

《天文统计学》 计算环境

章博

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Linux操作系统

- 为什么要使用linux而不是windows?
- 《天文统计学》课程将使用中国虚拟天文台提供的MADARA虚拟机 (VM, Fedora/32bit)
- VM的创建和使用
 - 登录<http://astrocloud.china-vo.org>按照教程创建VM,创建成功后会收到邮件提醒,包含端口号和root用户的密码
 - 远程访问VM
 - ssh
 - rdesktop (for linux)
 - Windows远程桌面 (for win/mac)
 - 以普通用户身份登录VM (student/naoc123)

Python

- 天文中常见的几种编程语言
 - Fortran, C/C++, java, python, MATLAB, IDL, R, ...
- 为什么要使用python
 - 高级、解释性语言,简单易学
 - 面向对象
 - 易于测试、排错
 - 开源、可扩展,“胶水语言”
 - Astropy等天文工具包的支持
- Python2 or 3?
 - Python3是趋势

Anaconda 集成环境

- Package 管理、升级
- 集成大部分常用 package
- 计算加速 (accelerate, numba, mkl ...)
- 不需要 root 权限, 安装方便

- 安装

- 登录 <https://www.continuum.io/downloads>
- 下载 Anaconda3-4.3.0-Linux-x86.sh
- `$ bash Anaconda3-4.3.0-Linux-x86.sh`
 - 安装过程中按 Enter, q, yes, Enter

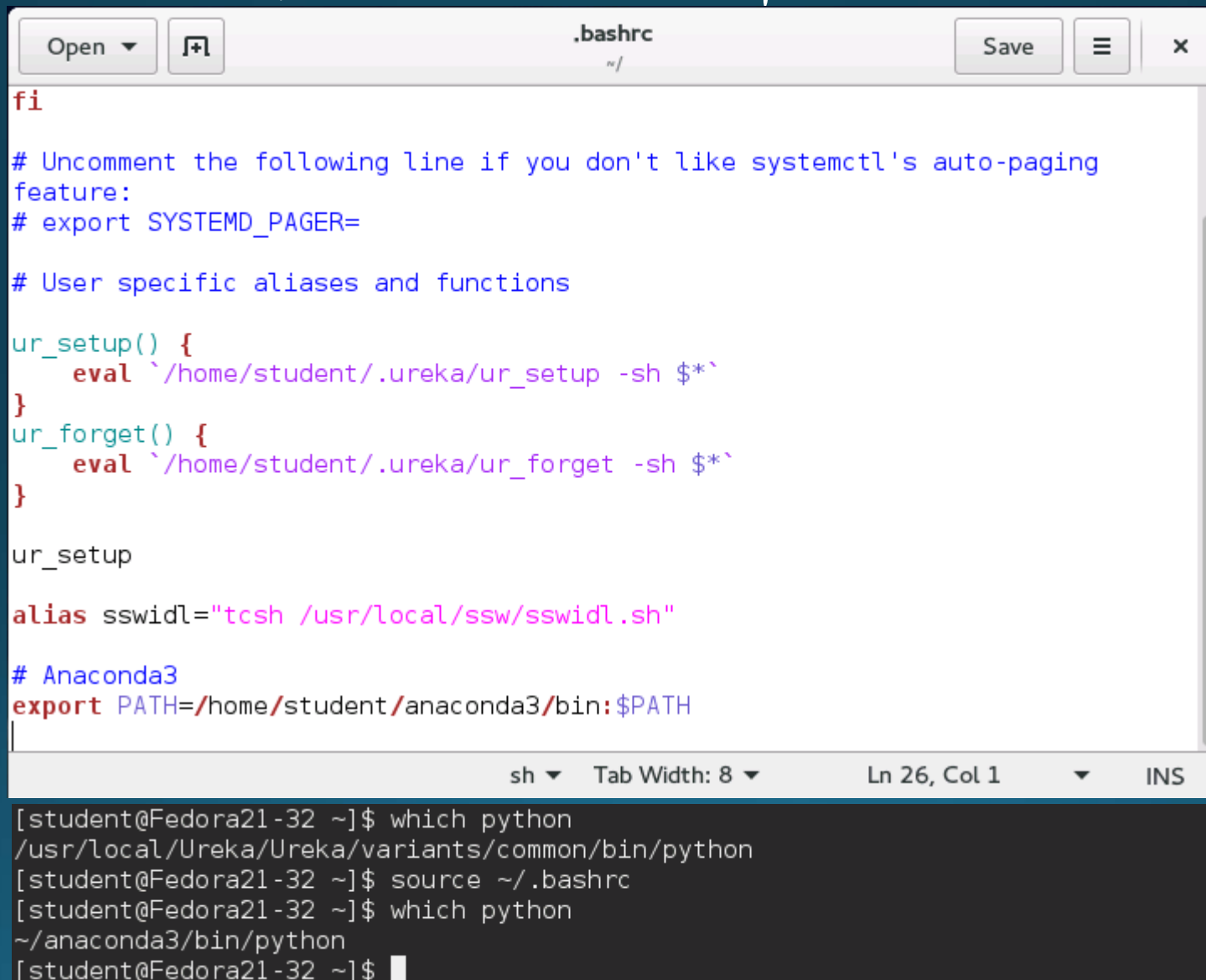
```
[student@Fedora21-32 ~]$ bash ~/Downloads/Anaconda3-4.3.0-Linux-x86.sh
```

- 修改环境变量, (用 gedit/vim) 在 `~/.bashrc` 末尾添加

```
You may wish to edit your .bashrc or prepend the Anaconda3 install location:
```

```
$ export PATH=/home/student/anaconda3/bin:$PATH
```

修改后的.bashrc文件



The image shows a text editor window titled ".bashrc" with a file icon, "Open" button, "Save" button, and window controls. The editor contains the following text:

```
fi

# Uncomment the following line if you don't like systemctl's auto-paging
feature:
# export SYSTEMD_PAGER=

# User specific aliases and functions

ur_setup() {
    eval `~/home/student/.ureka/ur_setup -sh $*`
}
ur_forget() {
    eval `~/home/student/.ureka/ur_forget -sh $*`
}

ur_setup

alias sswidl="tcsh /usr/local/ssw/sswidl.sh"

# Anaconda3
export PATH=/home/student/anaconda3/bin:$PATH
```

Below the editor is a terminal window showing the following commands and output:

```
[student@Fedora21-32 ~]$ which python
/usr/local/Ureka/Ureka/variants/common/bin/python
[student@Fedora21-32 ~]$ source ~/.bashrc
[student@Fedora21-32 ~]$ which python
~/anaconda3/bin/python
[student@Fedora21-32 ~]$
```

安装/升级python package

- 安装
 - pip install XXX
- 升级
 - pip install XXX -U

```
[student@Fedora21-32 ~]$ pip install emcee
Collecting emcee
  Downloading emcee-2.2.1.tar.gz
Requirement already satisfied: numpy in ./anaconda3/lib/python3.6/site-packages
(from emcee)
Building wheels for collected packages: emcee
  Running setup.py bdist_wheel for emcee ... done
  Stored in directory: /home/student/.cache/pip/wheels/4e/29/27/417d1cb44565c479
884d659a93edb24ff031d470db2be3b9dd
Successfully built emcee
Installing collected packages: emcee
Successfully installed emcee-2.2.1
[student@Fedora21-32 ~]$
```

Python IDEs

- Jupyter
 - Jupyter-console
 - Jupyter-qtconsole
 - Jupyter-notebook
- Spyder
- Pycharm/jetbrain
- ...

IDE – jupyter-console

```
[student@Fedora21-32 ~]$ jupyter-console
Jupyter console 5.0.0

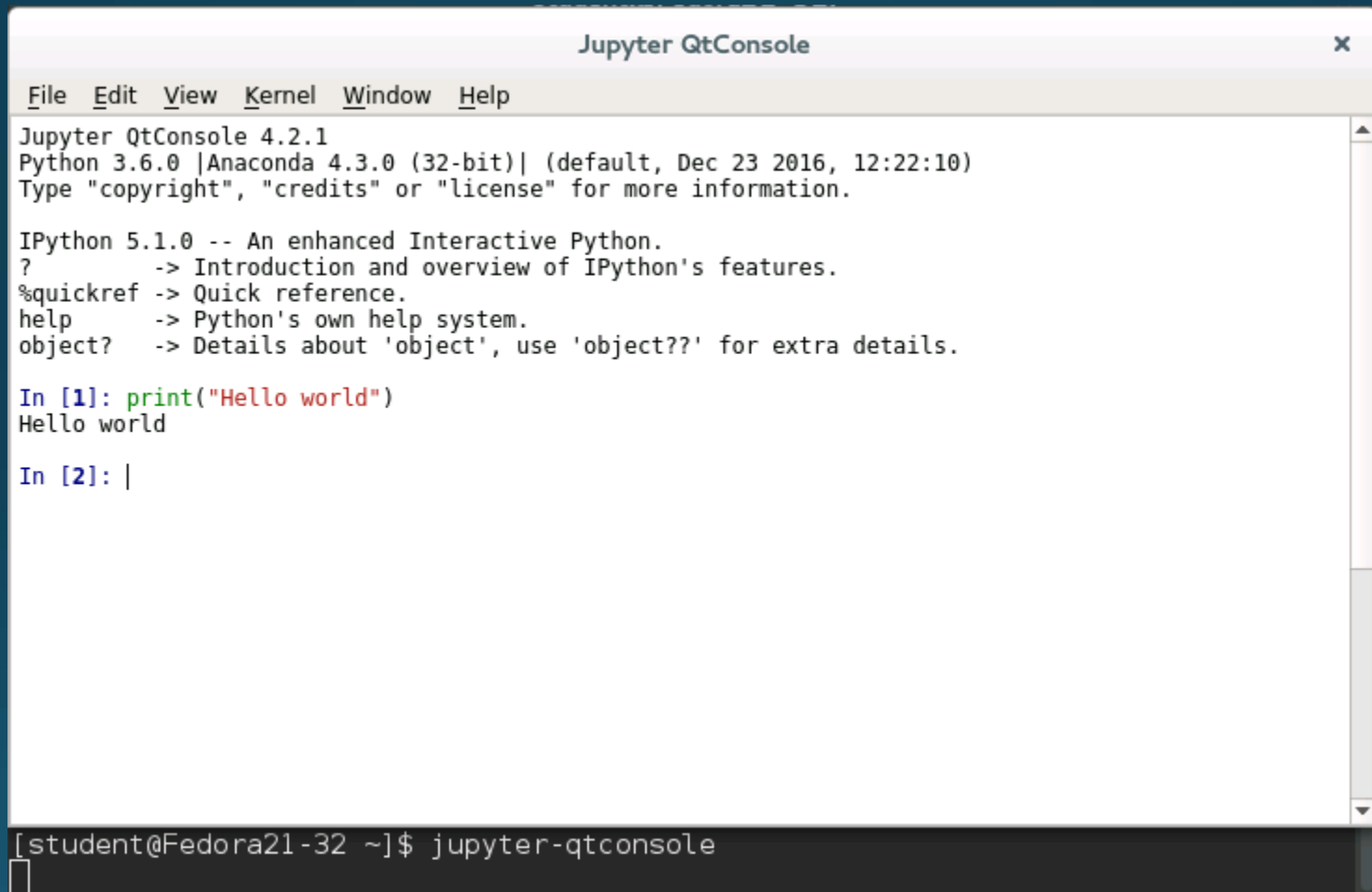
Python 3.6.0 |Anaconda 4.3.0 (32-bit)| (default, Dec 23 2016, 12:22:10)
Type "copyright", "credits" or "license" for more information.

IPython 5.1.0 -- An enhanced Interactive Python.
?                -> Introduction and overview of IPython's features.
%quickref        -> Quick reference.
help             -> Python's own help system.
object?         -> Details about 'object', use 'object??' for extra details.

In [1]: print("Hello world")
Hello world

In [2]: █
```


IDE – jupyter-qtconsole



The screenshot shows the Jupyter QtConsole application window. The title bar reads "Jupyter QtConsole" with a close button. The menu bar includes "File", "Edit", "View", "Kernel", "Window", and "Help". The main text area displays the following content:

```
Jupyter QtConsole 4.2.1
Python 3.6.0 |Anaconda 4.3.0 (32-bit)| (default, Dec 23 2016, 12:22:10)
Type "copyright", "credits" or "license" for more information.

IPython 5.1.0 -- An enhanced Interactive Python.
?          -> Introduction and overview of IPython's features.
%quickref  -> Quick reference.
help       -> Python's own help system.
object?    -> Details about 'object', use 'object??' for extra details.

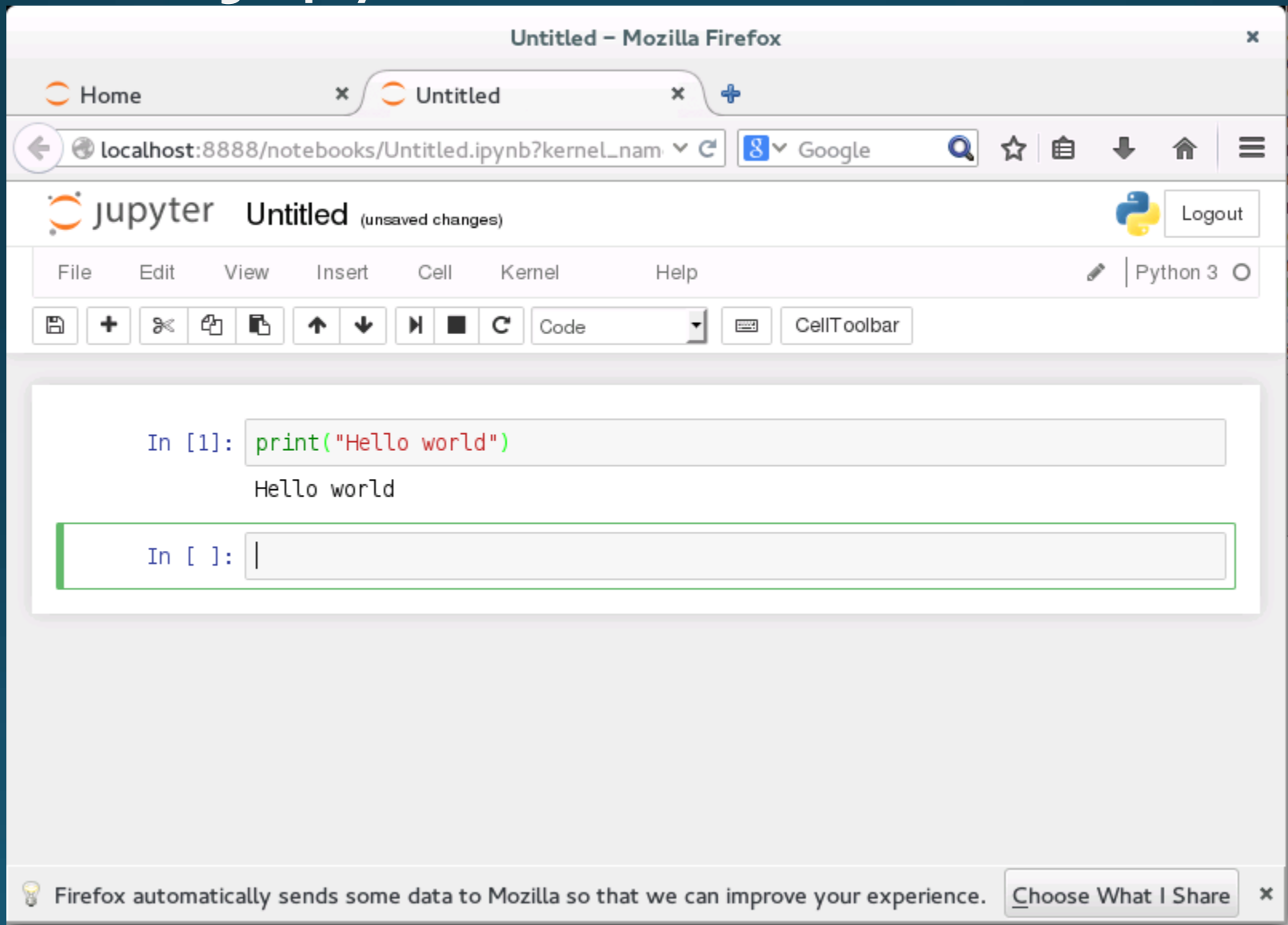
In [1]: print("Hello world")
Hello world

In [2]: |
```

At the bottom of the window, a terminal-like prompt shows the command used to launch the application:

```
[student@Fedora21-32 ~]$ jupyter-qtconsole
```

IDE – jupyter-notebook



FAQ

- 1. 是否一定要使用虚拟天文台提供的虚拟机？
- 否。大家完全可以使用自己的Linux系统，或者使用Mac。
- 2. 正在使用Windows系统，能否使用Windows下的工具完成课程作业？
- 可以，但是会遇到一些问题，推荐使用Linux/Mac。
- 3. 正在使用Windows，能否安装Windows/Linux双系统？
- 可以，生命在于折腾，安装双系统之前务必备份数据。
- 4. 没有创建虚拟机也没有安装anaconda，能否直接开始学习并联系python？
- 可以，试试<https://www.pythonanywhere.com/try-ipython/>，这里提供了基于网页的python2。

Python中几个常用的package

- Numpy
 - 提供科学计算的数据类型支持, `numpy.ndarray`
- Scipy
 - 提供基本的数值计算工具, 如积分, 插值, 最优化, 等等
- Matplotlib
 - 画图 (散点图, 曲线图, 等高线图, ...)
- Astropy
 - 天文工具包, `fits`读写, 天文时间, 等等
- Emcee
 - MCMC sampler (马尔科夫链-蒙特卡洛采样器)
 - 贝叶斯估计

Python elements

- Python的几个基本命令
 - print, type, dir, assert, range, in, as, open, class, ...
- Python built-in数据类型
 - int, float, bool, str, object
 - list, tuple, set, dictionary, ...
- Python控制流命令
 - for
 - if elif else
 - while
 - *try catch
- numpy.ndarray VS list
- matplotlib

参考书

在线试读↓



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张若愚 (作者)

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式DSP信号处理系统开发, 嵌入式MCU控制系统开发, 工业控制
及生产系统的计算机模拟。在工作中他积极采用Python作为主要

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