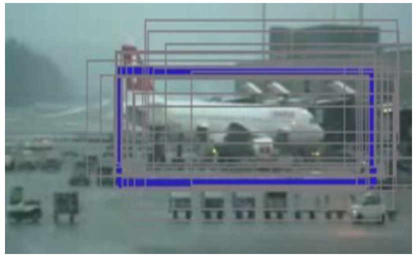
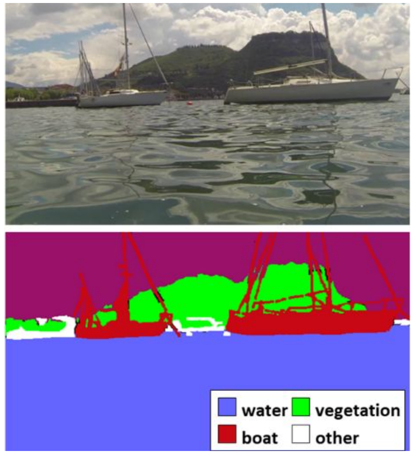
UNIVERSITÀ DEGLI STUDI DELLA BASILICATA

Corso di Sistemi Informativi
A.A. 2018/19

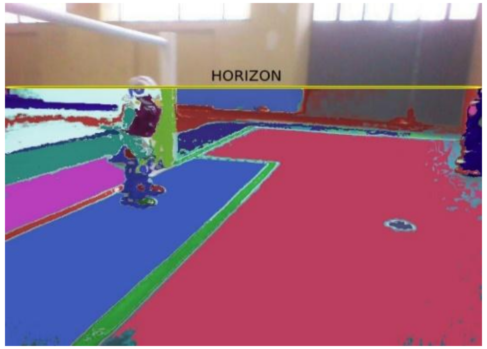
Docente
Domenico Daniele Bloisi

face detection





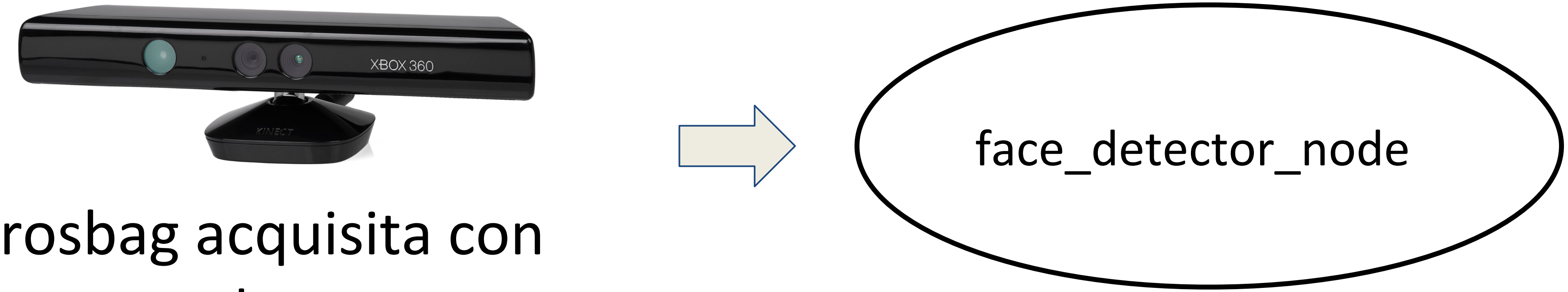
Maggio 2019



obiettivo

- Vogliamo realizzare un package ROS per la detection di volti
- Il package dovrà contenere due nodi:
  - il primo nodo servirà per rilevare i volti presenti nelle immagini a provenienti da una bag o da un sensore reale
  - il secondo nodo si occuperà di mostrare i risultati a video

Package unibas_face_detector

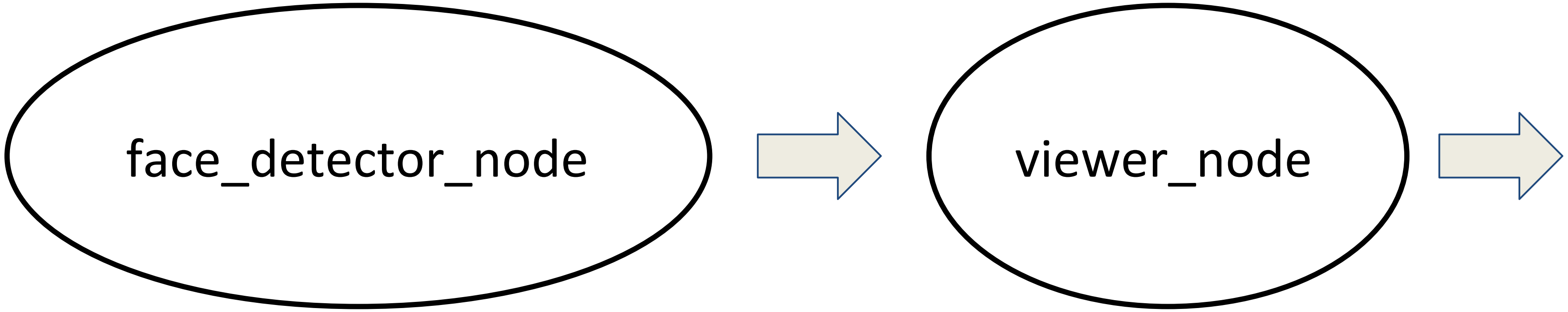


face_detector_node

rosbag acquisita con
una telecamera

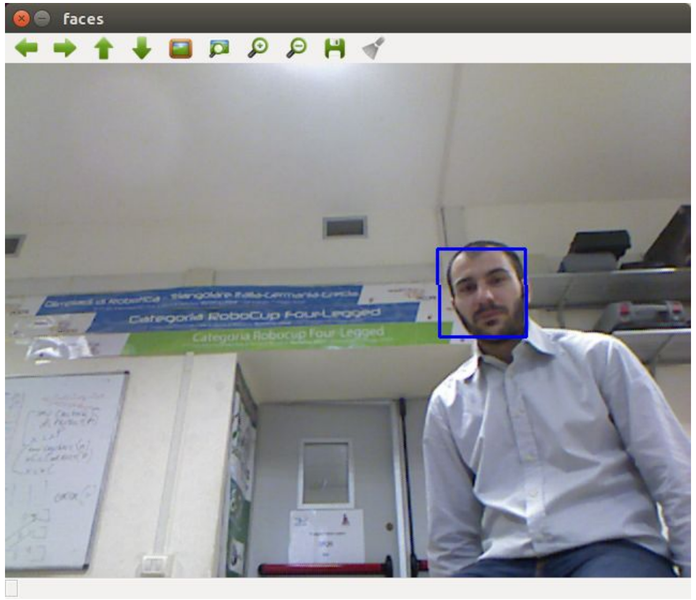
http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

face_detector_node e viewer_node



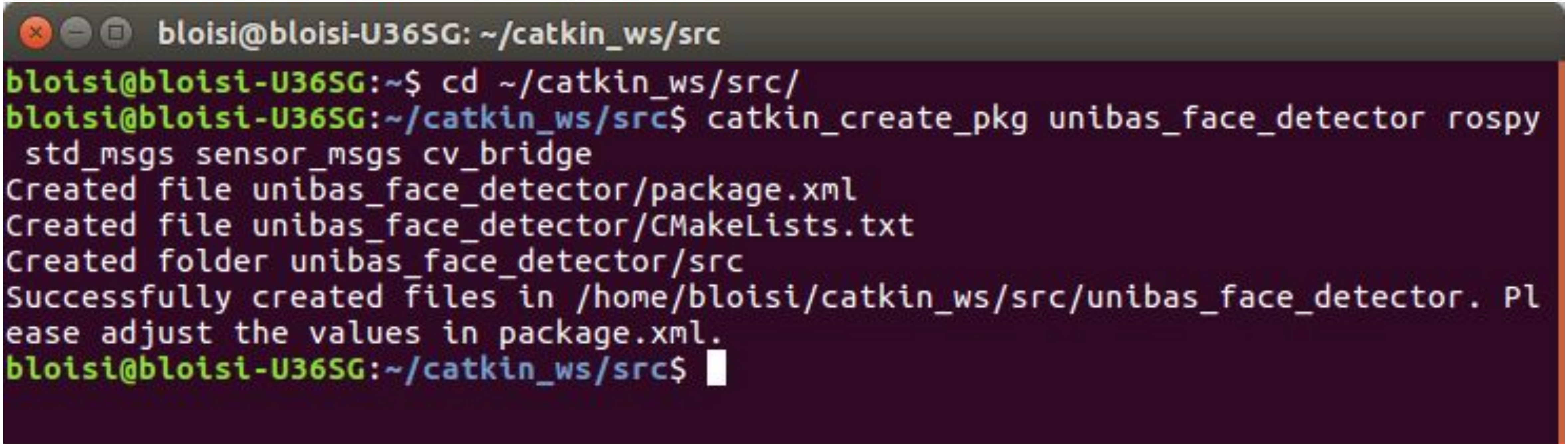
face_detector_node

viewer_node



visualizzazione
immagine OpenCV

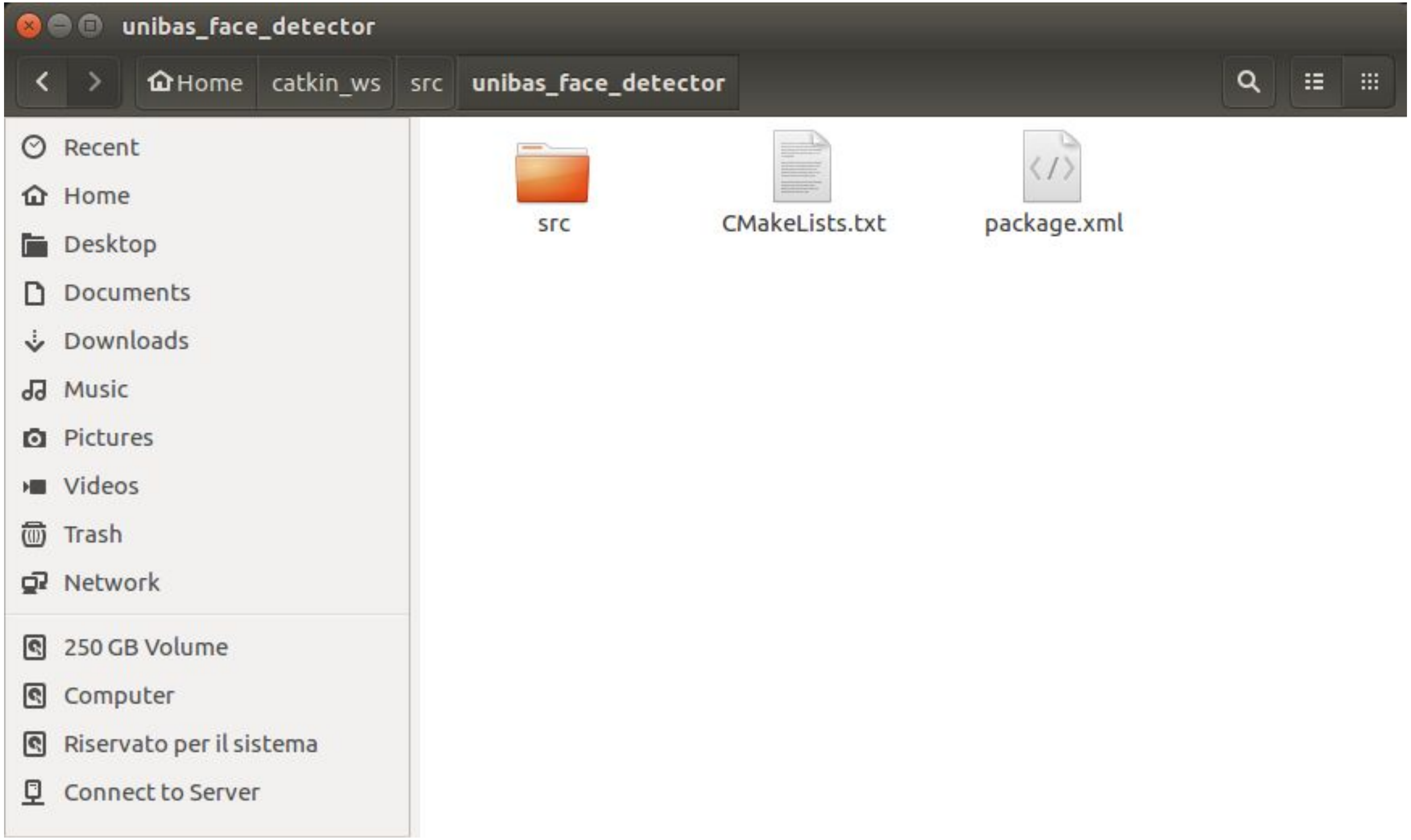
creazione unibas_face_detector



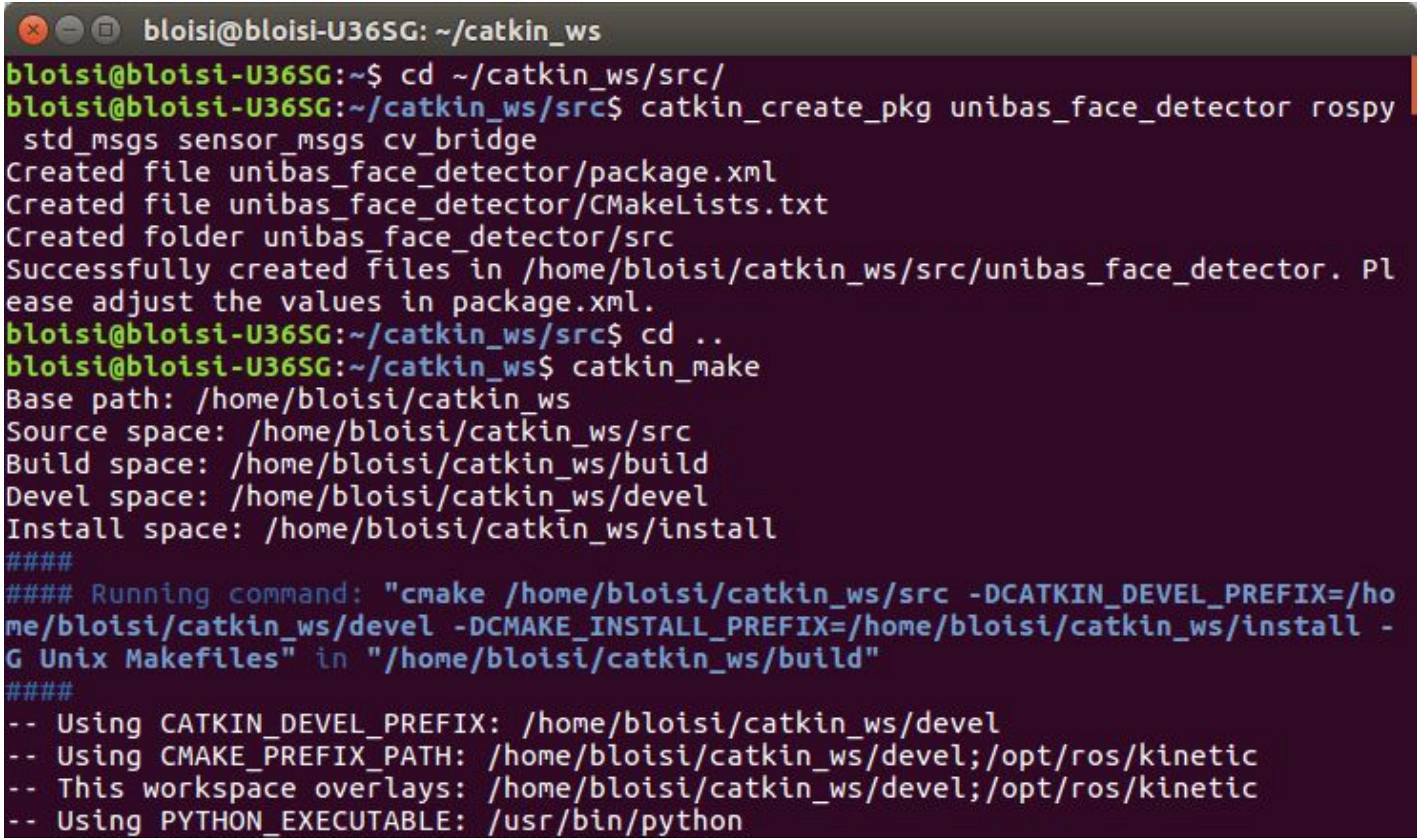
```
bloisi@bloisi-U36SG:~$ cd ~/catkin_ws/src/
bloisi@bloisi-U36SG:~/catkin_ws/src$ catkin_create_pkg unibas_face_detector rospy
 std_msgs sensor_msgs cv_bridge
Created file unibas_face_detector/package.xml
Created file unibas_face_detector/CMakeLists.txt
Created folder unibas_face_detector/src
Successfully created files in /home/bloisi/catkin_ws/src/unibas_face_detector. Pl
ease adjust the values in package.xml.
bloisi@bloisi-U36SG:~/catkin_ws/src$ 
```

http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

cartella unibas_face_detector



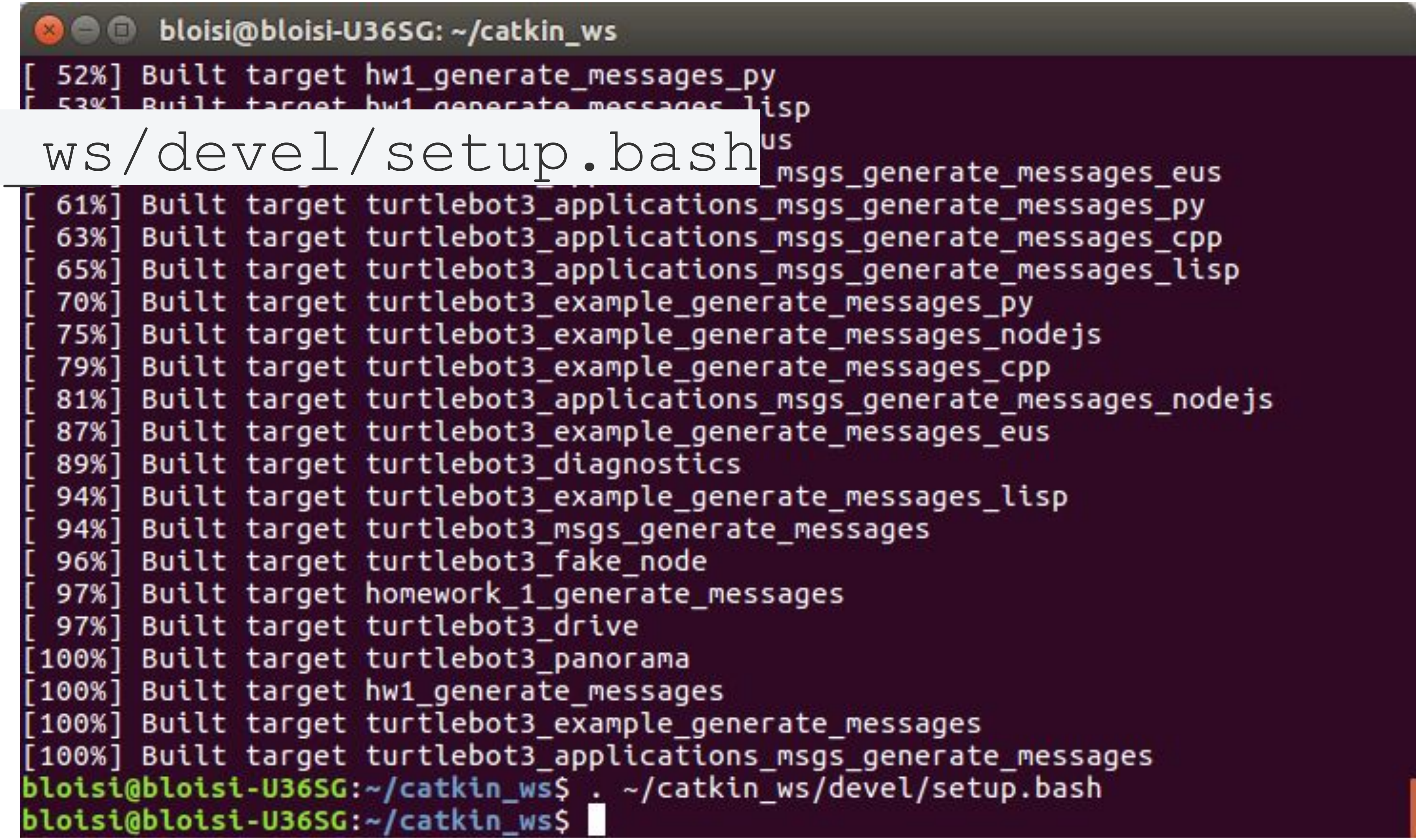
catkin_make



```
bloisi@bloisi-U36SG:~$ cd ~/catkin_ws/src/
bloisi@bloisi-U36SG:~/catkin_ws/src$ catkin_create_pkg unibas_face_detector rospy
 std_msgs sensor_msgs cv_bridge
Created file unibas_face_detector/package.xml
Created file unibas_face_detector/CMakeLists.txt
Created folder unibas_face_detector/src
Successfully created files in /home/bloisi/catkin_ws/src/unibas_face_detector. Pl
ease adjust the values in package.xml.
bloisi@bloisi-U36SG:~/catkin_ws/src$ cd ..
bloisi@bloisi-U36SG:~/catkin_ws$ catkin_make
Base path: /home/bloisi/catkin_ws
Source space: /home/bloisi/catkin_ws/src
Build space: /home/bloisi/catkin_ws/build
Devel space: /home/bloisi/catkin_ws/devel
Install space: /home/bloisi/catkin_ws/install
####
#### Running command: "cmake /home/bloisi/catkin_ws/src -DCATKIN_DEVEL_PREFIX=/ho
me/bloisi/catkin_ws/devel -DCMAKE_INSTALL_PREFIX=/home/bloisi/catkin_ws/install -
G Unix Makefiles" in "/home/bloisi/catkin_ws/build"
####
-- Using CATKIN_DEVEL_PREFIX: /home/bloisi/catkin_ws/devel
-- Using CMAKE_PREFIX_PATH: /home/bloisi/catkin_ws/devel;/opt/ros/kinetic
-- This workspace overlays: /home/bloisi/catkin_ws/devel;/opt/ros/kinetic
-- Using PYTHON_EXECUTABLE: /usr/bin/python
```

settiamo l’ambiente ROS

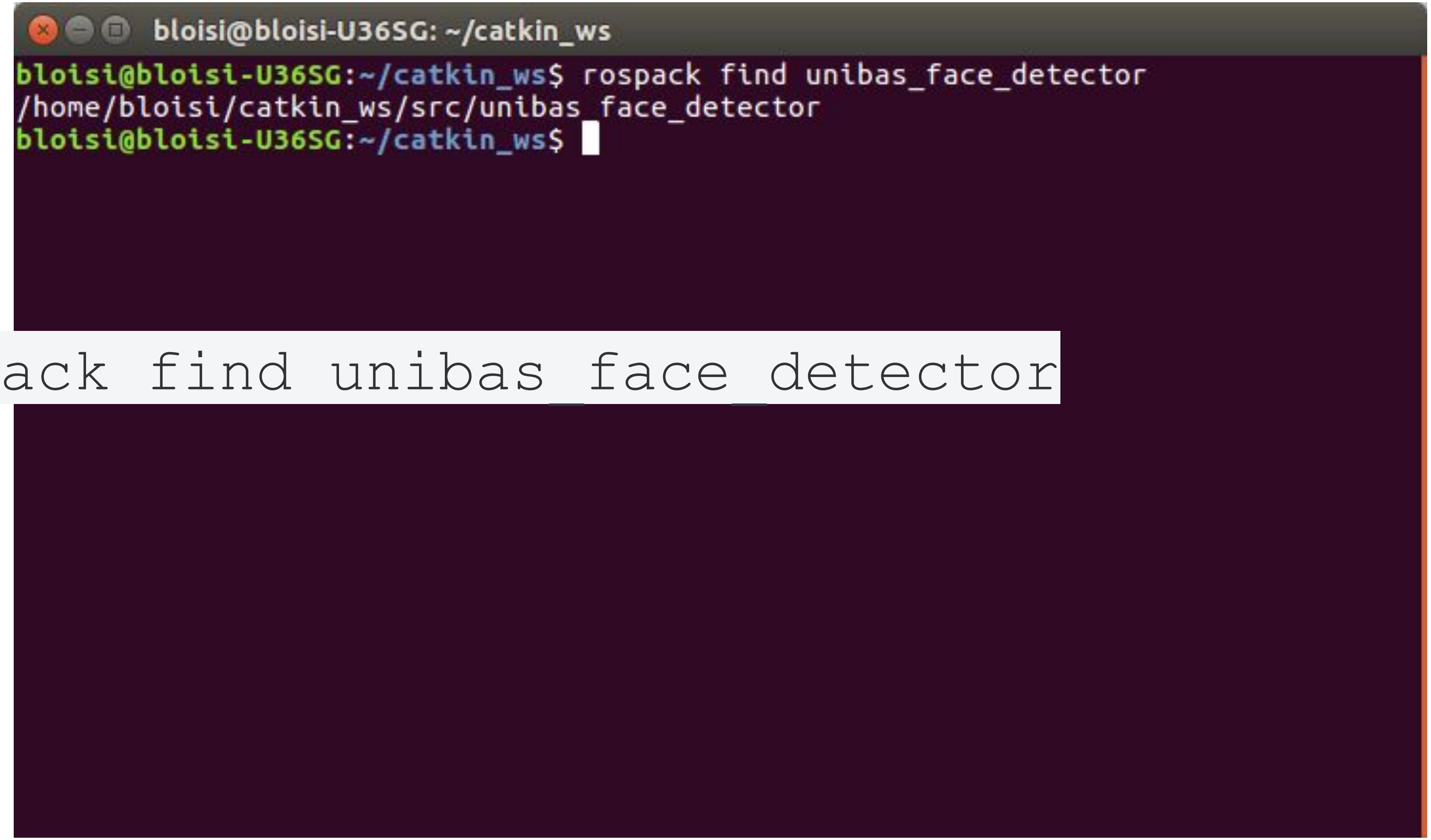
```
. ~/catkin_ws/devel/setup.bash
```



```
[ 52%] Built target hw1_generate_messages_py
[ 53%] Built target hw1_generate_messages_lisp
                                          us
                                          _msgs_generate_messages_eus
[ 61%] Built target turtlebot3_applications_msgs_generate_messages_py
[ 63%] Built target turtlebot3_applications_msgs_generate_messages_cpp
[ 65%] Built target turtlebot3_applications_msgs_generate_messages_lisp
[ 70%] Built target turtlebot3_example_generate_messages_py
[ 75%] Built target turtlebot3_example_generate_messages_nodejs
[ 79%] Built target turtlebot3_example_generate_messages_cpp
[ 81%] Built target turtlebot3_applications_msgs_generate_messages_nodejs
[ 87%] Built target turtlebot3_example_generate_messages_eus
[ 89%] Built target turtlebot3_diagnostics
[ 94%] Built target turtlebot3_example_generate_messages_lisp
[ 94%] Built target turtlebot3_msgs_generate_messages
[ 96%] Built target turtlebot3_fake_node
[ 97%] Built target homework_1_generate_messages
[ 97%] Built target turtlebot3_drive
[100%] Built target turtlebot3_panorama
[100%] Built target hw1_generate_messages
[100%] Built target turtlebot3_example_generate_messages
[100%] Built target turtlebot3_applications_msgs_generate_messages
bloisi@bloisi-U36SG:~/catkin_ws$ . ~/catkin_ws/devel/setup.bash
bloisi@bloisi-U36SG:~/catkin_ws$ 
```

https://answers.ros.org/question/229365/do-i-really-need-to-source-catkin_wsdevelsetupbash/

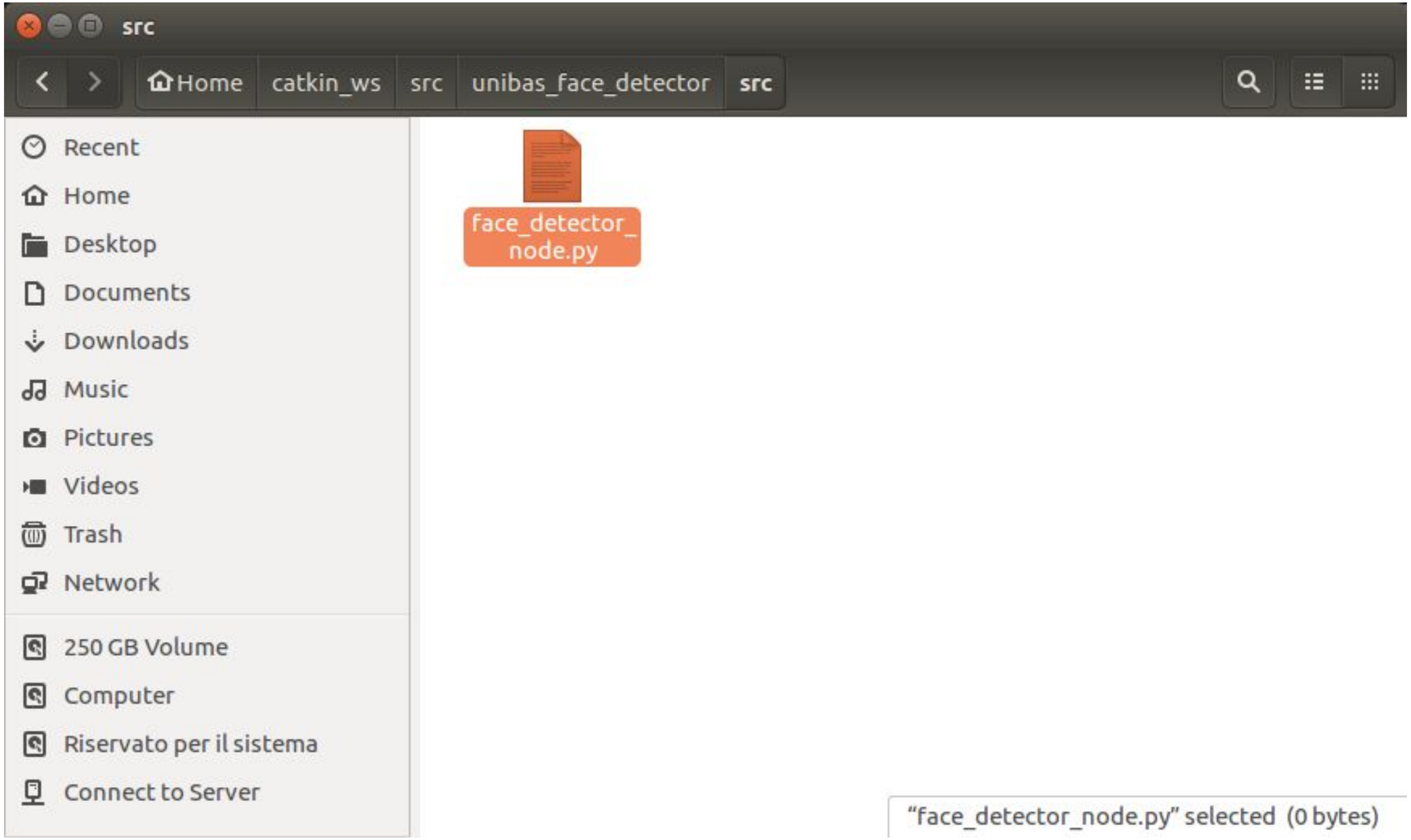
rospack find



```
bloisi@bloisi-U36SG:~/catkin_ws$ rospack find unibas_face_detector
/home/bloisi/catkin_ws/src/unibas_face_detector
bloisi@bloisi-U36SG:~/catkin_ws$
```

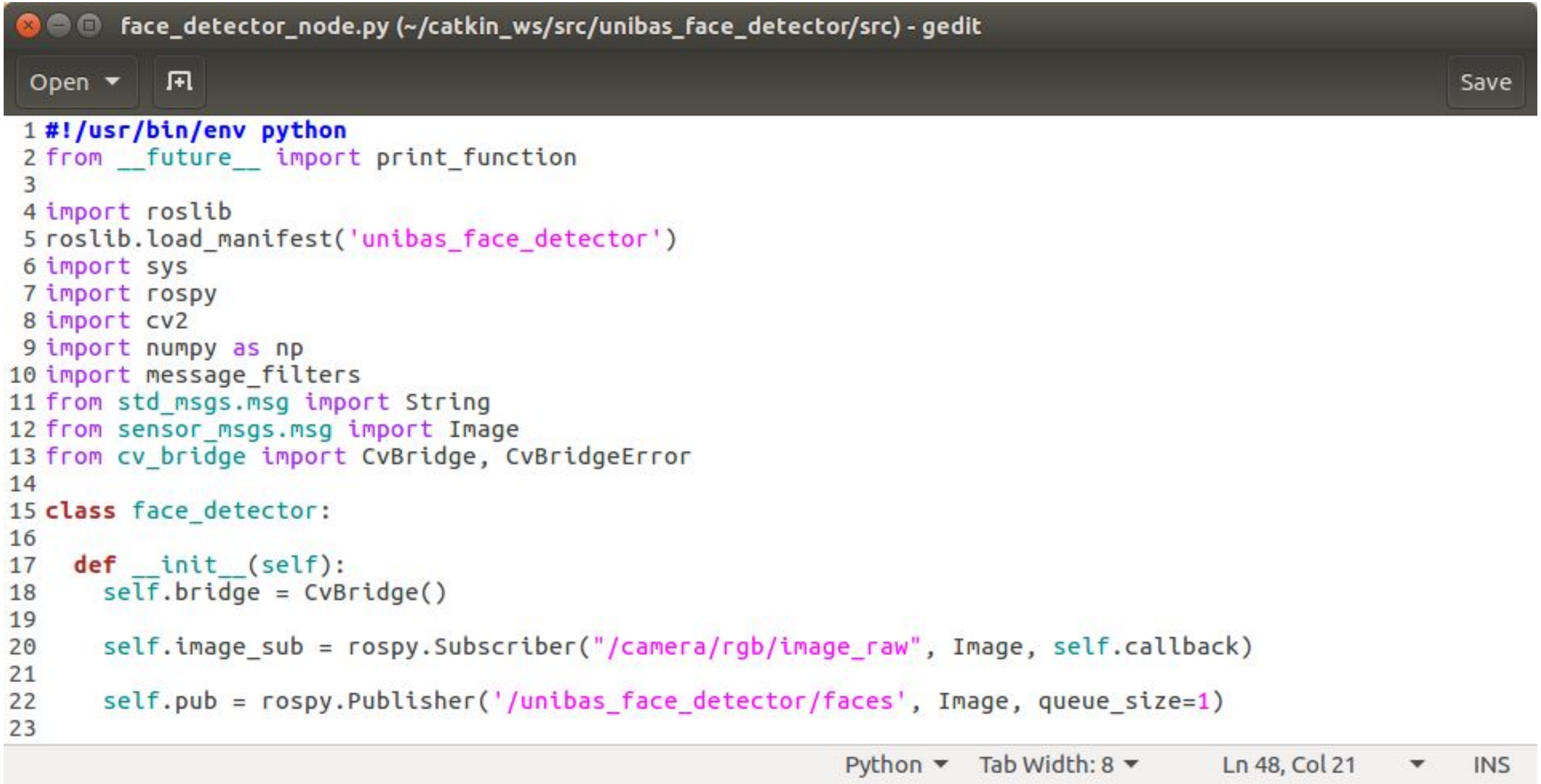
```
rospack find unibas_face_detector
```

creiamo face_detector_node.py



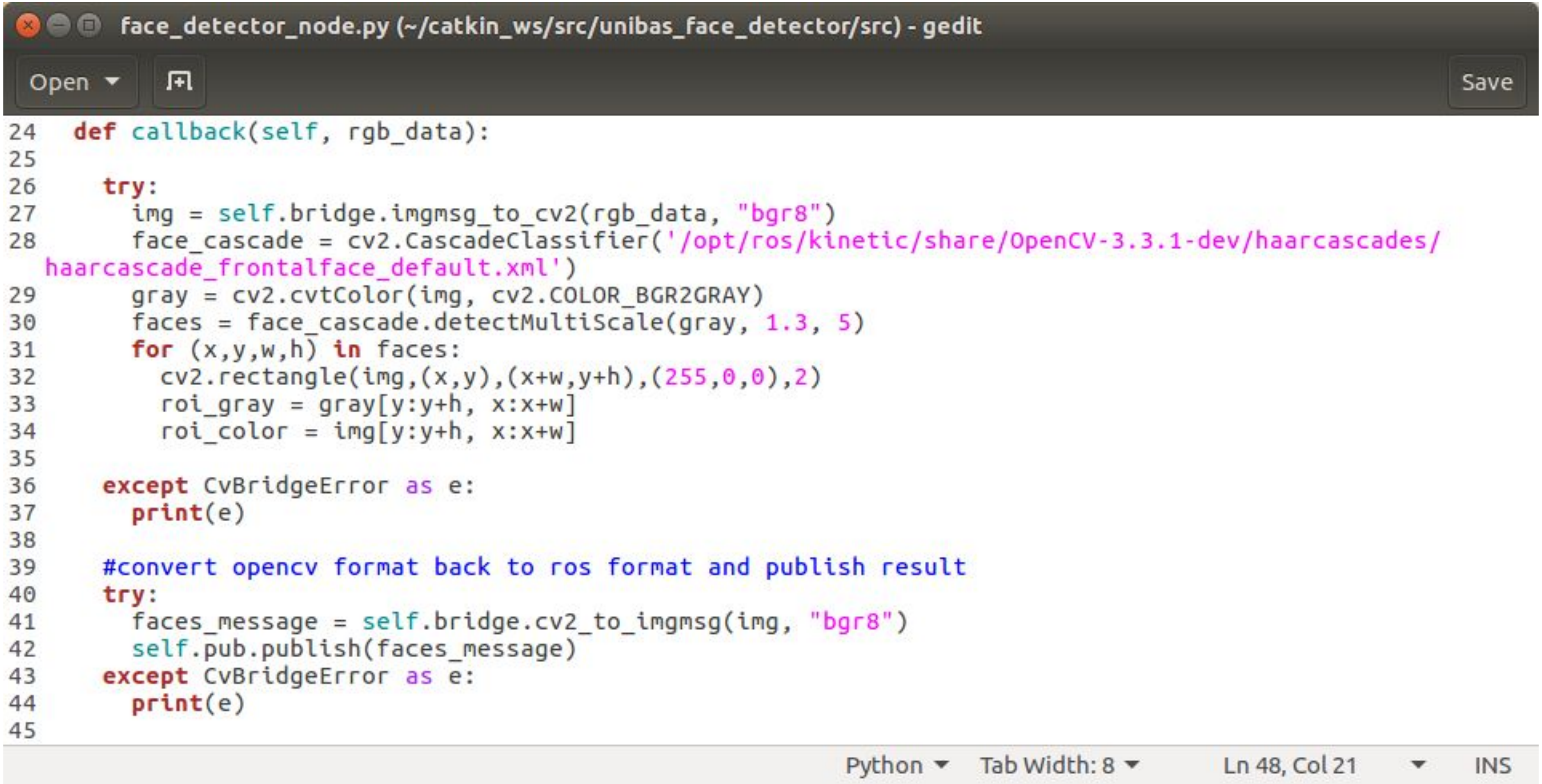
"face_detector_node.py" selected (0 bytes)

codice face_detector_node.py


face_detector_node.py (~/catkin_ws/src/unibas_face_detector/src) - gedit
Open
Save
Python
Tab Width: 8
Ln 48, Col 21
INS

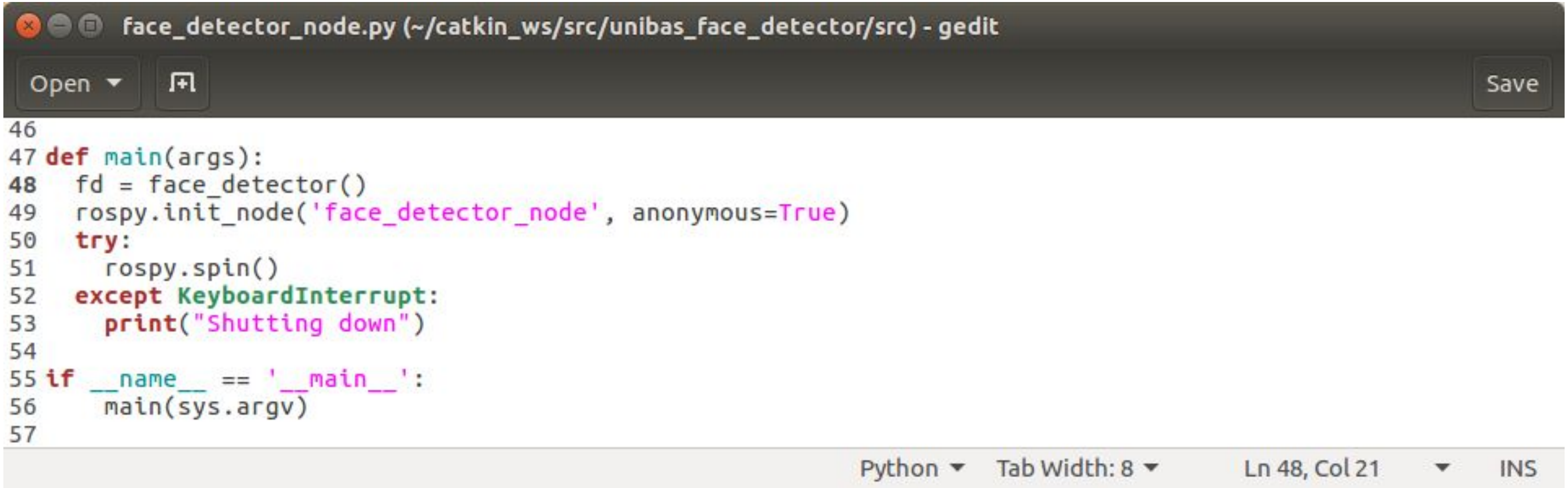
```python
#!/usr/bin/env python
from __future__ import print_function

import roslib
roslib.load_manifest('unibas_face_detector')
import sys
import rospy
import cv2
import numpy as np
import message_filters
from std_msgs.msg import String
from sensor_msgs.msg import Image
from cv_bridge import CvBridge, CvBridgeError

class face_detector:

  def __init__(self):
    self.bridge = CvBridge()

    self.image_sub = rospy.Subscriber("/camera/rgb/image_raw", Image, self.callback)

    self.pub = rospy.Publisher('/unibas_face_detector/faces', Image, queue_size=1)

```

codice face_detector_node.py


face_detector_node.py (~/catkin_ws/src/unibas_face_detector/src) - gedit
Open
Save
Python
Tab Width: 8
Ln 48, Col 21
INS

```python
  def callback(self, rgb_data):

    try:
      img = self.bridge.imgmsg_to_cv2(rgb_data, "bgr8")
      face_cascade = cv2.CascadeClassifier('/opt/ros/kinetic/share/OpenCV-3.3.1-dev/haarcascades/haarcascade_frontalface_default.xml')
      gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
      faces = face_cascade.detectMultiScale(gray, 1.3, 5)
      for (x,y,w,h) in faces:
        cv2.rectangle(img,(x,y),(x+w,y+h),(255,0,0),2)
        roi_gray = gray[y:y+h, x:x+w]
        roi_color = img[y:y+h, x:x+w]

    except CvBridgeError as e:
      print(e)

    #convert opencv format back to ros format and publish result
    try:
      faces_message = self.bridge.cv2_to_imgmsg(img, "bgr8")
      self.pub.publish(faces_message)
    except CvBridgeError as e:
      print(e)

```

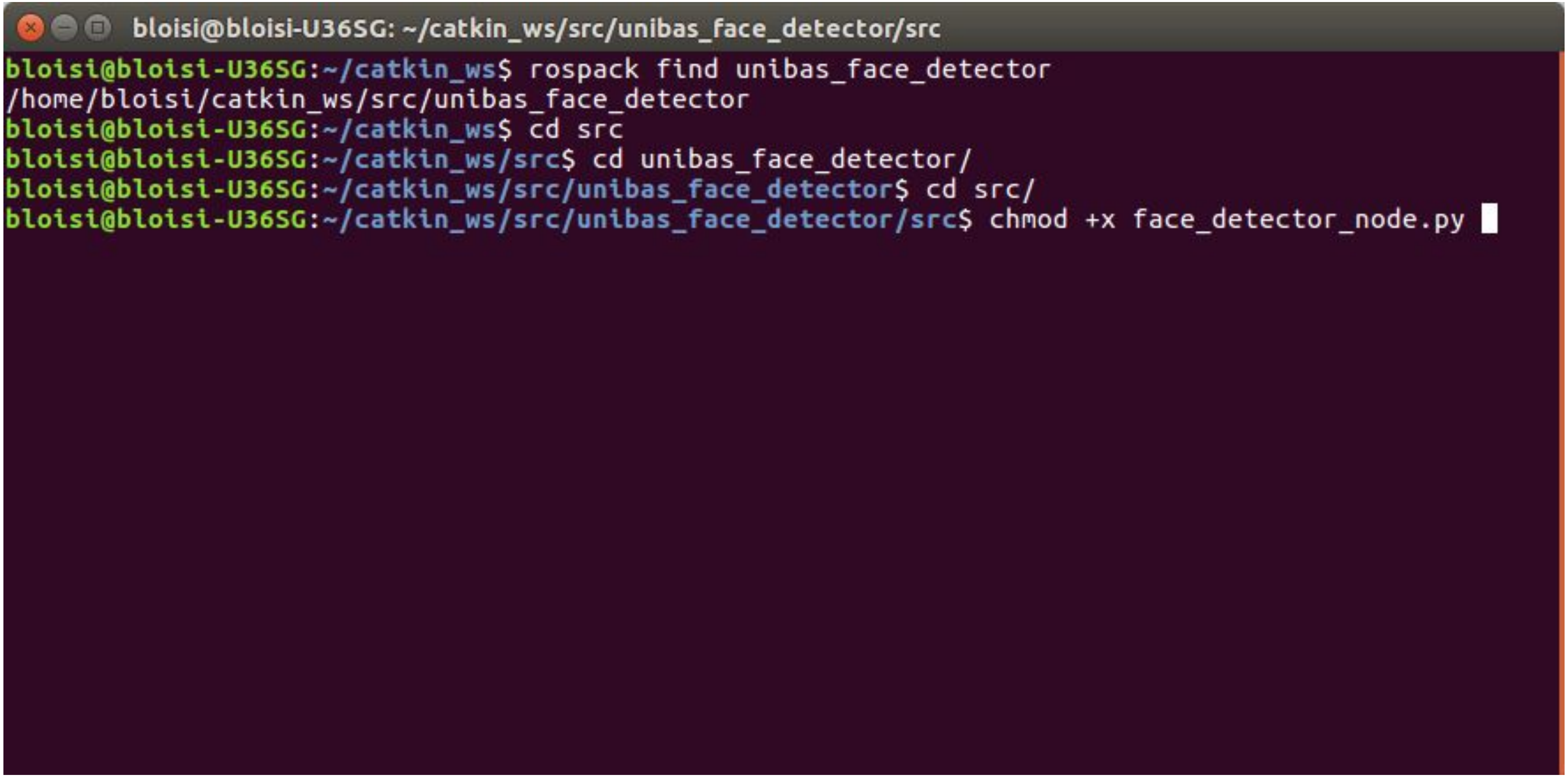
codice face_detector_node.py


face_detector_node.py (~/catkin_ws/src/unibas_face_detector/src) - gedit
Open
Save

```python

def main(args):
  fd = face_detector()
  rospy.init_node('face_detector_node', anonymous=True)
  try:
    rospy.spin()
  except KeyboardInterrupt:
    print("Shutting down")

if __name__ == '__main__':
    main(sys.argv)

```

Python   Tab Width: 8   Ln 48, Col 21   INS

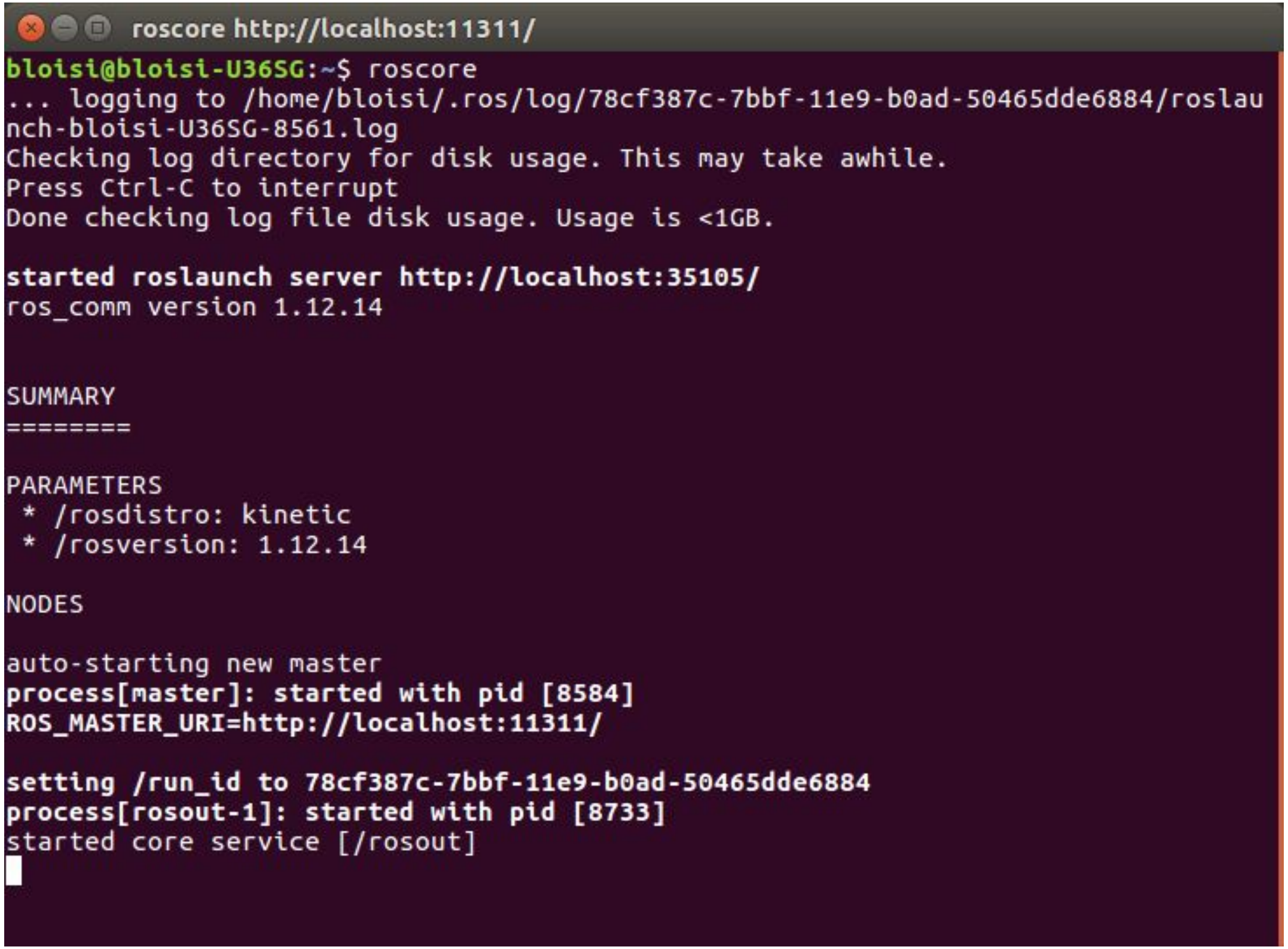
permessi per face_detector_node.py



bloisi@bloisi-U36SG: ~/catkin_ws/src/unibas_face_detector/src

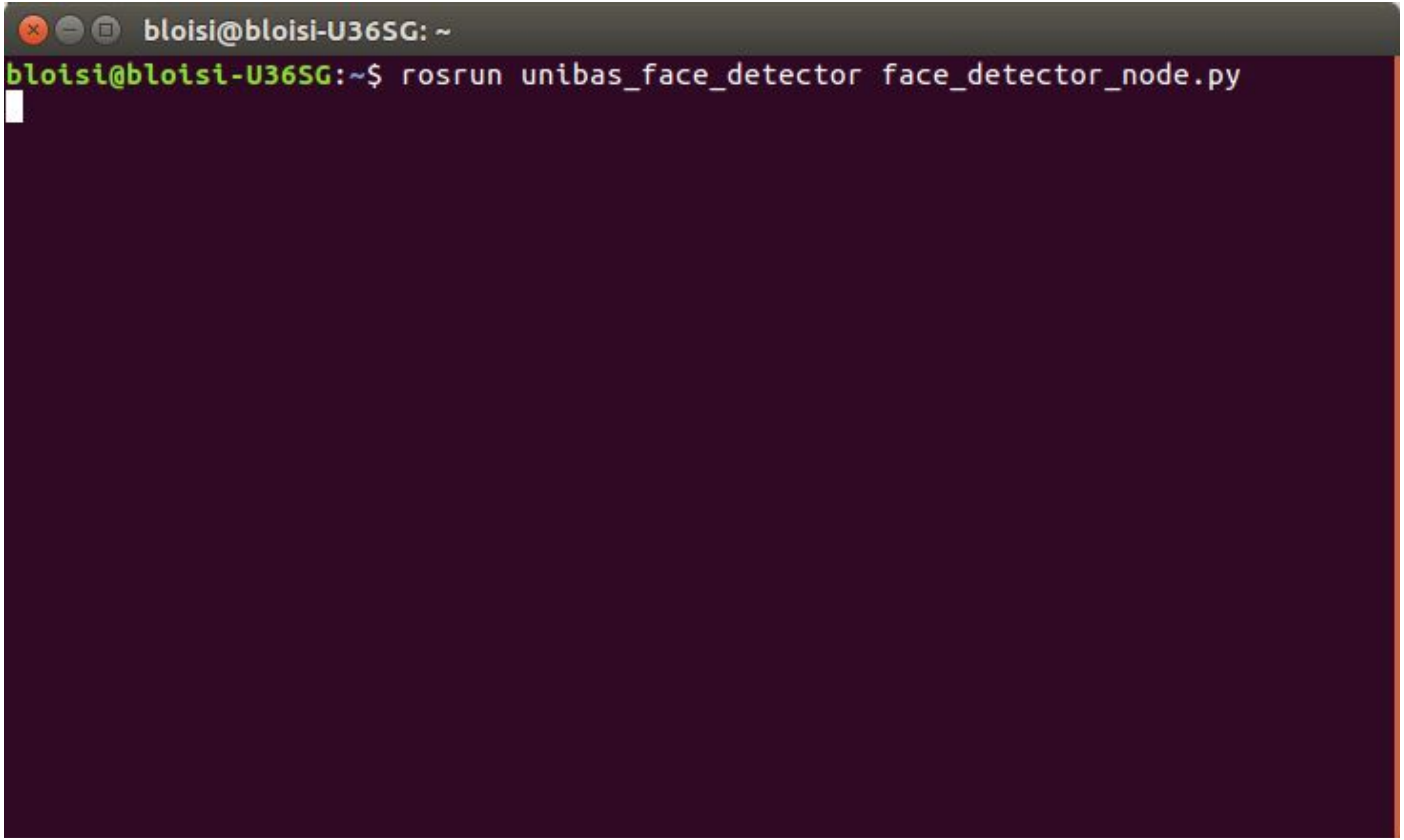
```
bloisi@bloisi-U36SG:~/catkin_ws$ rospack find unibas_face_detector
/home/bloisi/catkin_ws/src/unibas_face_detector
bloisi@bloisi-U36SG:~/catkin_ws$ cd src
bloisi@bloisi-U36SG:~/catkin_ws/src$ cd unibas_face_detector/
bloisi@bloisi-U36SG:~/catkin_ws/src/unibas_face_detector$ cd src/
bloisi@bloisi-U36SG:~/catkin_ws/src/unibas_face_detector/src$ chmod +x face_detector_node.py
```

roscore



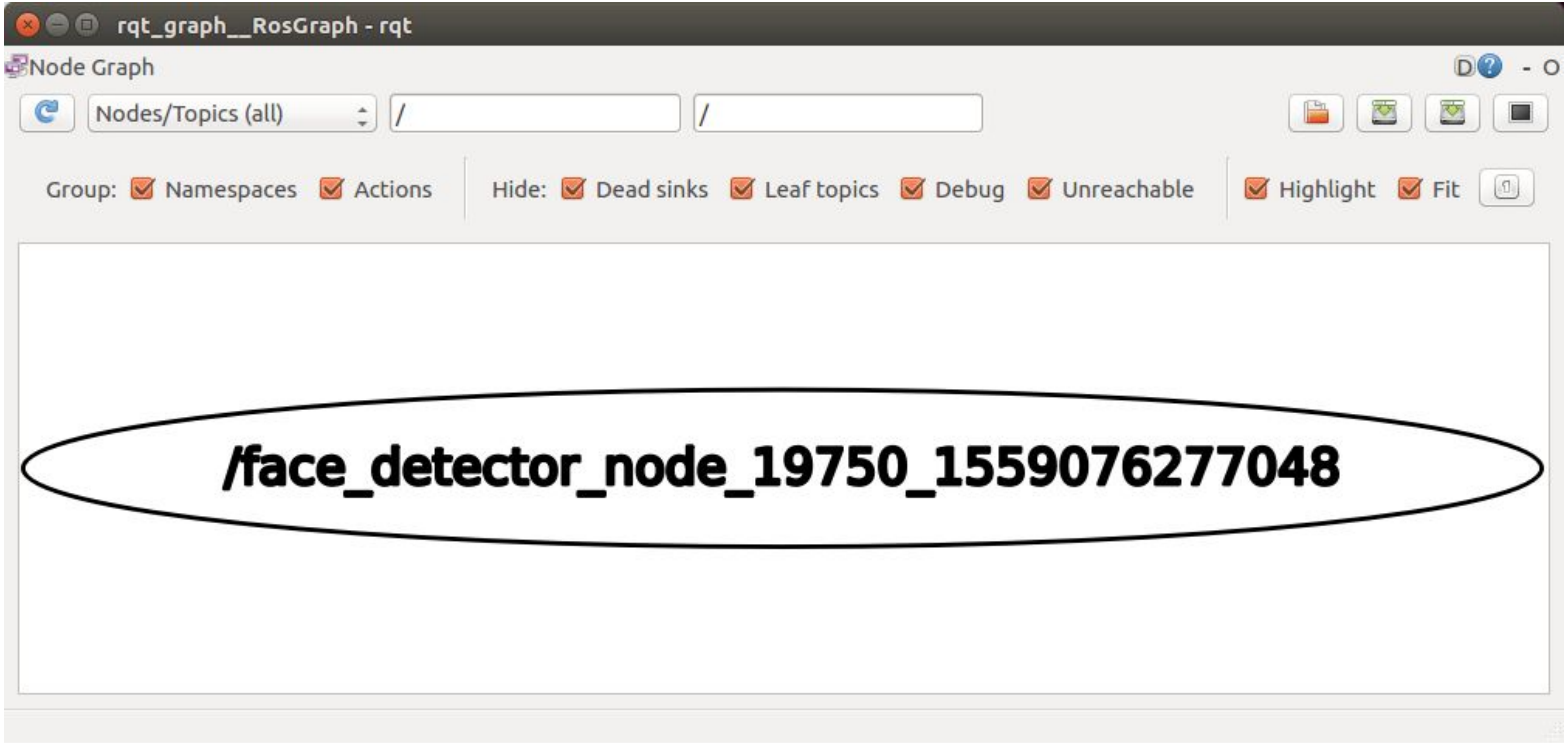
```
bloisi@bloisi-U36SG:~$ roscore
... logging to /home/bloisi/.ros/log/78cf387c-7bbf-11e9-b0ad-50465dde6884/roslau
nch-bloisi-U36SG-8561.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://localhost:35105/
ros_comm version 1.12.14


SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.14

NODES

auto-starting new master
process[master]: started with pid [8584]
ROS_MASTER_URI=http://localhost:11311/

setting /run_id to 78cf387c-7bbf-11e9-b0ad-50465dde6884
process[rosout-1]: started with pid [8733]
started core service [/rosout]
```

rosrun face_detector_node



```
bloisi@bloisi-U36SG:~$ rosrun unibas_face_detector face_detector_node.py
```

rqt_graph



Nodes/Topics (all) / /

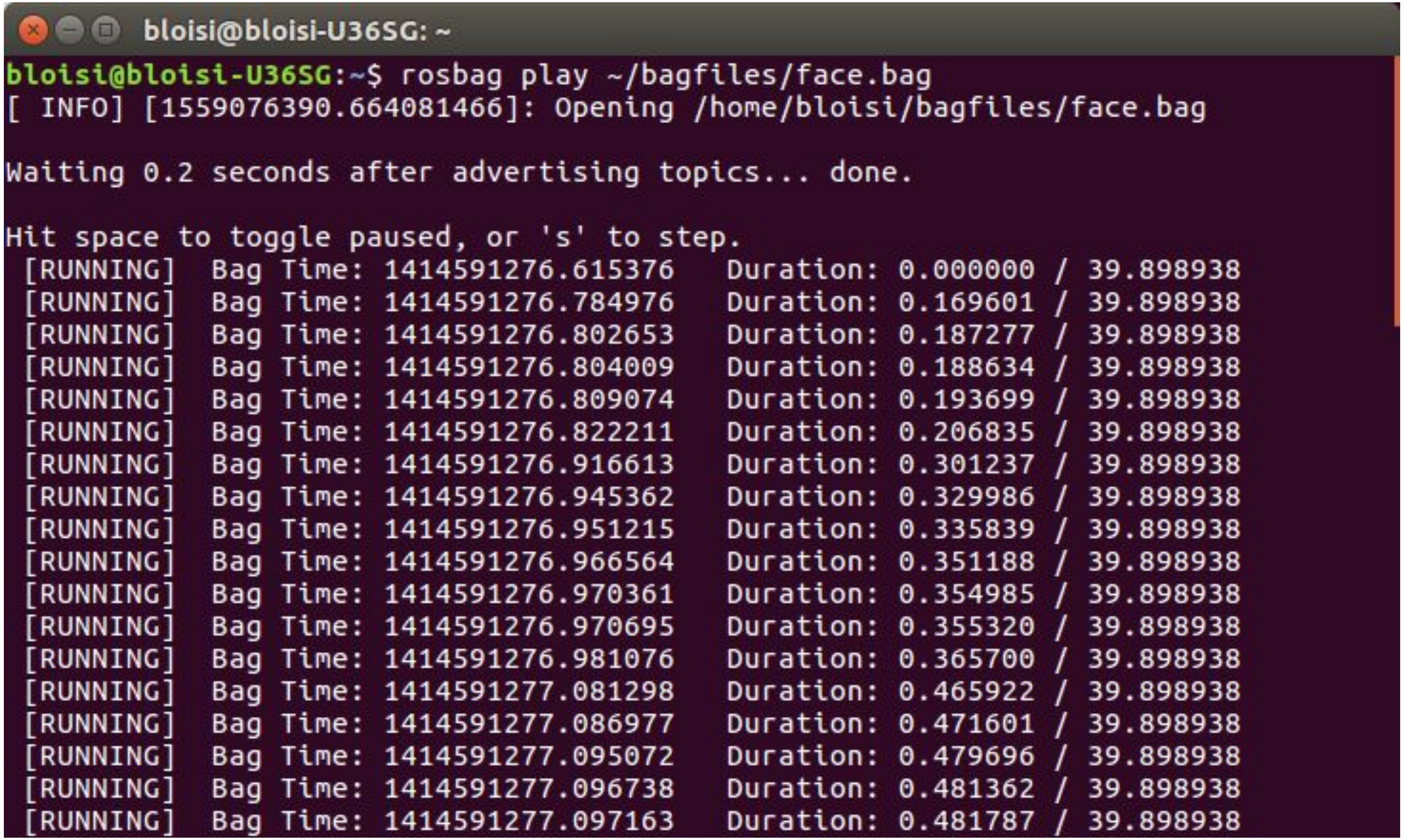
Group: ☑ Namespaces ☑ Actions

Hide: ☑ Dead sinks ☑ Leaf topics ☑ Debug ☑ Unreachable

☑ Highlight ☑ Fit

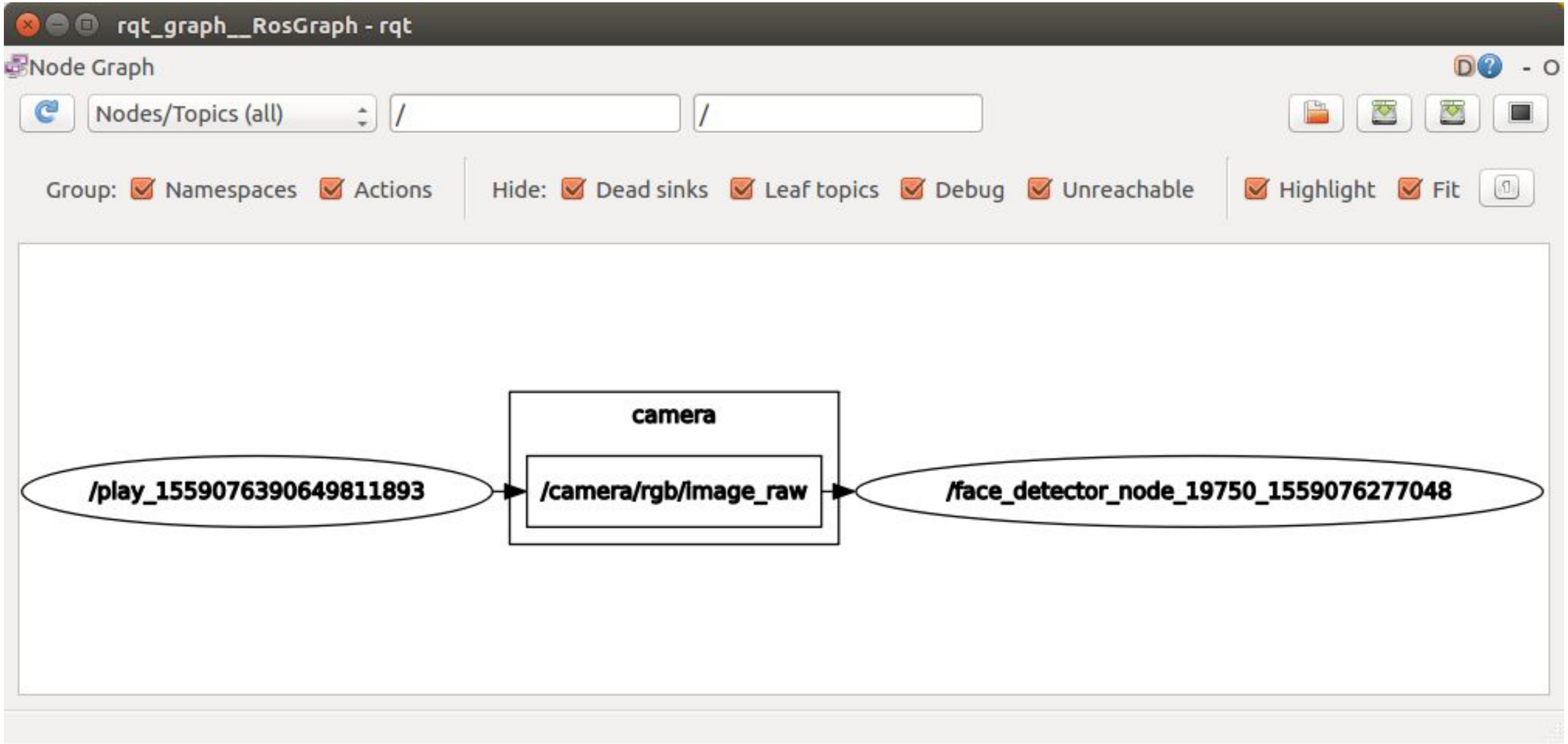
rqt_graph__RosGraph - rqt
Node Graph
/face_detector_node_19750_1559076277048

rosbag play



```
bloisi@bloisi-U36SG:~$ rosbag play ~/bagfiles/face.bag
[ INFO] [1559076390.664081466]: Opening /home/bloisi/bagfiles/face.bag

Waiting 0.2 seconds after advertising topics... done.

Hit space to toggle paused, or 's' to step.
 [RUNNING]  Bag Time: 1414591276.615376   Duration: 0.000000 / 39.898938
 [RUNNING]  Bag Time: 1414591276.784976   Duration: 0.169601 / 39.898938
 [RUNNING]  Bag Time: 1414591276.802653   Duration: 0.187277 / 39.898938
 [RUNNING]  Bag Time: 1414591276.804009   Duration: 0.188634 / 39.898938
 [RUNNING]  Bag Time: 1414591276.809074   Duration: 0.193699 / 39.898938
 [RUNNING]  Bag Time: 1414591276.822211   Duration: 0.206835 / 39.898938
 [RUNNING]  Bag Time: 1414591276.916613   Duration: 0.301237 / 39.898938
 [RUNNING]  Bag Time: 1414591276.945362   Duration: 0.329986 / 39.898938
 [RUNNING]  Bag Time: 1414591276.951215   Duration: 0.335839 / 39.898938
 [RUNNING]  Bag Time: 1414591276.966564   Duration: 0.351188 / 39.898938
 [RUNNING]  Bag Time: 1414591276.970361   Duration: 0.354985 / 39.898938
 [RUNNING]  Bag Time: 1414591276.970695   Duration: 0.355320 / 39.898938
 [RUNNING]  Bag Time: 1414591276.981076   Duration: 0.365700 / 39.898938
 [RUNNING]  Bag Time: 1414591277.081298   Duration: 0.465922 / 39.898938
 [RUNNING]  Bag Time: 1414591277.086977   Duration: 0.471601 / 39.898938
 [RUNNING]  Bag Time: 1414591277.095072   Duration: 0.479696 / 39.898938
 [RUNNING]  Bag Time: 1414591277.096738   Duration: 0.481362 / 39.898938
 [RUNNING]  Bag Time: 1414591277.097163   Duration: 0.481787 / 39.898938
```

rqt_graph



rqt_graph__RosGraph - rqt

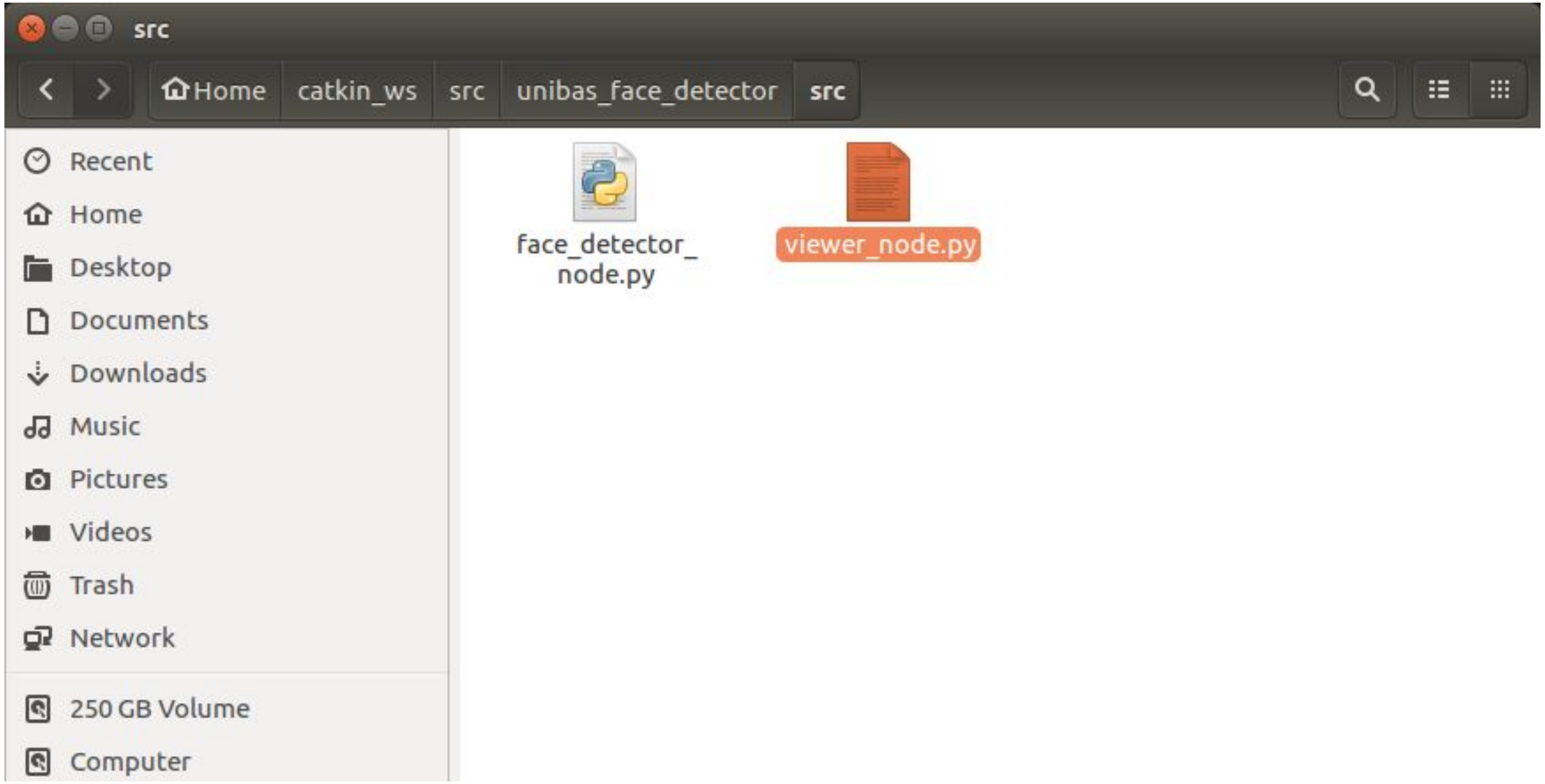
Node Graph

Nodes/Topics (all) / /

Group: ☑ Namespaces ☑ Actions Hide: ☑ Dead sinks ☑ Leaf topics ☑ Debug ☑ Unreachable ☑ Highlight ☑ Fit

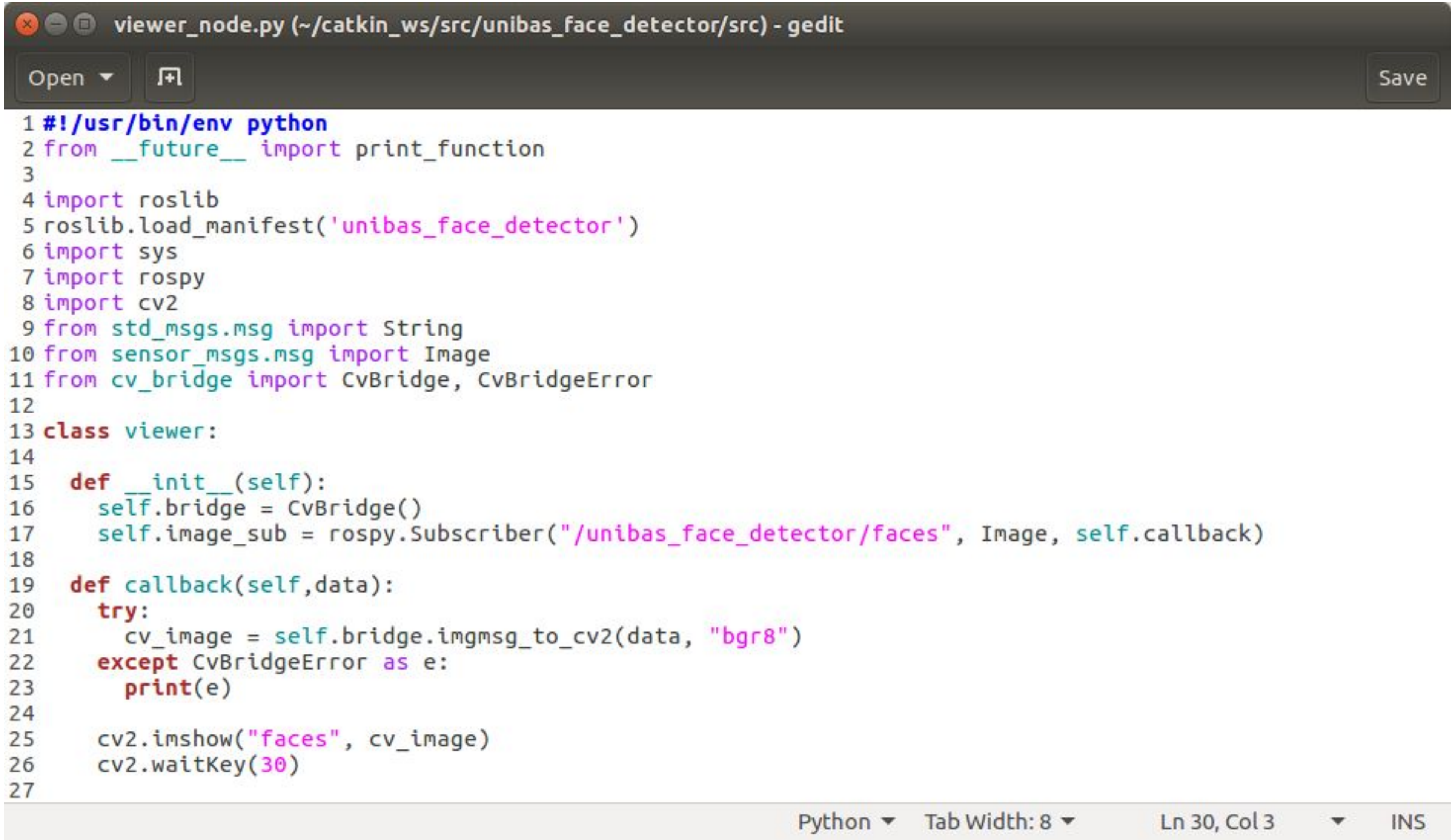
camera
/play_1559076390649811893
/camera/rgb/image_raw
/face_detector_node_19750_1559076277048

viewer_node



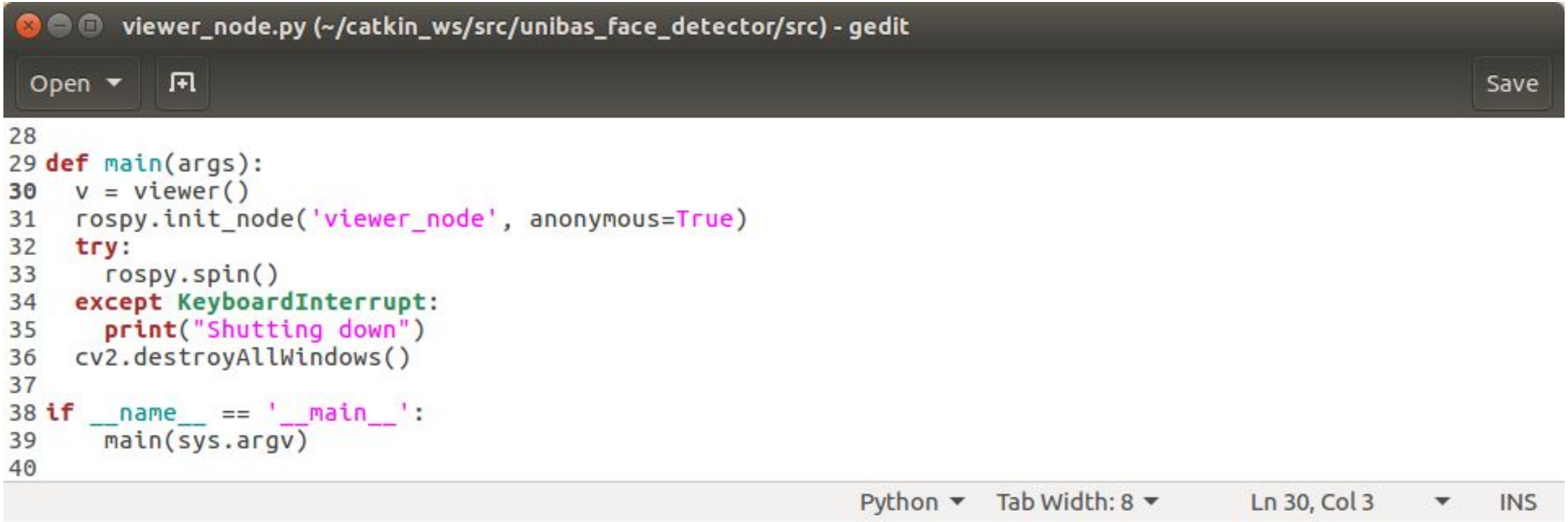
src
Home
catkin_ws
src
unibas_face_detector
src
Recent
Home
Desktop
Documents
Downloads
Music
Pictures
Videos
Trash
Network
250 GB Volume
Computer
face_detector_node.py
viewer_node.py

codice viewer_node


viewer_node.py (~/catkin_ws/src/unibas_face_detector/src) - gedit
Open
Save
Python
Tab Width: 8
Ln 30, Col 3
INS

```python
#!/usr/bin/env python
from __future__ import print_function

import roslib
roslib.load_manifest('unibas_face_detector')
import sys
import rospy
import cv2
from std_msgs.msg import String
from sensor_msgs.msg import Image
from cv_bridge import CvBridge, CvBridgeError

class viewer:

  def __init__(self):
    self.bridge = CvBridge()
    self.image_sub = rospy.Subscriber("/unibas_face_detector/faces", Image, self.callback)

  def callback(self,data):
    try:
      cv_image = self.bridge.imgmsg_to_cv2(data, "bgr8")
    except CvBridgeError as e:
      print(e)

    cv2.imshow("faces", cv_image)
    cv2.waitKey(30)

```

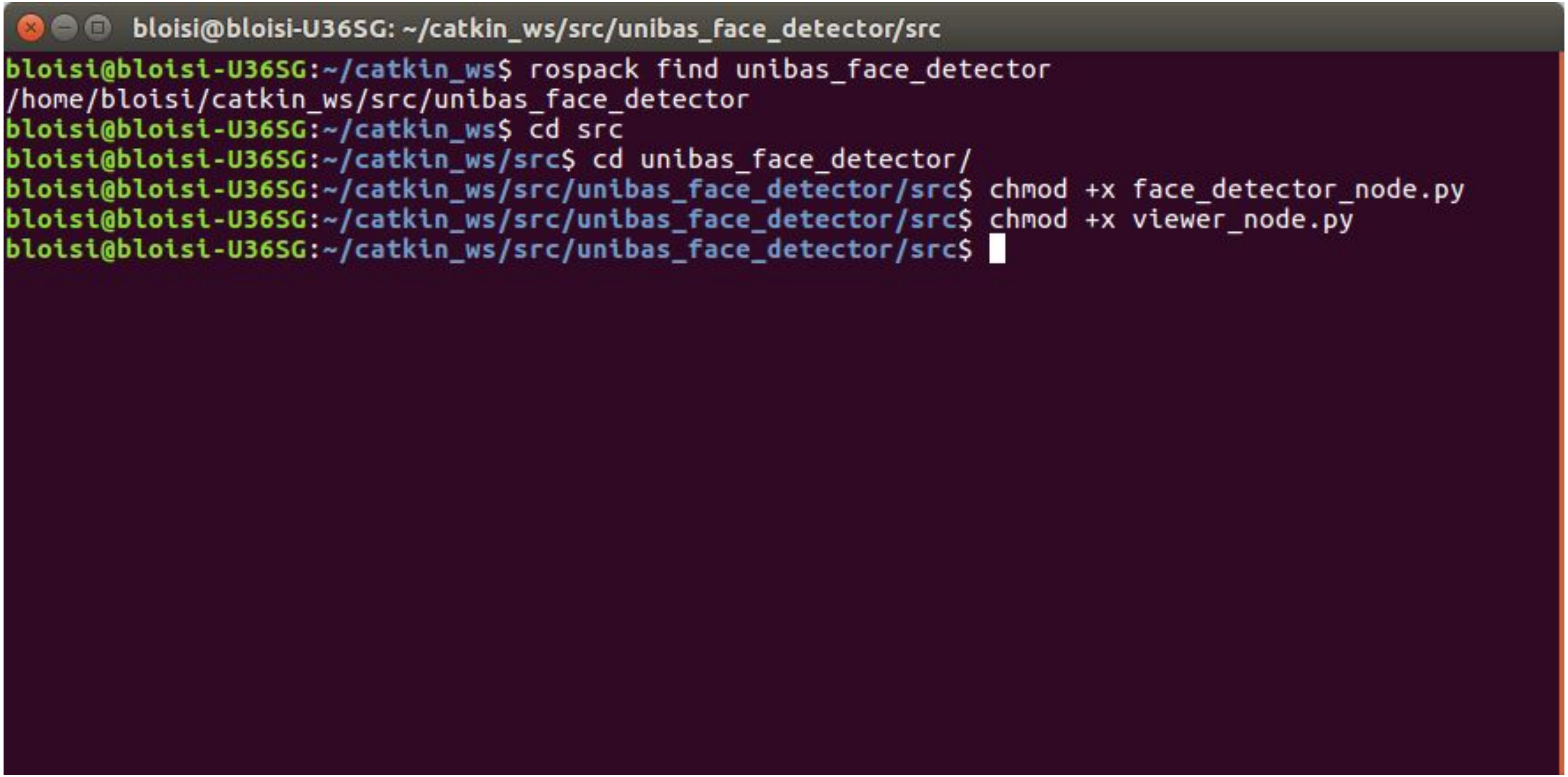
codice viewer_node



viewer_node.py (~/catkin_ws/src/unibas_face_detector/src) - gedit
Open
Save
Python
Tab Width: 8
Ln 30, Col 3
INS

```python

def main(args):
  v = viewer()
  rospy.init_node('viewer_node', anonymous=True)
  try:
    rospy.spin()
  except KeyboardInterrupt:
    print("Shutting down")
  cv2.destroyAllWindows()

if __name__ == '__main__':
    main(sys.argv)

```

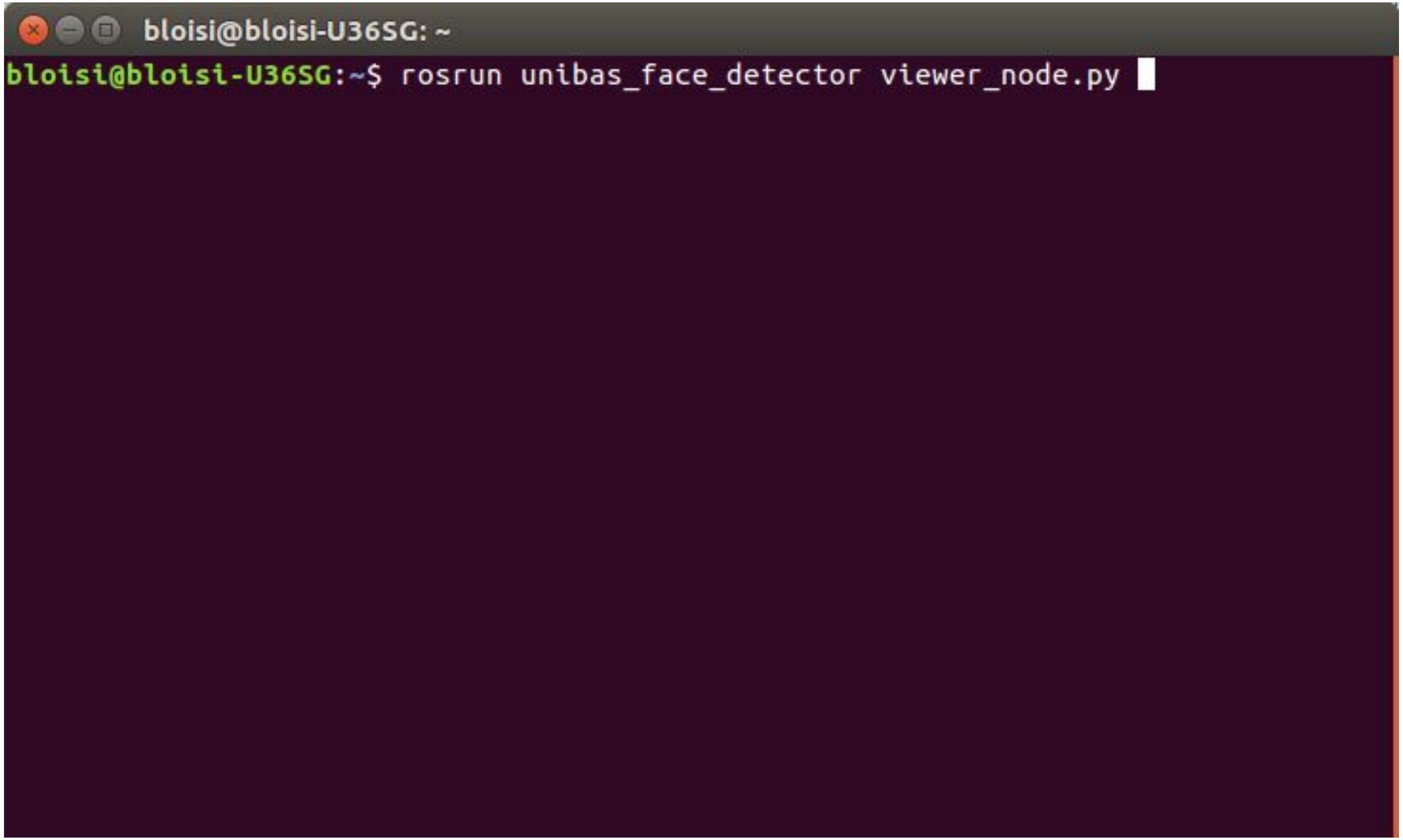
permessi per viewer_node.py



bloisi@bloisi-U36SG: ~/catkin_ws/src/unibas_face_detector/src

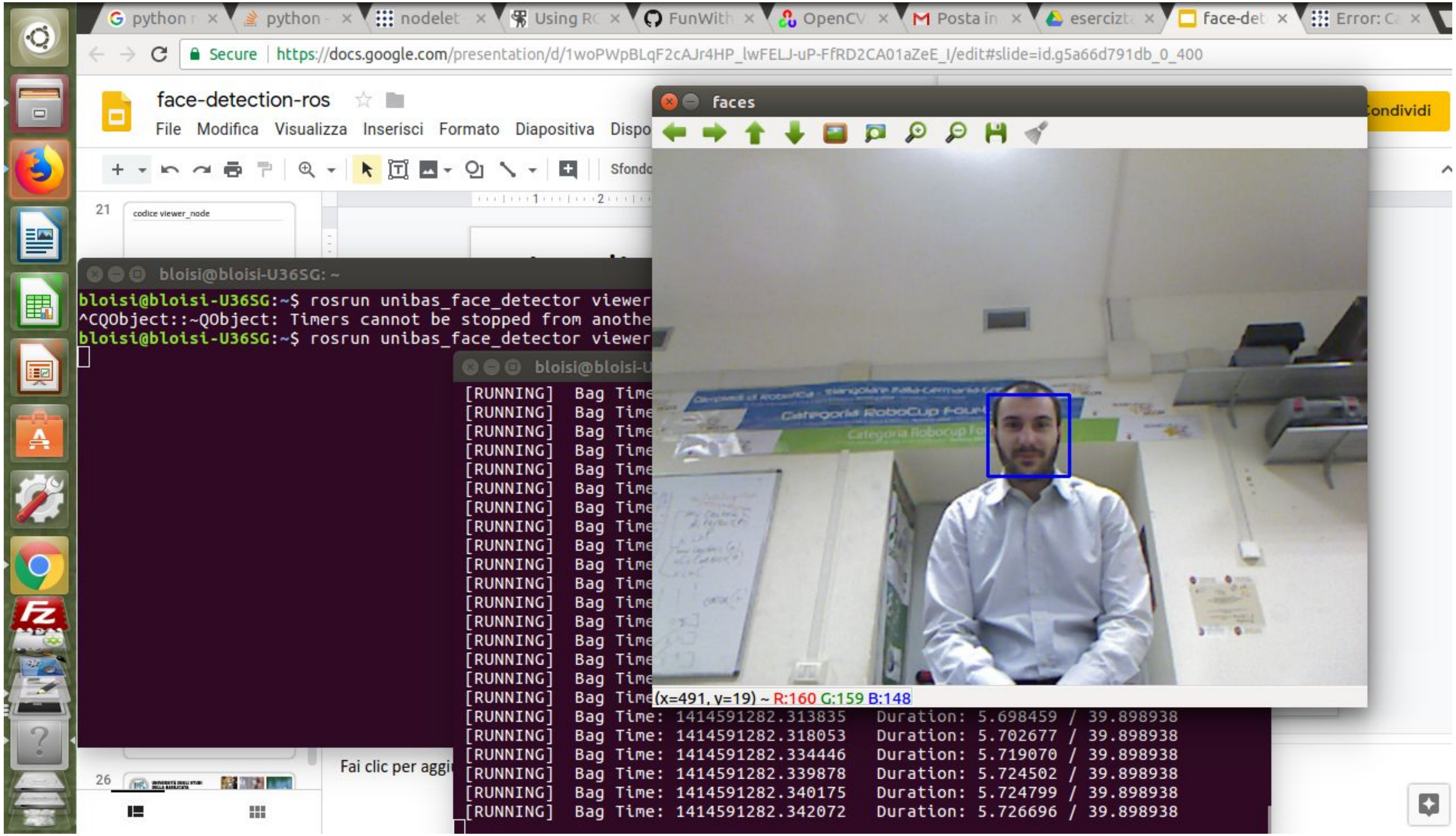
```
bloisi@bloisi-U36SG:~/catkin_ws$ rospack find unibas_face_detector
/home/bloisi/catkin_ws/src/unibas_face_detector
bloisi@bloisi-U36SG:~/catkin_ws$ cd src
bloisi@bloisi-U36SG:~/catkin_ws/src$ cd unibas_face_detector/
bloisi@bloisi-U36SG:~/catkin_ws/src/unibas_face_detector/src$ chmod +x face_detector_node.py
bloisi@bloisi-U36SG:~/catkin_ws/src/unibas_face_detector/src$ chmod +x viewer_node.py
bloisi@bloisi-U36SG:~/catkin_ws/src/unibas_face_detector/src$ 
```

rosrun viewer_node.py



```
bloisi@bloisi-U36SG:~$ rosrun unibas_face_detector viewer_node.py 
```

visualizzazione



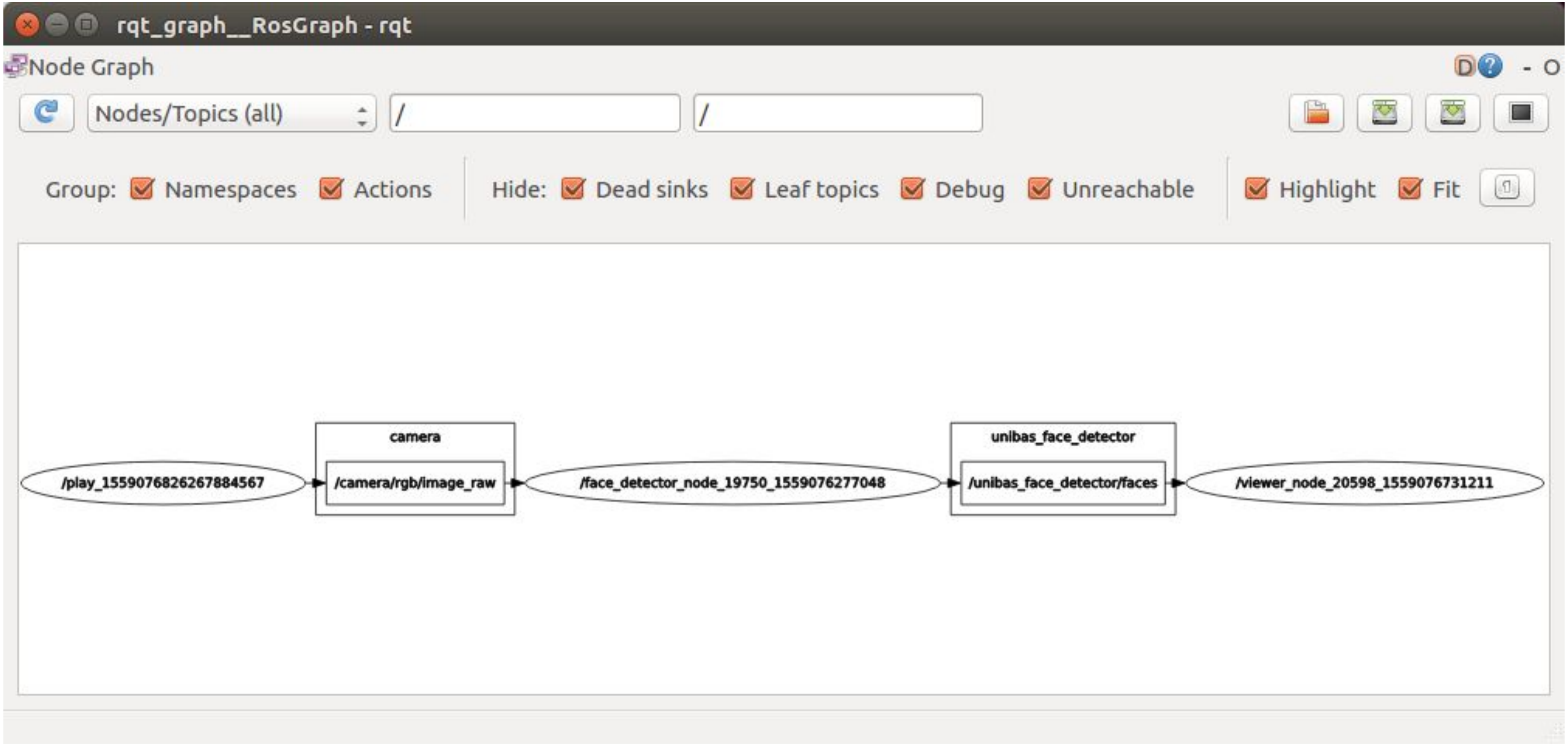
bloisi@bloisi-U36SG: ~

```
bloisi@bloisi-U36SG:~$ rosrun unibas_face_detector viewer
^CQObject::~QObject: Timers cannot be stopped from anothe
bloisi@bloisi-U36SG:~$ rosrun unibas_face_detector viewer
```

bloisi@bloisi-U

```
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time
[RUNNING]  Bag Time: 1414591282.313835   Duration: 5.698459 / 39.898938
[RUNNING]  Bag Time: 1414591282.318053   Duration: 5.702677 / 39.898938
[RUNNING]  Bag Time: 1414591282.334446   Duration: 5.719070 / 39.898938
[RUNNING]  Bag Time: 1414591282.339878   Duration: 5.724502 / 39.898938
[RUNNING]  Bag Time: 1414591282.340175   Duration: 5.724799 / 39.898938
[RUNNING]  Bag Time: 1414591282.342072   Duration: 5.726696 / 39.898938
```

rqt_graph



rqt_graph__RosGraph - rqt

Node Graph

Nodes/Topics (all) / /

Group: ☑ Namespaces ☑ Actions

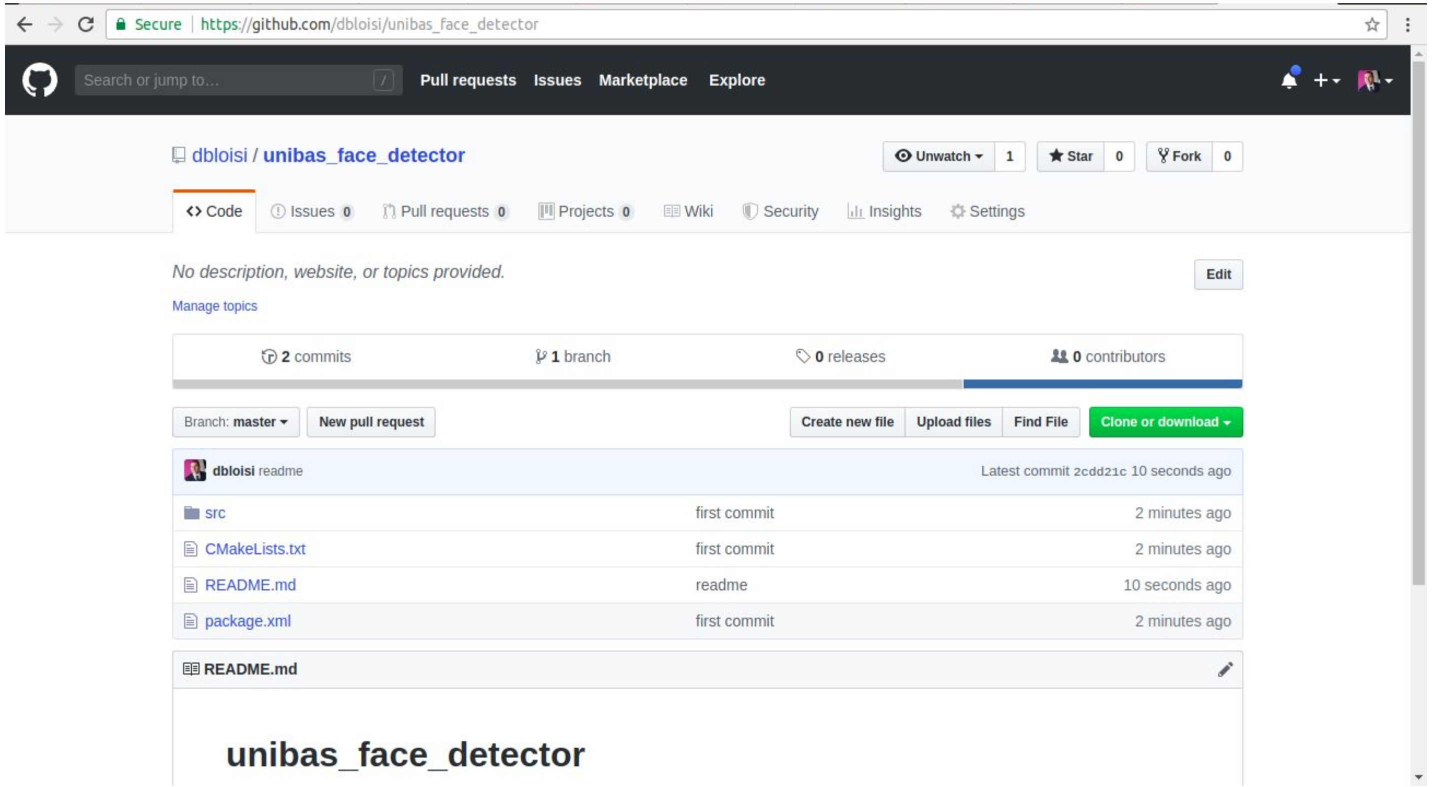
Hide: ☑ Dead sinks ☑ Leaf topics ☑ Debug ☑ Unreachable

☑ Highlight ☑ Fit

/play_1559076826267884567
camera
/camera/rgb/image_raw
/face_detector_node_19750_1559076277048
unibas_face_detector
/unibas_face_detector/faces
/viewer_node_20598_1559076731211

repository unibas_face_detector

Il codice del repository unibas_face_detector è disponibile al seguente link https://github.com/dbloisi/unibas_face_detector



No description, website, or topics provided.

dbloisi readme — Latest commit 2cdd21c 10 seconds ago

src	first commit	2 minutes ago
CMakeLists.txt	first commit	2 minutes ago
README.md	readme	10 seconds ago
package.xml	first commit	2 minutes ago

README.md

unibas_face_detector

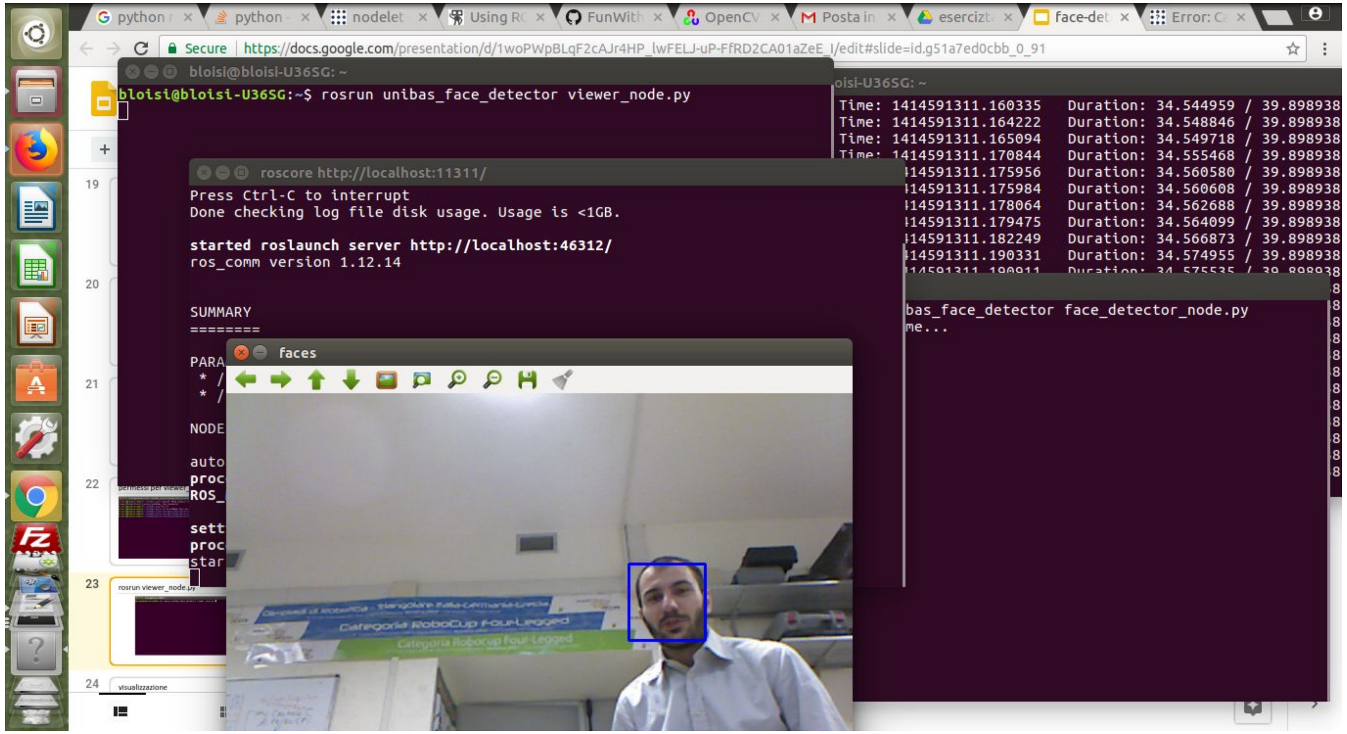
Esercizio 1

Utilizzare la rosbag people.bag
https://drive.google.com/file/d/1oOMahlPdlwJkHMqXLtrLMktfx68-AGfJ/view?usp=sharing
con il package unibas_face_detector

La detection dei volti presenti nella scena è corretta?

Esercizio 2

Creare un launchfile per evitare di dover aprire quattro differenti terminal per utilizzare il package unibas_face_detector



```
bloisi@bloisi-U36SG:~$ rosrun unibas_face_detector viewer_node.py
```

```
roscore http://localhost:11311/
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://localhost:46312/
ros_comm version 1.12.14


SUMMARY
========

PARA
 * /
 * /

NODE

auto
proc
ROS_

sett
proc
star
```

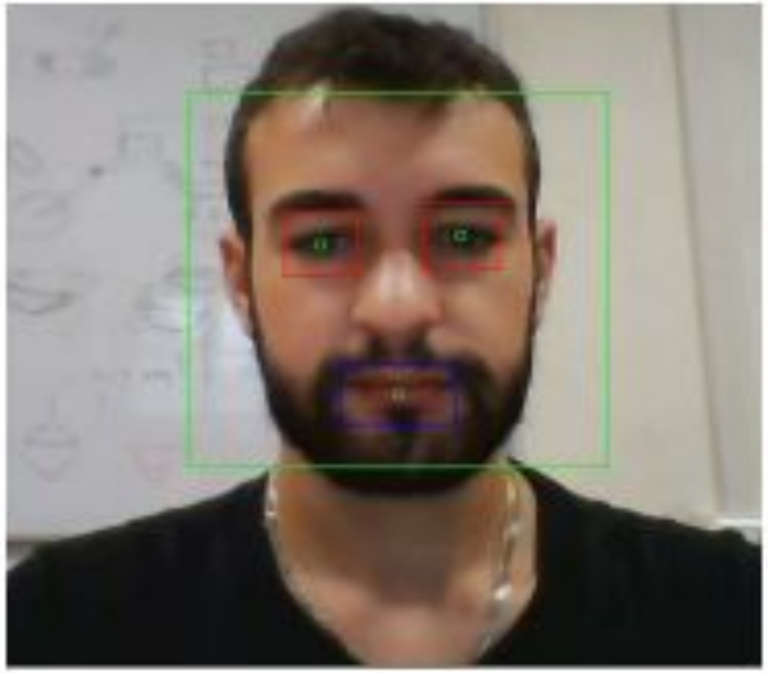
```
Time: 1414591311.160335   Duration: 34.544959 / 39.898938
Time: 1414591311.164222   Duration: 34.548846 / 39.898938
Time: 1414591311.165094   Duration: 34.549718 / 39.898938
Time: 1414591311.170844   Duration: 34.555468 / 39.898938
 14591311.175956   Duration: 34.560580 / 39.898938
 14591311.175984   Duration: 34.560608 / 39.898938
 14591311.178064   Duration: 34.562688 / 39.898938
 14591311.179475   Duration: 34.564099 / 39.898938
 14591311.182249   Duration: 34.566873 / 39.898938
 14591311.190331   Duration: 34.574955 / 39.898938
```

```
bas_face_detector face_detector_node.py
me...
```

Esercizio 3

Provare ad individuare anche gli occhi e la bocca all'interno della roi del volto come indicato nel tutorial OpenCV al seguente indirizzo

https://docs.opencv.org/3.3.1/d7/d8b/tutorial_py_face_detection.html

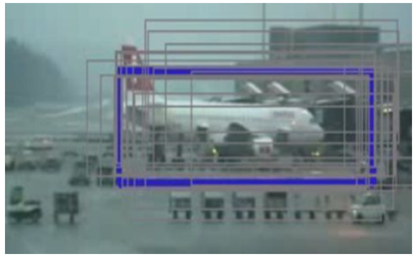


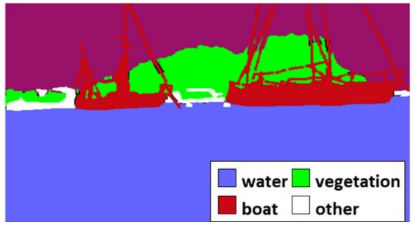
UNIVERSITÀ DEGLI STUDI DELLA BASILICATA

Corso di Sistemi Informativi
A.A. 2018/19

Docente
Domenico Daniele Bloisi

face detection





Maggio 2019