setuptools python3-wheel python3.6-dev
0 upgraded, 37 newly installed, 0 to remove and 3 not upgraded.
Need to get 74.5 MB of archives.
After this operation, 199 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

# OpenCV 설치

- Ubuntu

- pip 로 OpenCV 설치

- `$ pip3 install opencv-python==3.4.2.16 && \`

- `pip3 install opencv-contrib-python==3.4.2.16`

```
nickname@ubuntu:~$ pip3 install opencv-python==3.4.2.16 && pip3 install opencv-contrib-python==3.4.2.16
Collecting opencv-python==3.4.2.16
  Downloading https://files.pythonhosted.org/packages/fa/7d/5042b668a8ed41d2a80b8c172f5efcd572e3c046c75a36-cp36m-manylinux1_x86_64.whl (25.0MB)
    100% |████████████████████████████████████████| 25.0MB 66kB/s
Collecting numpy>=1.11.3 (from opencv-python==3.4.2.16)
  Downloading https://files.pythonhosted.org/packages/75/92/57179ed45307ec6179e344231c47da7f3f3da9e2eee5anylinux1_x86_64.whl (20.4MB)
    95% |██████████████████████████████████████| 19.5MB 12.7MB/s eta 0:00:01
```

# OpenCV 빌드방법(3.1.0)

- Prerequisite
  - \$ sudo apt-get install cmake git libgtk2.0-dev pkg-config libavcodec-dev libavformat-dev libswscale-dev
- OpenCV 3.1.0
  - \$ git clone <https://github.com/opencv/opencv.git>
  - \$ cd opencv
  - \$ git checkout 3.1.0
- OpenCV 3.1.0 contrib
  - \$ git clone [https://github.com/opencv/opencv\\_contrib.git](https://github.com/opencv/opencv_contrib.git)
  - \$ cd opencv\_contrib
  - \$ git checkout 3.1.0
- cmake
  - \$ sudo apt-get install cmake-curses-gui

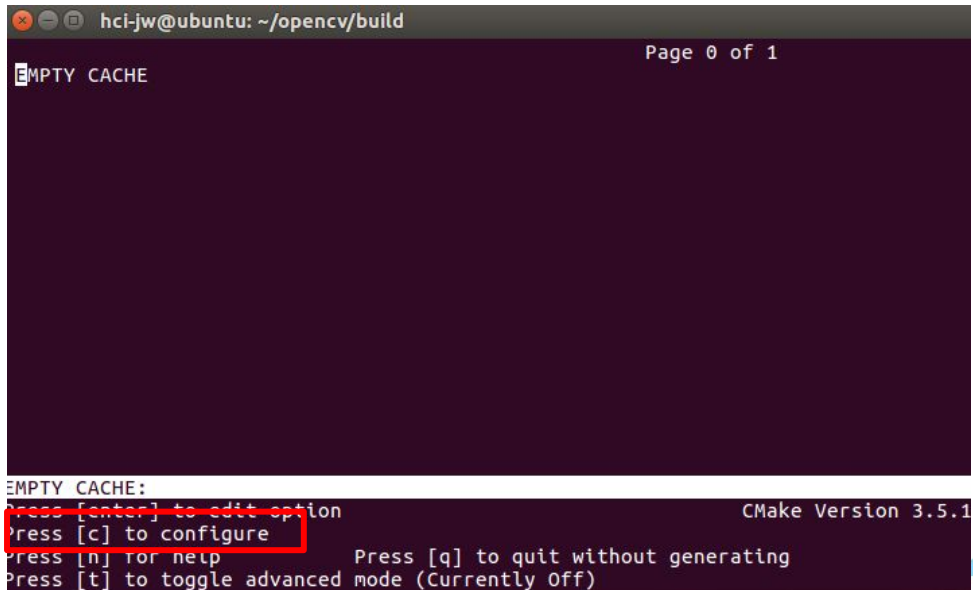
# OpenCV contrib repository

- OpenCV 의 extra module 저장소
- Why
  - 새로운 모듈은 불안정적
  - 더많은 테스트 필요
  - License 문제



# OpenCV 빌드방법(3.1.0)

- Opencv build with contrib
  - \$ cd opencv
  - \$ mkdir build && cd build
  - \$ cmake ..

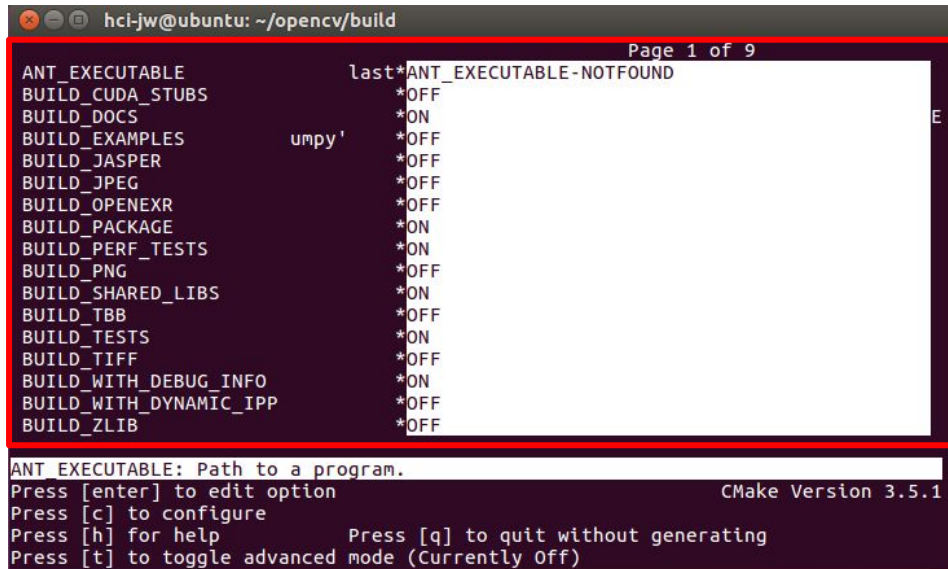


```
hci-jw@ubuntu: ~/opencv/build
Page 0 of 1
EMPTY CACHE

EMPTY CACHE:
press [enter] to edit option
press [c] to configure
press [h] for help
press [t] to toggle advanced mode (Currently Off)
CMake Version 3.5.1
Press [q] to quit without generating
```

# OpenCV 빌드방법(3.1.0)

- Opencv build with contrib
  - c (configure)

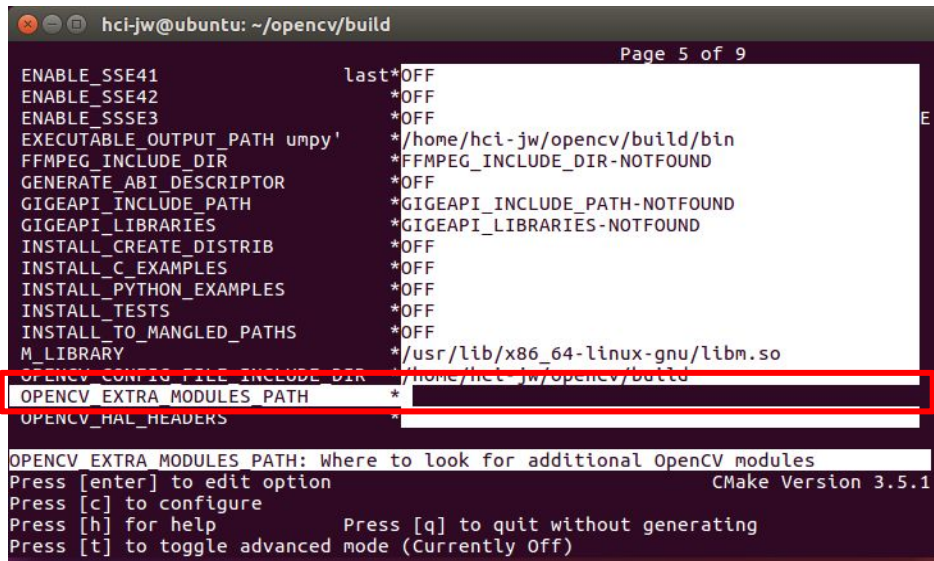


```
hci-jw@ubuntu: ~/opencv/build
Page 1 of 9
ANT_EXECUTABLE          last*ANT_EXECUTABLE-NOTFOUND
BUILD_CUDA_STUBS        *OFF
BUILD_DOCS               *ON
BUILD_EXAMPLES          umpy' *OFF
BUILD_JASPER             *OFF
BUILD_JPEG               *OFF
BUILD_OPENEXR            *OFF
BUILD_PACKAGE           *ON
BUILD_PERF_TESTS        *ON
BUILD_PNG                *OFF
BUILD_SHARED_LIBS       *ON
BUILD_TBB                *OFF
BUILD_TESTS              *ON
BUILD_TIFF               *OFF
BUILD_WITH_DEBUG_INFO   *ON
BUILD_WITH_DYNAMIC_IPP  *OFF
BUILD_ZLIB               *OFF

ANT_EXECUTABLE: Path to a program.
Press [enter] to edit option
Press [c] to configure
Press [h] for help
Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)
CMake Version 3.5.1
```

# OpenCV 빌드방법(3.1.0)

- Opencv build with contrib
  - OPENCV\_EXTRA\_MODULES\_PATH
  - opencv\_contrib/modules의 경로 입력
- eg: /home/hci-jw/opencv\_contrib/modules
  - c (다시 한번 configure)

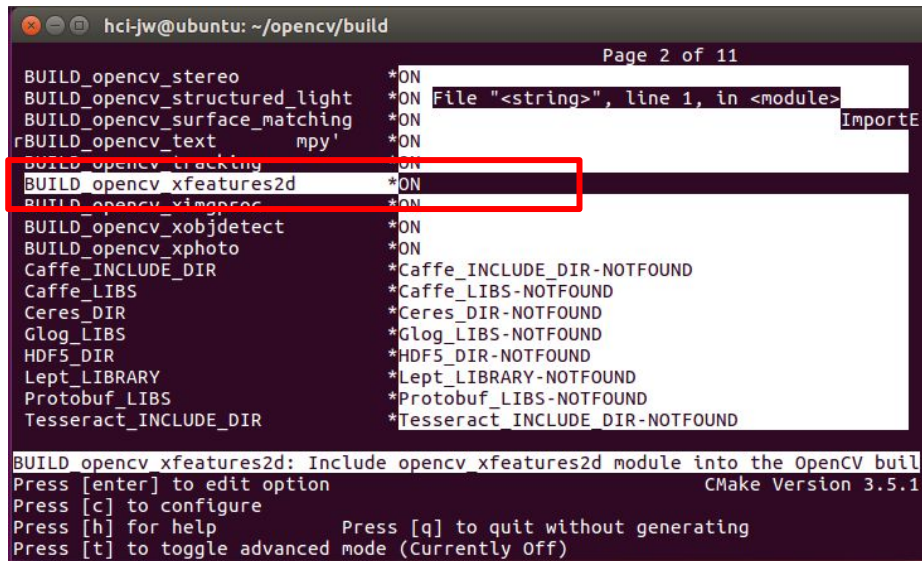


```
hci-jw@ubuntu: ~/opencv/build
Page 5 of 9
ENABLE_SSE41 last*OFF
ENABLE_SSE42 *OFF
ENABLE_SSSE3 *OFF
EXECUTABLE_OUTPUT_PATH umpy' */home/hci-jw/opencv/build/bin
FFMPEG_INCLUDE_DIR *FFMPEG_INCLUDE_DIR-NOTFOUND
GENERATE_ABI_DESCRIPTOR *OFF
GIGEAPI_INCLUDE_PATH *GIGEAPI_INCLUDE_PATH-NOTFOUND
GIGEAPI_LIBRARIES *GIGEAPI_LIBRARIES-NOTFOUND
INSTALL_CREATE_DISTRIB *OFF
INSTALL_C_EXAMPLES *OFF
INSTALL_PYTHON_EXAMPLES *OFF
INSTALL_TESTS *OFF
INSTALL_TO_MANGLED_PATHS *OFF
M_LIBRARY */usr/lib/x86_64-linux-gnu/libm.so
OPENCV_CONFIG_FILE_INCLUDE_DIR */home/hci-jw/opencv/build
OPENCV_EXTRA_MODULES_PATH *
OPENCV_HAL_HEADERS *

OPENCV EXTRA MODULES PATH: Where to look for additional OpenCV modules
Press [enter] to edit option CMake Version 3.5.1
Press [c] to configure
Press [h] for help Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)
```

# OpenCV 빌드방법(3.1.0)

- Opencv build with contrib
  - BUILD\_opencv\_xfeature2d ON 상태 확인
  - SIFT 알고리즘은 xfeature2d 안에 존재



The screenshot shows the CMake GUI interface for building OpenCV. The window title is 'hcl-jw@ubuntu: ~/opencv/build'. The 'Page 2 of 11' is displayed in the top right. A list of build options is shown on the left, with 'BUILD\_opencv\_xfeatures2d' highlighted by a red rectangle and set to '\*ON'. Other options include 'BUILD\_opencv\_stereo', 'BUILD\_opencv\_structured\_light', 'BUILD\_opencv\_surface\_matching', 'BUILD\_opencv\_text', 'BUILD\_opencv\_tracking', 'BUILD\_opencv\_ximgproc', 'BUILD\_opencv\_xobjdetect', 'BUILD\_opencv\_xphoto', 'Caffe\_INCLUDE\_DIR', 'Caffe\_LIBS', 'Ceres\_DIR', 'Glog\_LIBS', 'HDF5\_DIR', 'Lept\_LIBRARY', 'Protobuf\_LIBS', and 'Tesseract\_INCLUDE\_DIR'. The right pane shows the configuration for 'BUILD\_opencv\_xfeatures2d', indicating it will be included in the build. The bottom status bar shows 'CMake Version 3.5.1' and instructions for editing options, configuring, getting help, quitting, or toggling advanced mode.

```
hcl-jw@ubuntu: ~/opencv/build
Page 2 of 11
BUILD_opencv_stereo *ON
BUILD_opencv_structured_light *ON
BUILD_opencv_surface_matching *ON
BUILD_opencv_text *ON
BUILD_opencv_tracking *ON
BUILD_opencv_xfeatures2d *ON
BUILD_opencv_ximgproc *ON
BUILD_opencv_xobjdetect *ON
BUILD_opencv_xphoto *ON
Caffe_INCLUDE_DIR *Caffe_INCLUDE_DIR-NOTFOUND
Caffe_LIBS *Caffe_LIBS-NOTFOUND
Ceres_DIR *Ceres_DIR-NOTFOUND
Glog_LIBS *Glog_LIBS-NOTFOUND
HDF5_DIR *HDF5_DIR-NOTFOUND
Lept_LIBRARY *Lept_LIBRARY-NOTFOUND
Protobuf_LIBS *Protobuf_LIBS-NOTFOUND
Tesseract_INCLUDE_DIR *Tesseract_INCLUDE_DIR-NOTFOUND
BUILD_opencv_xfeatures2d: Include opencv_xfeatures2d module into the OpenCV build
Press [enter] to edit option
Press [c] to configure
Press [h] for help
Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)
```

# OpenCV 빌드방법(3.1.0)

- Opencv build for Python check
  - Python 관련 경로 확인
  - 이상이 없다면 c (configure) 다시

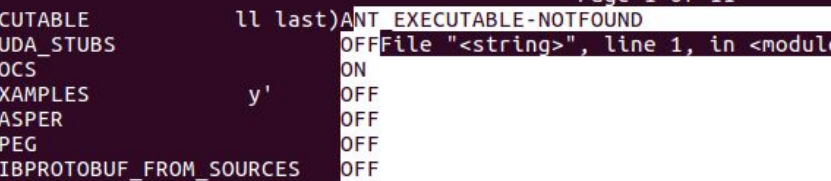
```

❌⚙️🔍 hci-jw@ubuntu: ~/opencv/build
Page 8 of 11
OPENCV_EXTRA_MODULES_PATH /home/hci-jw/opencv_contrib/modules
OPENCV_HAL_HEADERS File "<string>", line 1, in <module>
OPENCV_HAL_LIBS ImportE
OPENCV_WARNINGS_ARE_ERRORS OFF
OPENEXR_INCLUDE_PATH OPENEXR_INCLUDE_PATH-NOTFOUND
OPENCV_INCLUDE_PATH OPENCV_INCLUDE_PATH-NOTFOUND
PYTHON2_EXECUTABLE /usr/bin/python2.7
PYTHON2_INCLUDE_DIR /usr/include/python2.7
PYTHON2_INCLUDE_DIR2
PYTHON2_LIBRARY /usr/lib/x86_64-linux-gnu/libpython2.7.so
PYTHON2_LIBRARY_DEBUG
PYTHON2_NUMPY_INCLUDE_DIRS /usr/local/lib/python2.7/dist-packages/numpy/
PYTHON2_PACKAGES_PATH lib/python2.7/dist-packages
PYTHON2_EXECUTABLE /usr/bin/python2
PYTHON3_INCLUDE_DIR
PYTHON3_INCLUDE_DIR2
PYTHON3_LIBRARY
PYTHON3_INCLUDE_DIR: Python include dir
Press [enter] to edit option CMake Version 3.5.1
Press [c] to configure
Press [h] for help Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)

```

# OpenCV 빌드방법(3.1.0)

- **Generate Makefile**
  - generate and exit 이 생김
  - g 눌러서 Makefile 생성



```

Page 1 of 11
ANT_EXECUTABLE ll last)ANT_EXECUTABLE-NOTFOUND
BUILD_CUDA_STUBS OFF File "<string>", line 1, in <module>
BUILD_DOCS ON Importe
BUILD_EXAMPLES y' OFF
BUILD_JASPER OFF
BUILD_JPEG OFF
BUILD_LIBPROTOBUF_FROM_SOURCES OFF
BUILD_OPENEXR OFF
BUILD_PACKAGE ON
BUILD_PERF_TESTS ON
BUILD_PNG OFF
BUILD_SHARED_LIBS ON
BUILD_TIFF OFF
BUILD_WITH_DEBUG_INFO ON
BUILD_WITH_DYNAMIC_IPP OFF

LibreOffice Calc

ANT_EXECUTABLE: Path to a program.
Press [enter] to edit option
Press [c] to configure
Press [h] for help
Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)

CMake Version 3.5.1
Press [g] to generate and exit

```



# OpenCV 빌드 방법(3.1.0)

- Build OpenCV

- \$ make -j4
- \$ sudo make install
- \$ sudo ldconfig

```
hci-jw@ubuntu:~/opencv/build$ make -j4
Scanning dependencies of target zlib
Scanning dependencies of target libwebp
Scanning dependencies of target libjpeg
Scanning dependencies of target libjasper
[ 0%] Building C object 3rdparty/zlib/CMakeFiles/zlib.dir/adler32.c.o
[ 0%] Building C object 3rdparty/libjasper/CMakeFiles/libjasper.dir/jas_stream.c.o
[ 0%] Building C object 3rdparty/libjpeg/CMakeFiles/libjpeg.dir/jutils.c.o
[ 0%] Building C object 3rdparty/libwebp/CMakeFiles/libwebp.dir/dec/idec.c.o
[ 0%] Building C object 3rdparty/libjpeg/CMakeFiles/libjpeg.dir/jddctmgr.c.o
[ 0%] Building C object 3rdparty/zlib/CMakeFiles/zlib.dir/compress.c.o
[ 0%] Building C object 3rdparty/zlib/CMakeFiles/zlib.dir/crc32.c.o
[ 0%] Building C object 3rdparty/libwebp/CMakeFiles/libwebp.dir/dec/frame.c.o
[ 0%] Building C object 3rdparty/libjpeg/CMakeFiles/libjpeg.dir/jccoefct.c.o
[ 0%] Building C object 3rdparty/libjasper/CMakeFiles/libjasper.dir/jpc_cs.c.o
[ 0%] Building C object 3rdparty/zlib/CMakeFiles/zlib.dir/deflate.c.o
[ 0%] Building C object 3rdparty/libjpeg/CMakeFiles/libjpeg.dir/jfdctflt.c.o
[ 0%] Building C object 3rdparty/libwebp/CMakeFiles/libwebp.dir/dec/tree.c.o
[ 0%] Building C object 3rdparty/libjpeg/CMakeFiles/libjpeg.dir/jcdctmgr.c.o
[ 0%] Building C object 3rdparty/libwebp/CMakeFiles/libwebp.dir/dec/quant.c.o
[ 0%] Building C object 3rdparty/libjpeg/CMakeFiles/libjpeg.dir/jdmaster.c.o
[ 0%] Building C object 3rdparty/libwebp/CMakeFiles/libwebp.dir/dec/buffer.c.o
```

# OpenCV 빌드방법(3.1.0)

- Python check

- \$ python
- >>> import cv2
- >>> cv2.\_\_version\_\_

```
hci-jw@ubuntu:~/opencv/build$ python
Python 2.7.12 (default, Nov 19 2016, 06:48:10)
[GCC 5.4.0 20160609] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> import cv2
>>> cv2.__version__
'3.1.0'
>>>
```

- Python-tk install (matplotlib)

- sudo apt-get install python-tk



# Test Code

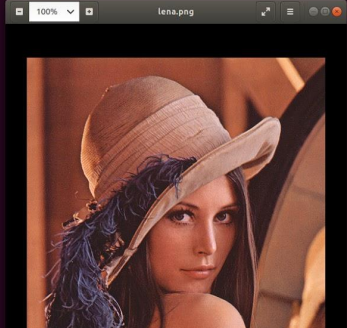
- OpenCV를 이용한 이미지 출력
  - Eye of GNOME graphics viewer (eog)를 이용한 이미지 출력 예시

```
nickname@ubuntu:~/testcode$ wget https://docs.opencv.org/2.4/_images/lena.png
--2019-09-01 03:53:12-- https://docs.opencv.org/2.4/_images/lena.png
Resolving docs.opencv.org (docs.opencv.org)... 207.38.86.214, 2605:de00:1:1:4a:39:0:7
Connecting to docs.opencv.org (docs.opencv.org)|207.38.86.214|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 620636 (606K) [image/png]
Saving to: 'lena.png'

lena.png                               100%[=====] 606.09K  467KB/s  in 1.3s

2019-09-01 03:53:14 (467 KB/s) - 'lena.png' saved [620636/620636]

nickname@ubuntu:~/testcode$ ls
lena.png
nickname@ubuntu:~/testcode$ eog lena.png
```

A screenshot of a terminal window on a Linux system. The terminal shows the execution of the 'wget' command to download the 'lena.png' image from the OpenCV documentation website. The download is successful, and the file is saved in the current directory. Then, the 'ls' command is used to verify the file's presence. Finally, the 'eog lena.png' command is executed, which opens the Eye of GNOME graphics viewer. The viewer window is titled 'lena.png' and shows the image at 100% zoom. The image is a portrait of a woman wearing a straw hat, which is the standard 'Lena' test image used in computer vision.

# Test Code

- OpenCV를 이용한 이미지 출력
  - 이미지 다운로드
    - \$ wget [https://docs.opencv.org/2.4/\\_images/lena.png](https://docs.opencv.org/2.4/_images/lena.png)
  - 코드 작성 (pycharm, gedit, vim 등의 에디터이용)

```
import cv2
import argparse

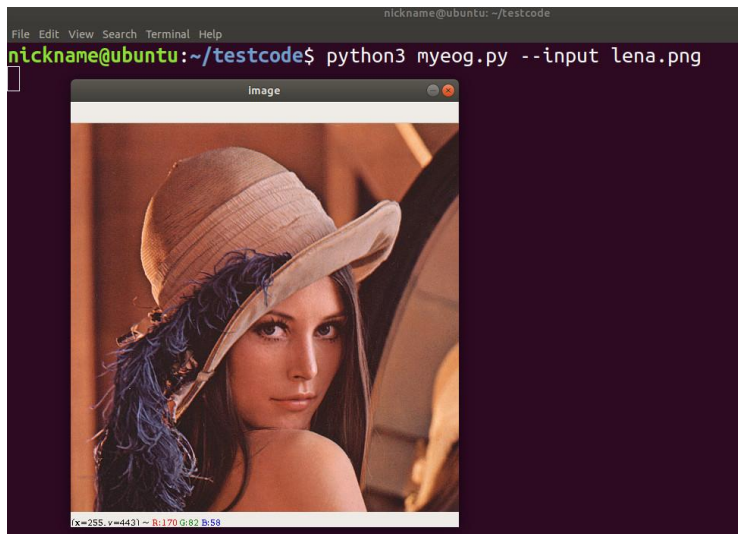
parser = argparse.ArgumentParser()
parser.add_argument("--input", help="display this image", type=str)
args = parser.parse_args()

img = cv2.imread(args.input)

cv2.imshow("image", img)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

# Test Code

- OpenCV를 이용한 이미지 출력
  - 실행예시



# 컴퓨터 비전

## VMware 이용한 Ubuntu 설치

국민대학교 HCI Lab

최 정 우

# VMware Workstation Player

vmware

🔍 🌐 대한민국 커뮤니티 | 스토어 | 로그인 >

VMware Cloud 제품 솔루션 지원 전문 서비스 다운로드 파트너 회사

제품 > Workstation Player > VMware Workstation Player 사용해 보기

## VMware Workstation Player 사용해 보기



### VMware Workstation Player 15

VMware Workstation Player는 Windows 또는 Linux PC에서 단일 가상 머신을 실행하기에 가장 적합한 유틸리티입니다. 조직은 Workstation Player를 사용하여 관리형 기업 데스크톱을 제공할 수 있으며, 학생과 교육 관계자는 학습 및 교육을 위해 사용할 수 있습니다.

무료 버전은 비상업적인 개인 및 가정용으로 사용할 수 있습니다. VMware는 또한 학생들과 비영리 단체가 이 제품의 이점을 활용할 수 있기를 바랍니다.

상업 조직에서 **Workstation Player**를 사용하려면 상업용 라이선스가 필요합니다.

더 강력한 가상화 솔루션이 필요하십니까? Workstation Pro를 확인해 보십시오.

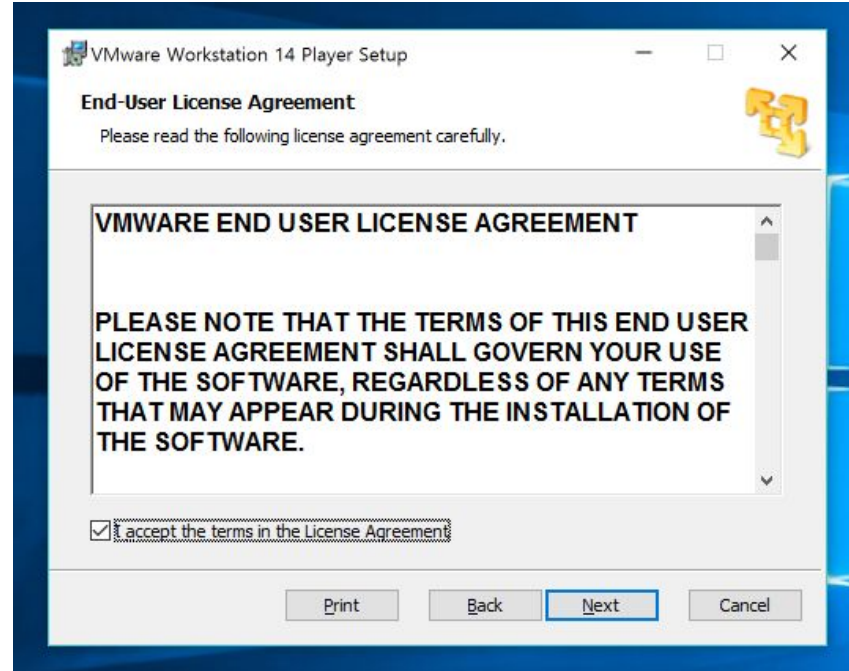
Windows용 Workstation 15 Player 사용해 보기

📄 지금 다운로드 >

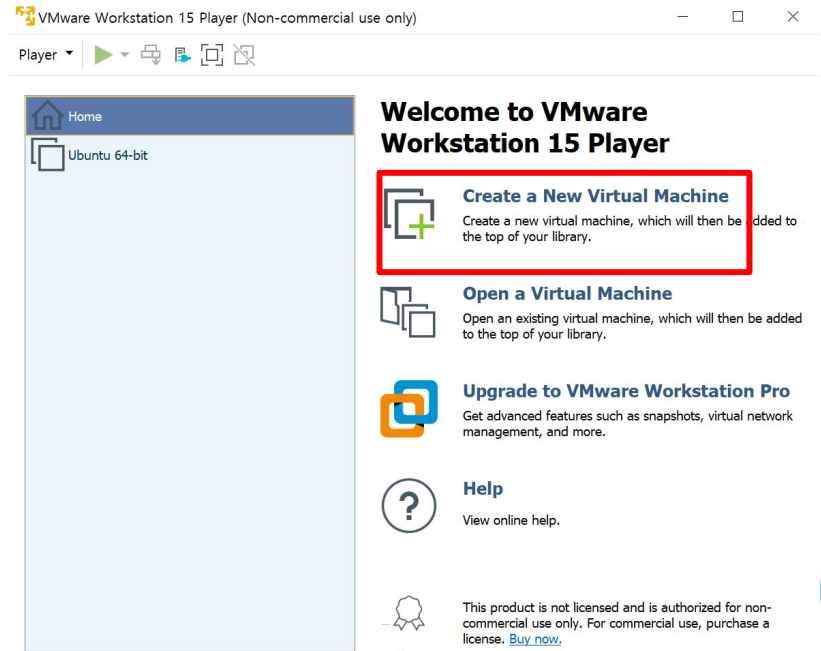
Linux용 Workstation 15 Player 사용해 보기

📄 지금 다운로드 >

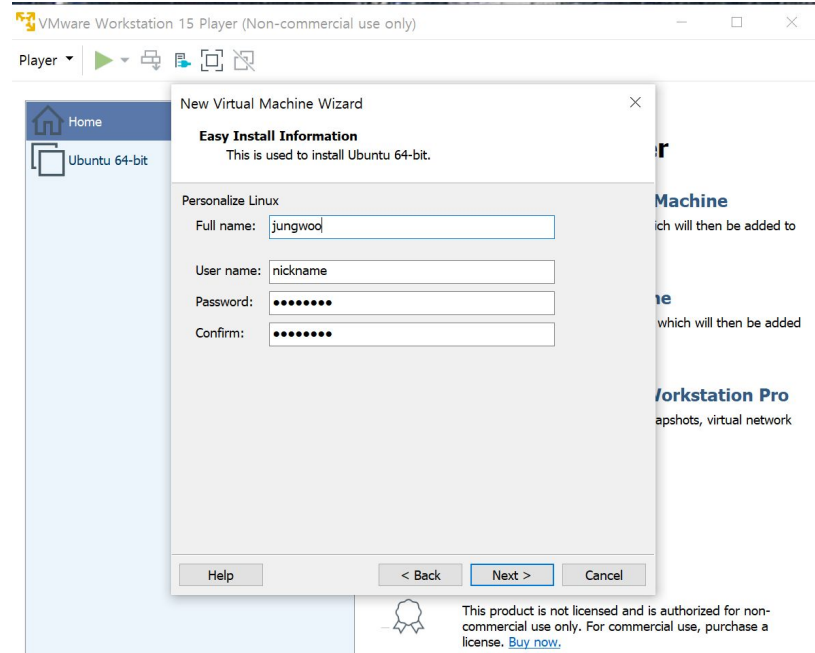
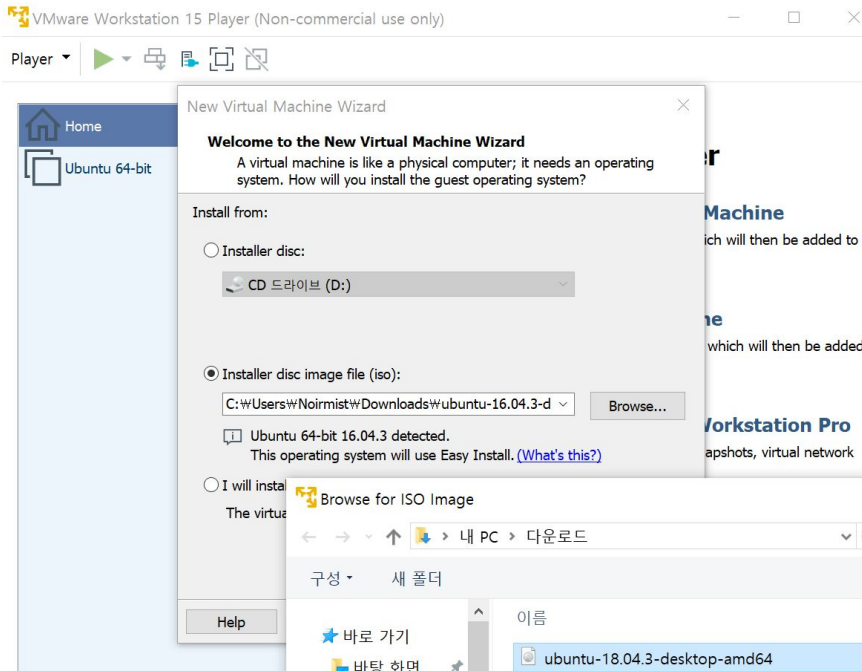
# VMware Workstation Player



# Install Ubuntu

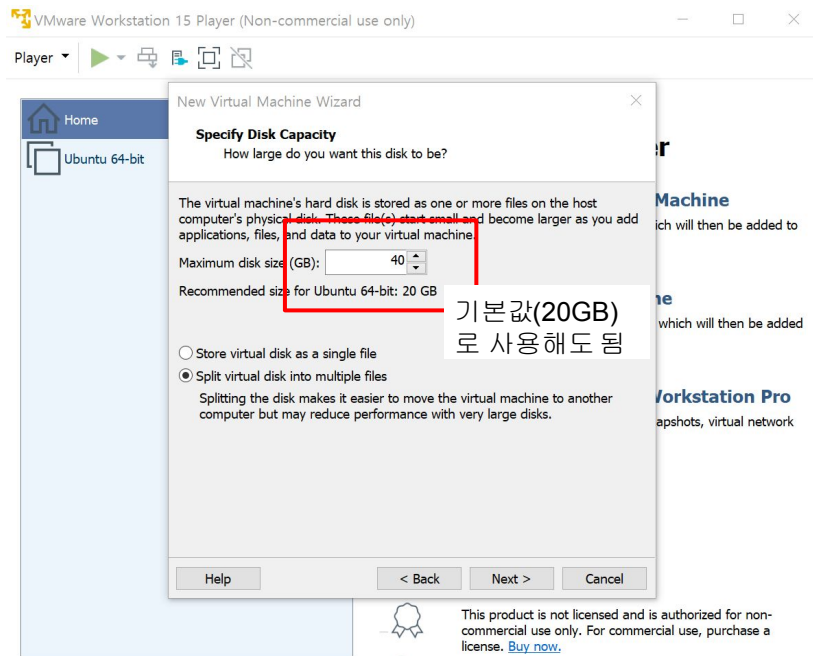
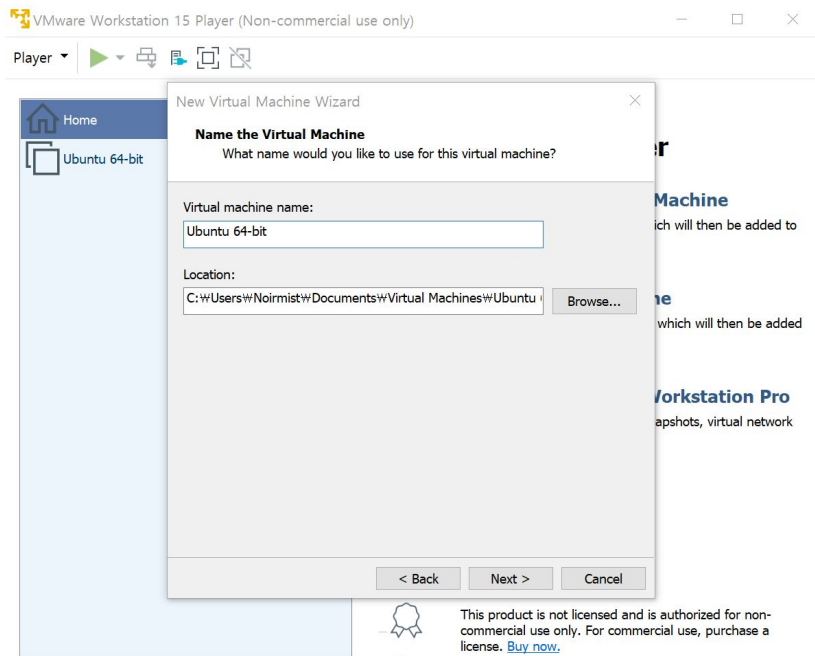


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The screenshot displays the VMware Workstation 15 Player interface. A 'New Virtual Machine Wizard' dialog is open, showing the 'Ready to Create Virtual Machine' step. The wizard lists the following settings:

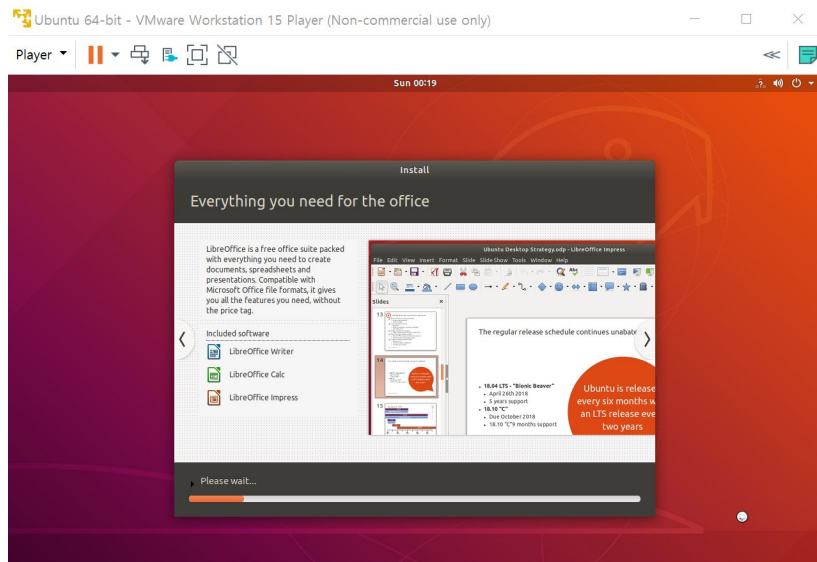
- Name: Ubuntu 64-bit
- Location: C:\Users\Noirmist\Documents\Virtual Machines\U...
- Version: Workstation 15.x
- Operating System: Ubuntu 64-bit
- Hard Disk: 40 GB, Split
- Memory: 2048 MB
- Network Adapter: NAT
- Other Devices: CD/DVD, USB Controller, Printer, Sound Card

The 'Customize Hardware...' button is highlighted with a red box. Below the settings, there is a checkbox for 'Power on this virtual machine after creation' which is checked.

The 'Hardware' window is also open, showing the 'Processors' and 'Memory' settings. The 'Processors' section shows 'Number of processor cores' set to 4, highlighted with a red box. The 'Memory' section shows 'Memory for this virtual machine' set to 4096 MB, also highlighted with a red box. A memory size selector is visible, showing a range from 1 GB to 64 GB, with a blue arrow pointing to 4 GB. A green arrow points to 6.2 GB. A legend indicates that the blue arrow represents 'Maximum recommended memory (Memory swapping may occur beyond this size.)' and the green arrow represents 'Recommended memory'.

At the bottom of the screen, there is a disclaimer: 'This product is not licensed and is authorized for non-commercial use only. For commercial use, purchase a license. [Buy now.](#)'

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설치 완료 까지 15분에서 20분정도 소요됨  
(소요시간은 컴퓨터의 성능에 따라서 다를 수 있음)

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