Python on the command line

DATA PROCESSING IN SHELL

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Data Person

Python basics

Python

- comes pre-installed on MacOS, Linux
- needs to be user-install for Windows **instructions here**
- can be used with GUI interfaces (e.g Jupyter Notebook, Spyder, PyCharm, etc.)
- can also be accessed directly via the command line interface

Using Python documentation

Documentation:

```
man python
```

```
...
-V ,  --version
    Prints the Python version number of the executable and exits.
```

```
python --version
```

```
Python 3.5.2
```

Using Python documentation

Example 1: using native Python

```
which python
```

```
/usr/bin/python
```

Example 2: using Anaconda Python

```
which python
```

```
/anaconda3/bin/python
```

The Python interactive session

To activate a Python interactive session in the terminal:

```
python
```

```
Python 3.5.2 (default, Nov 23 2017, 16:37:01)
[GCC 5.4.0 20160609] on linuxType "help", "copyright", "credits" or
"license" for more information.
>>>
```

The Python interactive session

Inside the interactive session, only use Python syntax:

```
>>> print('hello world')
hello world
```

To exit the Python session and return to terminal:

```
>>> exit()
$
```

Python interactive session alternative

Python interactive session:

- easy to activate, intuitive
- not good for code reproducibility

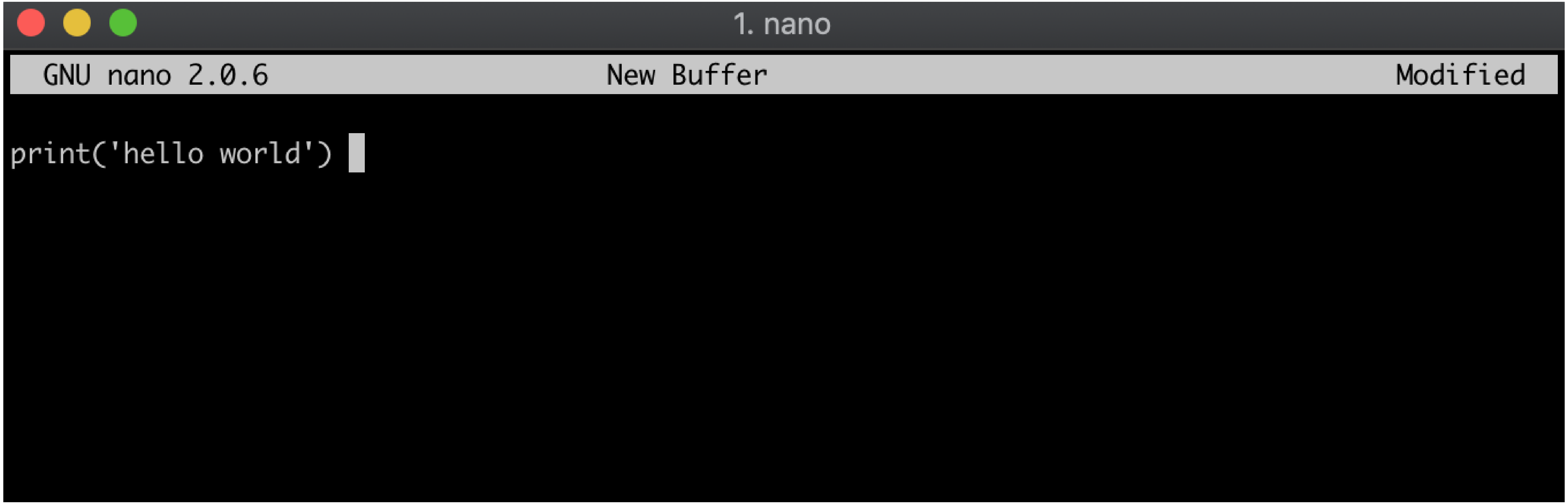
Alternative:

- save Python commands in a Python `.py` script
- execute script by calling `python` + script

Python script execution on the command line

Method 1

- Create a `.py` file using a text editor on the command line (e.g. nano, Vim, Emacs)



```
  GNU nano 2.0.6                  New Buffer                       Modified

print('hello world')
```

Python script execution on the command line

Method 2

- Create a `.py` file by `echo` -ing the Python syntax into the `hello_world.py` file, instantiating the Python file in the same step.

```
echo “print(‘hello world’)” > hello_world.py
```

Sanity check file content:

```
cat hello_world.py
```

```
print('hello world')
```

Python script execution on the command line

Make sure in the same directory as the `.py` file:

```
ls
```

```
hello_world.py
```

Execute `.py` file by preceding filename with `python` :

```
python hello_world.py
```

```
hello world
```

Let's practice!

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Python package installation with pip

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Python standard library

Python standard library has a collection of:

- built-in functions (e.g. print())
- built-in packages (e.g. math, os)

Data science packages like **scikit-learn** and **statsmodel**:

- are **NOT** part of the Python standard library
- can be installed through `pip` , the standard package manager for Python, **via the command line**

Using pip documentation

Documentation:

```
pip -h
```

```
Usage:
  pip <command> [options]

Commands:
  install          Install packages.
  uninstall        Uninstall packages.
  freeze           Output installed packages in requirements format.
  list             List installed packages.
```

Using pip documentation

Documentation:

```
pip --version
```

```
pip 19.1.1 from /usr/local/lib/python3.5/dist-packages/pip (python 3.5)
```

```
python --version
```

```
Python 3.5.2
```

Upgrading pip

If `pip` is giving an upgrade warning:

```
WARNING: You are using pip version 19.1.1, however version 19.2.1 is available.
You should consider upgrading via the 'pip install --upgrade pip' command.
```

Upgrade `pip` using itself:

```
pip install --upgrade pip
```

```
Collecting pip
     |################################| 1.4MB 10.7MB/s
Successfully installed pip-19.2.1
```

pip list

`pip list` : displays the Python packages in your current Python environment

```
pip list
```

```
Package         Version
- - - - - - - - - - - -
agate           1.6.1
agate-dbf       0.2.1
agate-excel     0.2.3
agate-sql       0.5.4
Babel           2.7.0
```

pip install one package

`pip install` installs the package specified **and** any other dependencies

```
pip install scikit-learn
```

```
Collecting scikit-learn
  Downloading https://files.pythonhosted.org/packages/1f/af/e3c3cd6f61093830059138624dbc
     |################################| 6.6MB 32.5MB/s
Collecting scipy>=0.17.0 (from scikit-learn)
  Downloading https://files.pythonhosted.org/packages/14/49/8f13fa215e10a7ab0731cc95b0e9
     |################################| 25.1MB 35.5MB/s
...
```

pip install a specific version

By default, `pip install` will always install the latest version of the library.

```
pip install scikit-learn
```

```
Successfully built sklearn
Installing collected packages: joblib, scipy, scikit-learn, sklearn
Successfully installed joblib-0.13.2 scikit-learn-0.21.3 scipy-1.3.0 sklearn-0.0
```

pip install a specific version

To install a specific (or older) version of the library:

```
pip install scikit-learn==0.19.2
```

```
Collecting scikit-learn==0.19.2
  Downloading https://files.pythonhosted.org/packages/b6/e2/a1e254a4a4598588d4fe88b45ab8
     |################################| 4.9MB 15.6MB/s
Installing collected packages: scikit-learn
Successfully installed scikit-learn-0.19.2
```

Upgrading packages using pip

Upgrade the Scikit-Learn package using pip:

```
pip install --upgrade scikit-learn
```

```
Collecting scikit-learn
  Downloading https://files.pythonhosted.org/packages/1f/af/e3c3cd6f61093830059138624dbd
     |################################| 6.6MB 41.5MB/s
Requirement already satisfied, skipping upgrade: numpy>=1.11.0 in /usr/local/lib/python3
Collecting scipy>=0.17.0 (from scikit-learn)
Installing collected packages: scipy, joblib, scikit-learn
Successfully installed joblib-0.13.2 scikit-learn-0.21.3 scipy-1.3.0
```

pip install multiple packages

To `pip install` multiple packages, separate the packages with spaces:

```
pip install scikit-learn statsmodels
```

Upgrade multiple packages:

```
pip install --upgrade scikit-learn statsmodels
```

pip install with requirements.txt

`requirements.txt` file contains a list of packages to be installed:

```
cat requirements.txt
```

```
scikit-learn
statsmodel
```

Most Python developers include `requirements.txt` files in their Python Github repos.

pip install with requirements.txt

`-r` allows `pip install` to install packages from a pre-written file:

```
-r, --requirement <file>
Install from the given requirements file. This option can be used multiple times.
```

In our example:

```
pip install -r requirements.txt
```

is the same as

```
pip install scikit-learn statsmodel
```

Let's practice!

DATA PROCESSING IN SHELL

Data job automation with cron

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What is a scheduler?

- Scheduler runs jobs on a pre-determined schedule
- Commercial schedulers: Airflow, Luigi, Rundeck, etc.
- cron scheduler is
  - simple
  - free
  - customizable
  - purely command-line
  - native to MacOS and Linux

What is cron?

Cron:

- is a time-based job-scheduler
- comes pre-installed in MacOS, Unix
- can be installed in Windows via Cygwin or replaced with Windows Task Scheduler
- is used to automate jobs like system maintenance, bash scripts, Python jobs, etc.

What is crontab?

Crontab is a central file to keep track of cron jobs.

```
crontab -l
```

```
no crontab for <username>
```

Documentation:

```
man crontab
```

Add a job to crontab

Method 1: modify crontab using a text editor (e.g. nano, Vim, Emacs)

Method 2: echo the scheduler command into crontab

```
echo "* * * * * python create_model.py" | crontab
```

Check if the job is properly scheduled:

```
crontab -l
```

```
* * * * * python create_model.py
```

Learning to time a cron job

The most frequent schedule for cron jobs is **one minute**.

Breaking down the time component for a cron job:

```
.---------------- minute (0 - 59)
|  .------------- hour (0 - 23)
|  |  .---------- day of month (1 - 31)
|  |  |  .------- month (1 - 12) OR jan,feb,mar,apr ...
|  |  |  |  .---- day of week (0 - 6) (Sunday=0 or 7) OR sun,mon,tue,wed ...
|  |  |  |  |
*  *  *  *  * command-to-be-executed
```

Learning to time a cron job

```
*  *  *  *  * python create_model.py
```

Interpretation:

- Run every minute of every hour of every day of every month and of every day of the week.
- In short, run every minute

Further resources:

- Use https://crontab.guru/ to see more ways to schedule a cron job

Let's practice!

DATA PROCESSING IN SHELL

Course recap

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Data downloading on the command line

- How to download data files via `curl` and `wget`
- Documentations, manuals (e.g. `man curl` , `wget --help`)
- Multiple file downloads (e.g. `wget --limit-rate=200k -i url_list.txt`)

Data processing on the command line

- Introduction to command line data toolkit: `csvkit`
- Convert files to csv using `in2csv`
- Print preview using `csvlook` , `csvstat`
- Filter data using `csvcut` , `csvgrep`
- Append multiple data files using `csvstack`

Database manipulation on the command line

- Database manipulation using `sql2csv` , `csvsql`
- Advanced SQL-like ETL commands using `csvkit`

Building data pipelines on the command line

- Execute Python on the command line
- Python package management using `pip`
- Automate Python model and build pipelines with `cron`

Thank you! So long!

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