Python Basics

CME451 Tutorial

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Outline

Introduction

Why Python?

- Open source;
- Easy to learn and fast to write;
  - Syntax similar to MATLAB
  - Shorter code than C/C++
  - Almost like pseudocode
- Abundant supporting libraries for various applications.
  - e.g. the well-documented `scikit-learn` library.

Introduction

An example

```
1  # quick sort in Python
2  def quicksort(arr):
3      if len(arr) <= 1:
4          return arr
5      pivot = arr[int(len(arr) / 2)]
6      left = [x for x in arr if x < pivot]
7      middle = [x for x in arr if x == pivot]
8      right = [x for x in arr if x > pivot]
9      return quicksort(left) + middle + quicksort(right)
10
11 print(quicksort([3,6,8,10,1,2,1,11,111]))
12 # Prints "[1, 1, 2, 3, 6, 8, 10, 11, 111]"
```

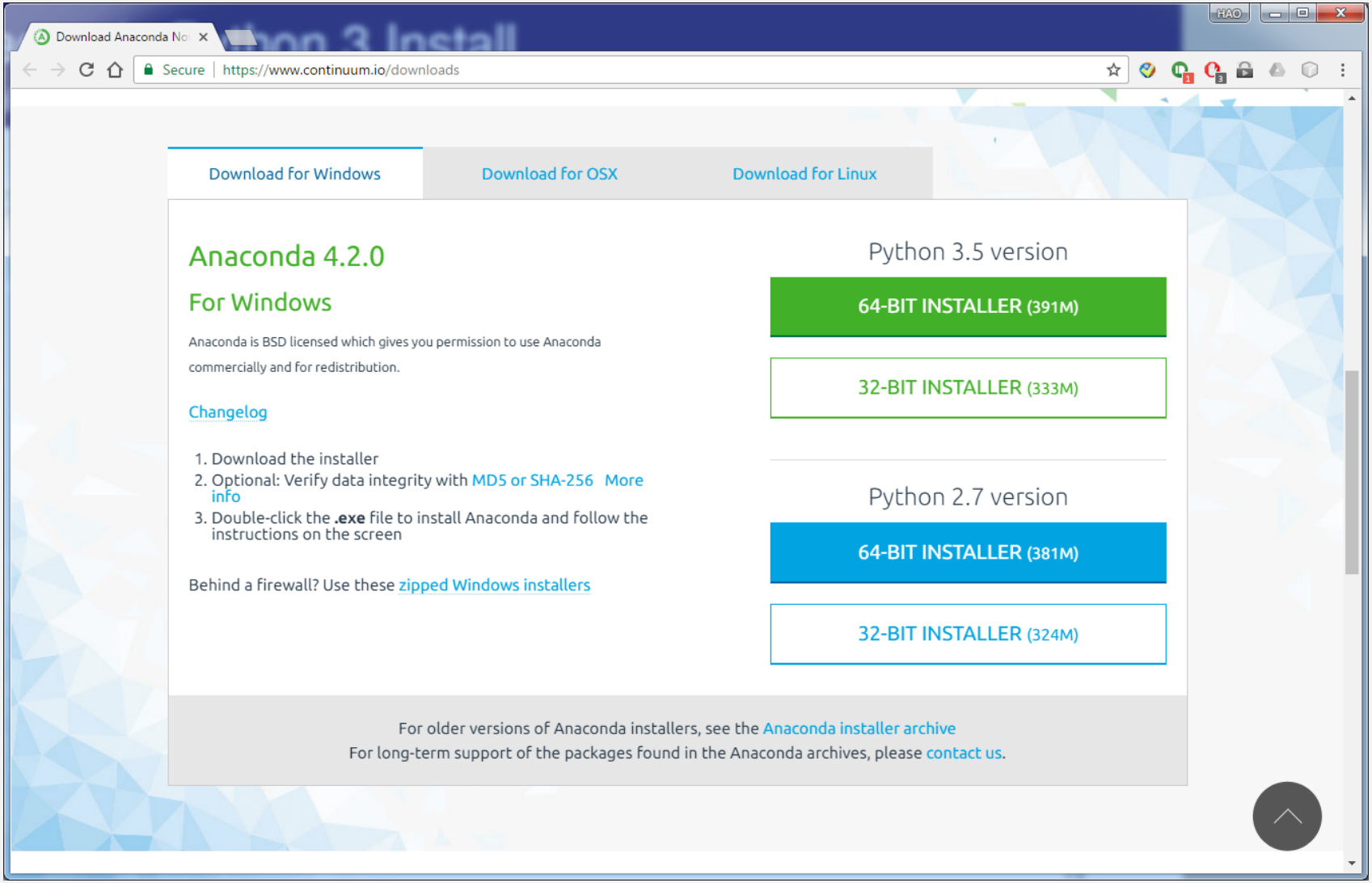
Python Installation

Python Distribution

- Official Python
  - `https://www.python.org/`
- **Anaconda Python**
  - `https://www.continuum.io/downloads`
- Enthought Canopy, miniconda, ...

Anaconda Python 3 Install

Download Installer

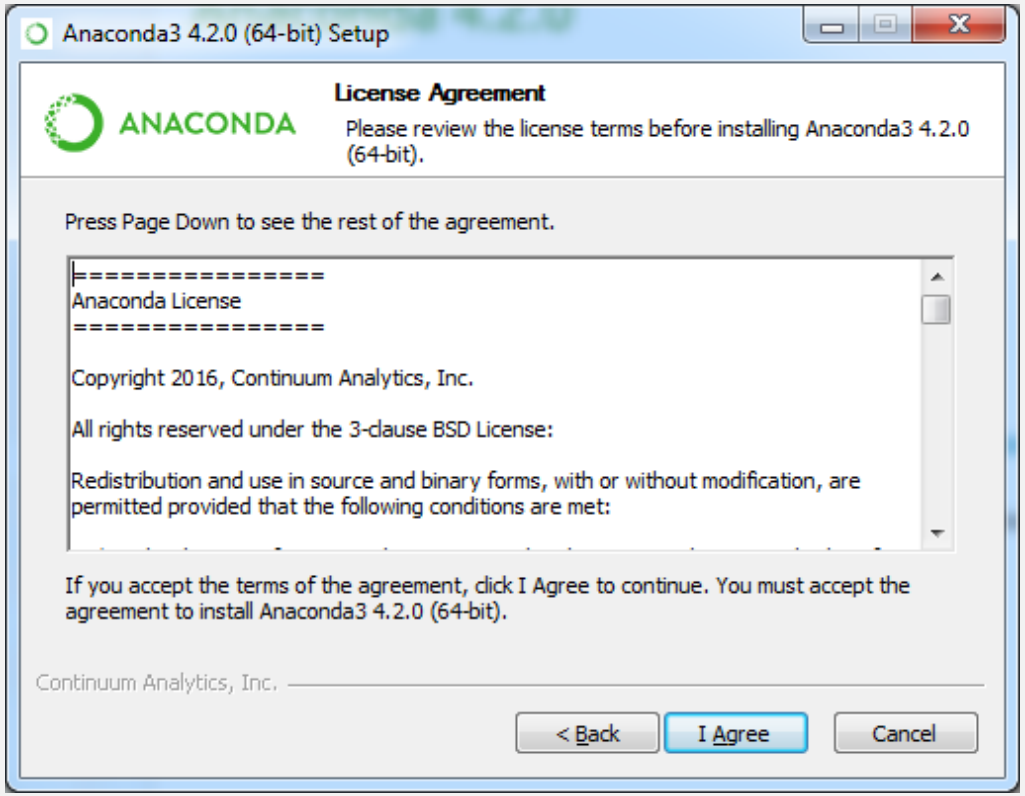


Anaconda Python 3 Install

Installation Process

Anaconda Python 3 Install

Installation Process



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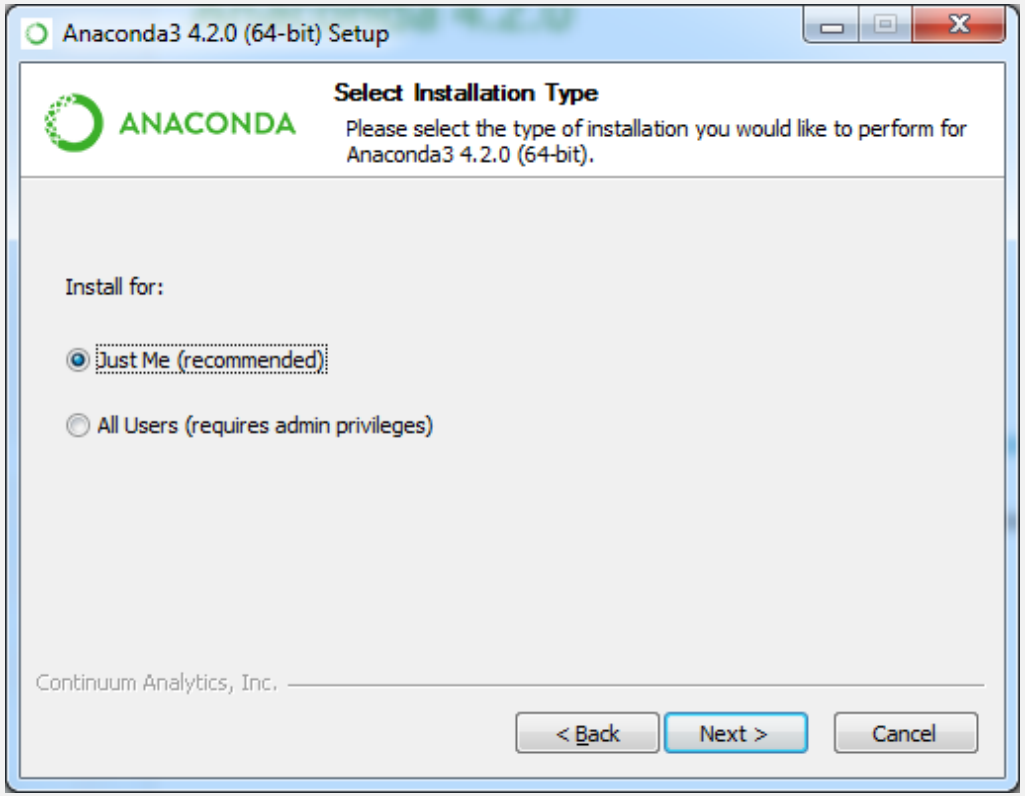
Installation Process



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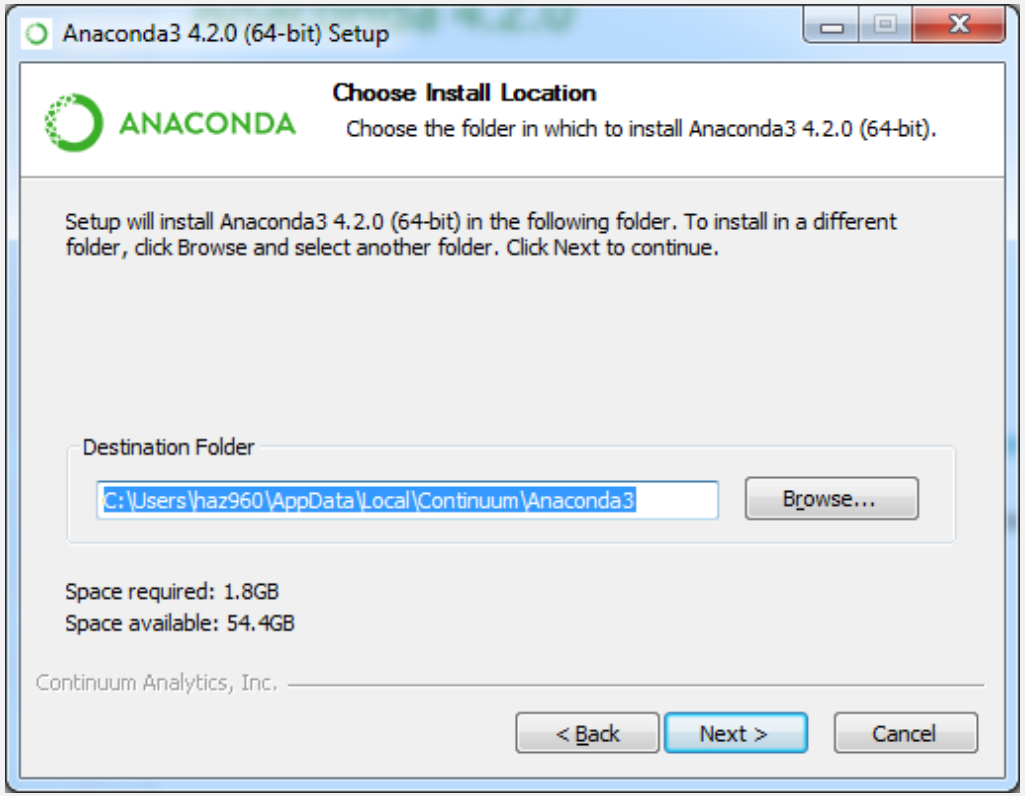
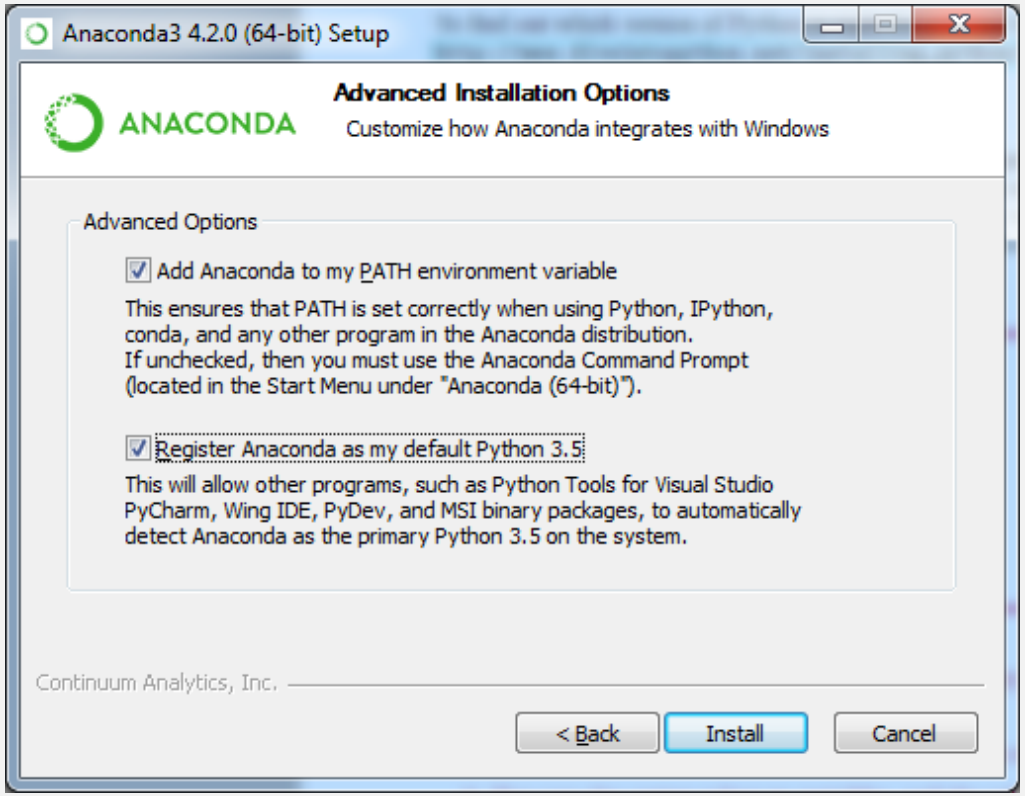
Installation Process



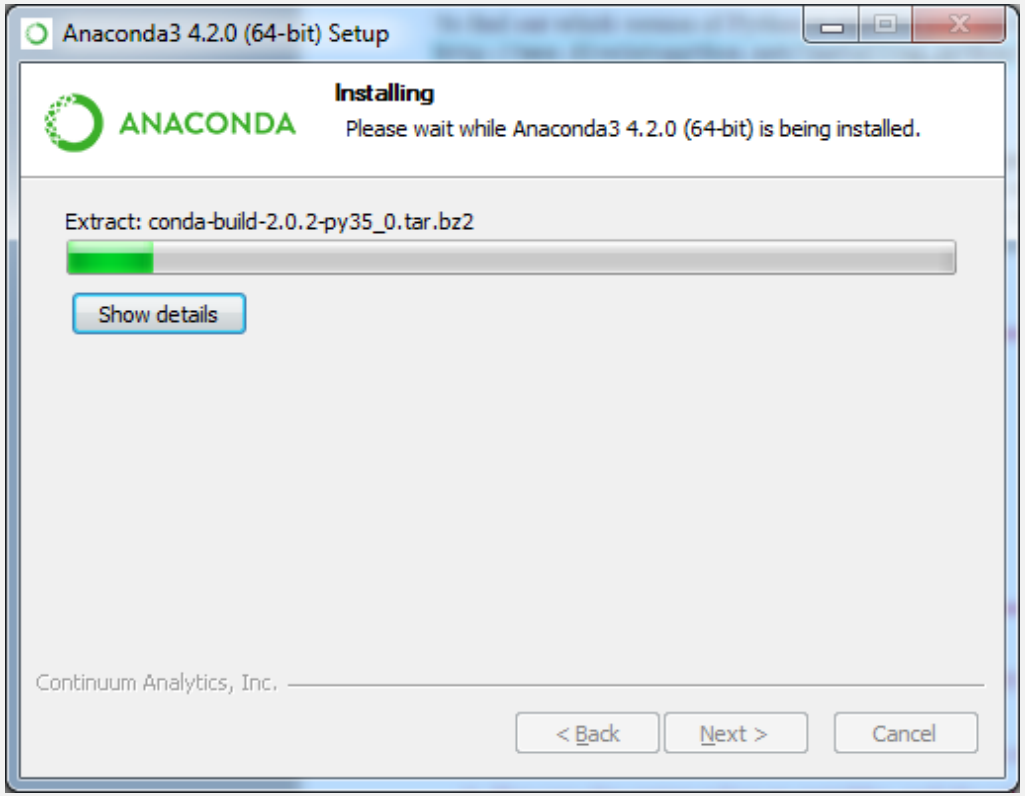
Anaconda Python 3 Install

Installation Process



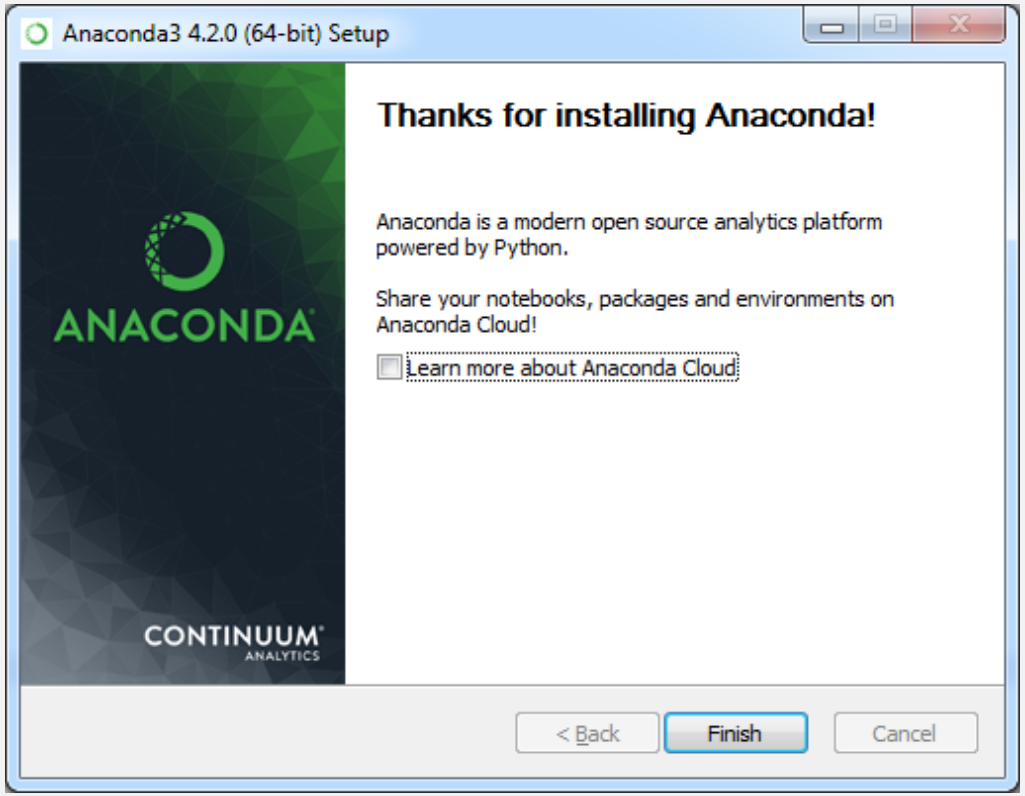
Anaconda Python 3 Install

Installation Process



Anaconda Python 3 Install

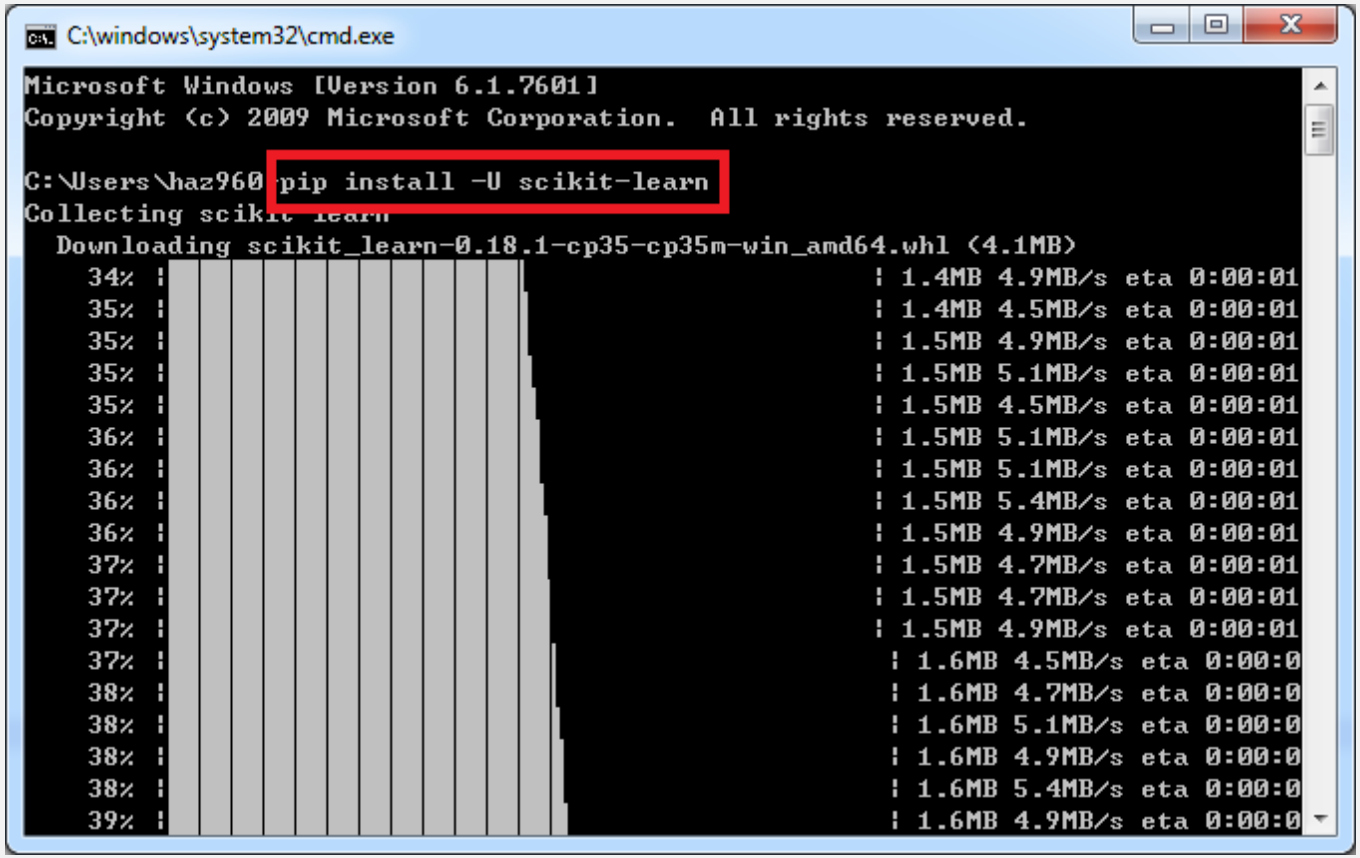
Installation Process



Anaconda Python 3 Library

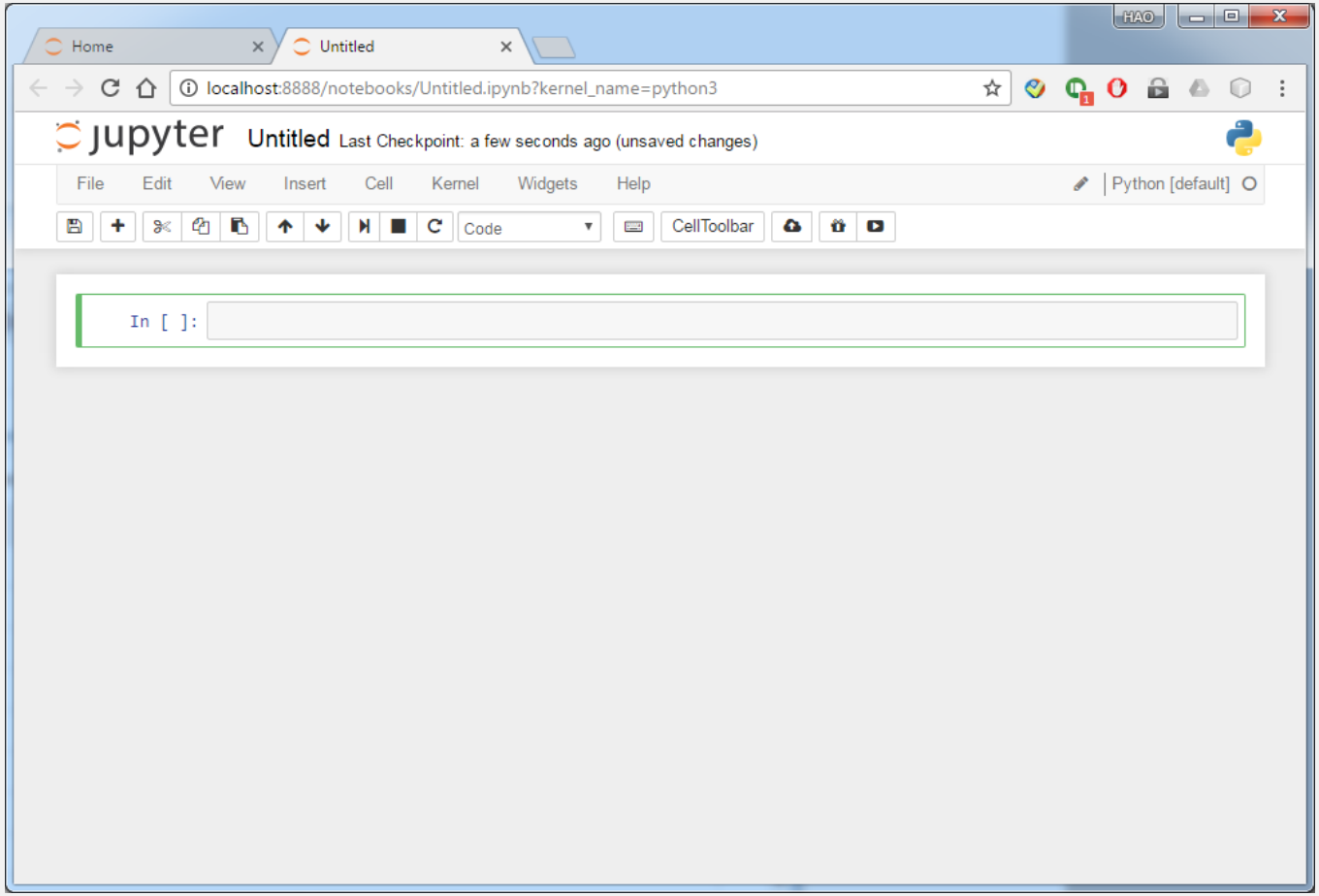
Scikit-Learn

- http://scikit-learn.org/stable/install.html



IPython Notebook

- Type `jupyter notebook` from the command line



Python Basic Syntax

```
'''
Python multiple lines comments

Python do not use ';' at the end of each line

Code blocks (function, loop, if) are defined by identation
'''

# single line comment
# using of non built-in libraries
import math
import numpy as np
```

Python Basic Syntax

Data Type

```
 1  # basic datatype:
 2  #     integer, float, boolean, string
 3  print(type(2))          # print <class 'int'>
 4  print(type(2.0))      # print <class 'float'>
 5  print(type('two'))    # print <class 'str'>
 6  print(type(True))     # print <class 'bool'>
 7  print(type(None))     # print <class 'NoneType'>
 8
 9  # datatype conversion
10  print(float(2))             # print 2.0
11  print(int(2.1))             # print 2
12  print(type(str(2.5)))     # print <class 'str'>
13  print(bool(0))             # print False
14  print(bool(2))             # print True
```

Python Basic Syntax

Math Operation

```
1  # basic math operations
2  x = 5
3  print(x + 1)    # add, print 6
4  print(x - 1)    # subtract, print 4
5  print(x * 2)    # multiply, print 10
6  print(x ** 2)   # exponent, print 25
7  print(x % 2)    # modulo, print 1
8  print(x / 2)    # divide, print 2.5, will print 2 in python 2
9  print(x / 2.0)  # divide, print 2.5
10 # other advanced operation should
11 # import math
```

Python Basic Syntax

String Operation

```
1  # string operations
2  hello = 'hello'         # define strint with ''
3  world = "world"         # define string with " "
4  print(len(hello))       # string length, print 5
5  hw = hello + ' ' + world # concatenate two strings
6  print(hw)               # print hello world
7  print('%s %s %d' % (hello, world, 12)) # print with format
8
9  print(hello.capitalize()) # capitalize a string, print Hello
10 print(hello.upper())      # convert to upper case, print HELLO
11 print(hello.replace('l', '(ell)')) # replace l with (ell)
12                                    # print he(ell)(ell)o
13 print('  world  '.strip()) # strip the leading and trailing whitespace
14                           # print world
15 print(hw.find('hello'))    # return index of first occurence, print 0
16 print(hw[1:6])             # string slice, print 'ello '
17 print(hw.split(' '))       # split string by delimiter
18                           # print ['hello','world']
```

- https://docs.python.org/3.5/library/stdtypes.html#string-methods.

Python Basic Syntax

List Operation

```
1  # list operation
2  # list is equivalent to array, but resizeable
3  empty_list = []                 # create an empty list
4  simpsons = ['homer', 'marge', 'bart']   # create a list with three elements
5  print(simpsons[0])              # print element 0
6  print(len(simpsons))            # print list length
7  simpsons.append('lisa')         # append element to the end
8  simpsons.insert(0, 'maggie')    # insert element at index 0
9  simpsons.remove('bart')         # search for instance and remove it
10 del simpsons[0]                 # remove element 0
11 simpsons[0] = 'krusty'          # replace element 0
12 simpsons.sort(reverse=True, key=len)    # sort by length in descending order
```

Python Basic Syntax

Function

```
 1  def sign_of_num(x):
 2      if x > 0:
 3          return 'positive'
 4      elif x < 0:
 5          return 'negative'
 6      else:
 7          return 'zero'
 8
 9  for x in [-1, 0, 1]:
10      print(sign_of_num(x))
11
12  # Prints "negative", "zero", "positive"
```