DEEP LEARNING DRONES

DEV Tools

Patrick Christ

CDTM DEV Tools

- Anaconda
- Spyder
- Git
- Numpy
- Opencv
- Libardrone
- FFMPEG
- Docker

Anaconda – Python Distribution

Python Distribution with 195 Packages such as Numpy and Spyder

Download from http://continuum.io/downloads
Install

Package Manager from Terminal (Mac OS) or CMD (Windows):
- conda install "package-name" to install a new package
- conda run "package-name" to start an package (e.g. conda run spyder or spyder)
- conda remove "package-name" to deinstall a package

Task:
→Open Spyder

Spyder - IDE

Editor for Scientific Development

Spyder is a Matlab like Editor for Python.

Main Feature: Variable Explorer, Interactive Console and Debugging Editor
Interactive Console: Test and run your code in real time

For Windows: Open Programs/Anaconda Launcher and than Spyder

For Mac: Open Home/Anaconda/Launcher and than Spyder

Or in Terminal/CMD conda run spyder

Script Editor

Object Inspector and Variable Explorer

Interactive Console and Interpreter
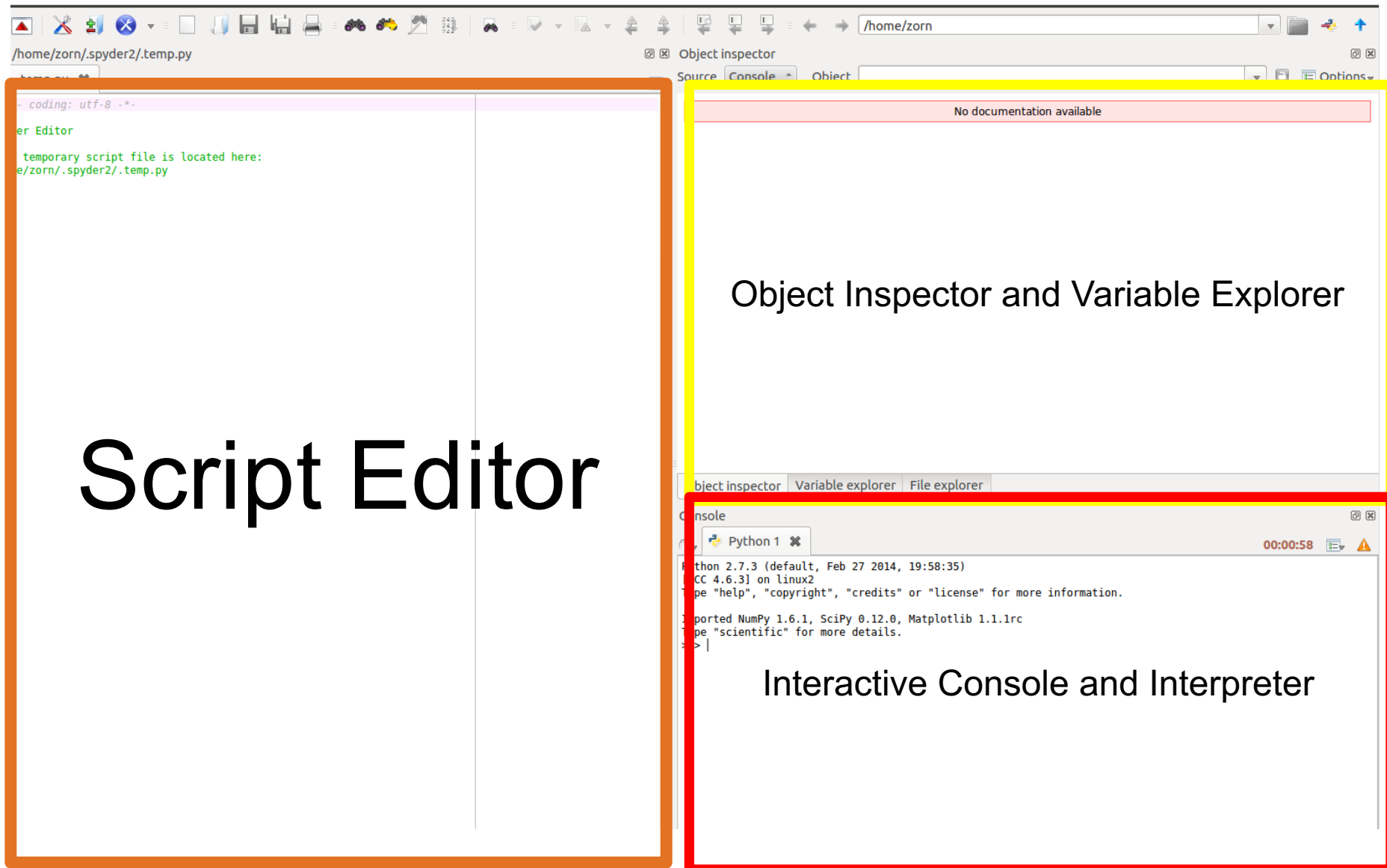
Installing new libraries with Anaconda

Library for manipulating Images and Videos

For installing new libraries and frameworks use the conda package manager.

Open Terminal or CMD and type:

conda info # to show the current conda info
conda list # to show all installed packages
conda install „packagename" # to install a new package

Task: install OpenCV
conda install opencv

Git and Github

Collaboration Tool for Programmers

Share code and work together in Teams on your Drone Project.

Installation:
https://git-scm.com/

Usage:
Explain your team partner how to use git.

Task: Register on Github, Clone and Star
https://github.com/PatrickChrist/CDTM-Deep-Learning-Drones

Introduction to Numpy

- Lists ok for storing small amounts of one-dimensional data

```
>>> a = [1,3,5,7,9]
>>> print(a[2:4])
[5, 7]
>>> b = [[1, 3, 5, 7, 9], [2, 4, 6, 8, 10]]
>>> print(b[0])
[1, 3, 5, 7, 9]
>>> print(b[1][2:4])
[6, 8]
```

```
>>> a = [1,3,5,7,9]
>>> b = [3,5,6,7,9]
>>> c = a + b
>>> print c
[1, 3, 5, 7, 9, 3, 5, 6, 7, 9]
```

- But, can't use directly with arithmetical operators (+, -, *, /, …)
- Need efficient arrays with arithmetic and better multidimensional tools

Important: Images and Videos are multidimensional lists/arrays

Changing from Python Array to Numpy Array

Numpy Array are computional more efficent and capable

```
>>> import numpy
>>> l = [[1, 2, 3], [3, 6, 9], [2, 4, 6]]  # create a list
>>> a = numpy.array(l)  # convert a list to an array
>>> print(a)
[[1 2 3]
 [3 6 9]
 [2 4 6]]
>>> a.shape
(3, 3)
>>> print(a.dtype)  # get type of an array
int32
>>> print(a[0])  # this is just like a list of lists
[1 2 3]
>>> print(a[1, 2])  # arrays can be given comma separated indices
9
>>> print(a[1, 1:3])  # and slices
[6 9]
>>> print(a[:,1])
[2 6 4]
```

Introduction to OpenCV

OpenCV is the most popular library for Image Processing and Computer Vision.
You can manipulate, process and show Images and Videos with OpenCV
Usage:

```python
import cv2
# Creates a numpy.ndarray object
img = cv2.imread("path to your file", cv2.IMREAD_COLOR)

# Creates a window (title = 'Your Image!') and displays img in it.
cv2.imshow('Your Image', img)

# Waits for any key to be pressed.
cv2.waitKey(0)
# Destroys all windows.
cv2.destroyAllWindows()
```

Processing Video data

Example get the stream of your webcam

```python
import cv2
cam = cv2.VideoCapture(0) # Get the stream of your webcam
running = True
while running:    # get current frame of video
        running, frame = cam.read()
                if running:
                        # cv2.rectangle(frame, (x1, y1), (x2, y2), (255,0,0), 2)
                        cv2.imshow('frame', frame)
                if cv2.waitKey(1) & 0xFF == 27:        # escape key pressed
                        running = False
                else:      # error reading frame
                        print 'error reading video feed'
cam.release()
cv2.destroyAllWindows()
```

Modifying Images

Modify or process your Frame with OpenCV.

```python
import cv2
cam = cv2.VideoCapture(0)   # Get the stream of your webcam
running = True
while running:   # get current frame of video
            running, frame = cam.read()
                        if running:
                                    # Paste here your modifcation
                                    cv2.rectangle(frame, (100, 100), (200, 200), (255,0,0), 2)
                                    font = cv2.FONT_HERSHEY_SIMPLEX
                                    cv2.putText(frame,'Finally Done',(10,500), font, 4,(255,255,255),2,cv2.LINE_AA)
                                    cv2.imshow('frame', frame)
                        if cv2.waitKey(1) & 0xFF == 27:           # escape key pressed
                                    running = False
                        else:       # error reading frame
                                    print 'error reading video feed'
cam.release()
cv2.destroyAllWindows()
```

Installing Libardrone and PSdrone

For installing external libraries such as the libardrone open Terminal or CMD.
Change the folder:
e.g.
cd /home/patrickchrist/Downloads/python-ardrone

Execute the Setup.py with the following command
python setup.py install

Script will install the library to you Anaconda Python Distribution
You can access the library with
import libardrone.libardrone as libardone

You can use psdrone directly.

Installing ffmpeg

Install ffmpeg to stream the camera stream
Conda install ffmpeg

```
● ● ●                          ⌂ patrickchrist — bash — 134×32

PatrickMBA:~ patrickchrist$ conda install ffmpeg
Fetching package metadata: ....
Error: No packages found in current osx-64 channels matching: ffmpeg

You can search for this package on Binstar with

    binstar search -t conda ffmpeg
PatrickMBA:~ patrickchrist$ binstar search -t conda ffmpeg
Using binstar api site https://api.anaconda.org
Run 'binstar show <USER/PACKAGE>' to get more details:
Packages:
     Name                        | Version | Package Types     | Platforms
     --------------------------- | ------- | ----------------- | ---------------
     asmeurer/ffmpeg             |   2.1.0 | conda             | linux-64
                                           : None
     auto/easy-thumbnails-ffmpeg |   0.1.1 | conda             | linux-32
                                           : Video thumbnails source generator.
     bgreen-litl/ffmpeg          |   2.5.3 | conda             | linux-64
     community/ffmpeg            |   2.2.4 | conda             | linux-64, osx-64
                                           : http://www.ffmpeg.org/
     derickl/ffmpeg              |   2.5.3 | conda             | osx-64
     erik/ffmpeg                 |   2.2.4 | conda             | osx-64
                                           : None
     joemarct/ffmpeg             |   2.2.4 | conda             | linux-64
                                           : ffmpeg with libmp3lame enabled for use in audio file conversions to mp3
     litl-rnd/ffmpeg             |   2.5.3 | conda             | linux-64, osx-64
     mutirri/ffmpeg              |   2.1.0 | conda             | linux-64
                                           : http://www.ffmpeg.org/
     ver228/ffmpeg               |   2.2.4 | conda             | osx-64
Found 10 packages
PatrickMBA:~ patrickchrist$ ▮
```

Docker

Configurable Enviroments for Development und Production

Every machine and environment is different. Code may not run on your teams computer.

Solution: Sharing the same environment using Docker. Even share environment and configurations among others.
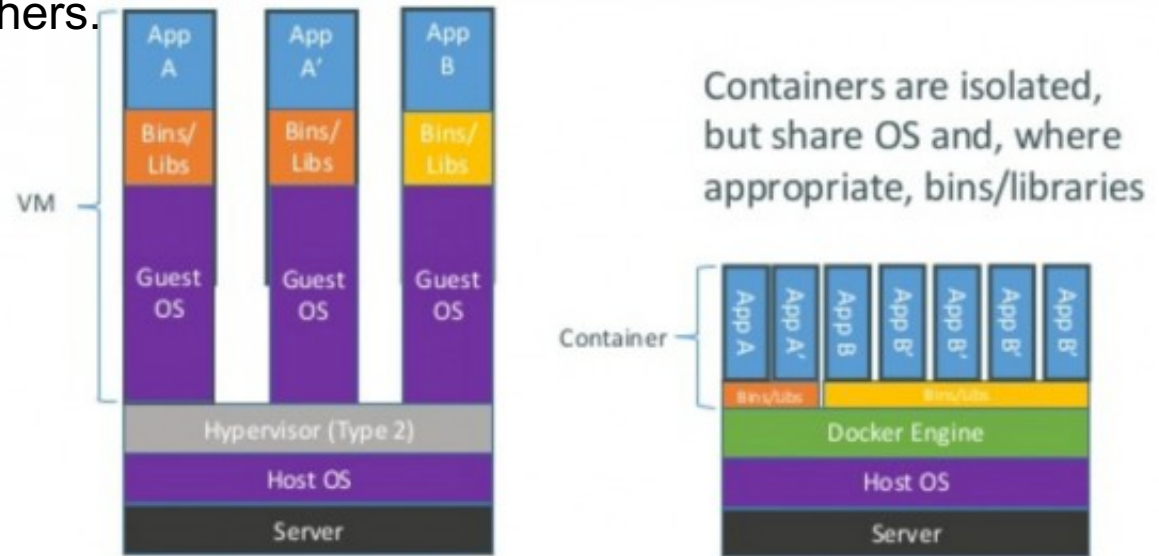
Installation:
https://www.docker.com/

Usage:
For building a Docker container
from a Dockerfile
docker build
Running a container
docker run
Look into https://github.com/PatrickChrist/CDTM-Deep-Learning-Drones for more infos

Start with Coding Challenge 1

Troubleshooting

No connection to the drone
lsof -i :5555
Kill pid
Restart drone