

Advanced Topics

May 30, 2017

Poll Results



Poll Results



1) Basic ML Tools (64%)

Poll Results



- 1) Basic ML Tools (64%)
- 2) Building a Web App (43%)

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- 1) Basic ML Tools (64%)
- 2) Building a Web App (43%)
- 3) Idiomatic Python (36%)

Machine Learning and Data Science

Well...

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TL;DR: this section won't teach you data science or ML

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We'll do some ML examples, and then see some resources

TL;DR: this section won't teach you data science or ML

... but it can show you some examples in Python

It Probably Exists

TL;DR:

Before You *Really* Do Data Science / ML

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Read official tutorials and documentation!

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[NumPy Quickstart](#) (35 pages)

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Get familiar with [jupyter](#) (iPython notebooks and science)

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[NumPy Quickstart](#) (35 pages)

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Get familiar with [jupyter](#) (iPython notebooks and science)

Read problem-/domain-specific documentation too!

Example: Digit Classification

Credit

MNIST in TensorFlow for Beginners

Example: Exploring NLTK

Credit and Credit

Where to Find Interesting Datasets

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Kaggle – hundreds of publicly-accessible datasets for DS

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or... build your own! – log files, APIs, web scraping

Web Applications

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Connect your program to the outside world

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Easy to deploy Django/Flask on Heroku/AWS

Django-on-Heroku or Flask-on-Heroku

Alternatively, use ngrok to expose local ports to the web

Example: Flask Microblog

Credit - Mega-Tutorial through Part IV

Time-Out for Announcements

Final Projects

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Due Friday, June 2nd @ midnight

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At most one late day

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Submit code and writeup on AFS (myth)

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Classwide poll to choose presenters

Next Tuesday



Next Tuesday



Project Presentations

Next Tuesday



Project Presentations

EOQ Activities

Next Tuesday



Project Presentations

EOQ Activities

Last Class :(

Back to Python!

Honorable Mentions

"In-Depth Machine Learning Tools"

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1) Learn Python

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Take CS229 or CS221! Or just read the course notes =)

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numpy / scipy / matplotlib / scikit-learn

tensorflow / keras for machine intelligence

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`numpy / scipy / matplotlib / scikit-learn`

`tensorflow / keras` for machine intelligence

Check out CME 193 and CS 20SI at Stanford!

"Surprising Random Facts about Python"

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As with CS41, the official docs are full of inside jokes

Idiomatic Python

21 Common Python Style Tricks



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We're not talking about PEP8 here...

... though you should still be PEP8-compliant

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All about using Python's tools to simplify programming

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We're not talking about PEP8 here...

... though you should still be PEP8-compliant

All about using Python's tools to simplify programming

But... practicality beats purity

"A foolish consistency is the hobgoblin of little minds."

Practicality shouldn't beat purity to a pulp!

An Example

Bad Python

Good Python

1

Swap Two Variables

```
temp = a
```

```
a = b
```

```
b = temp
```

```
a, b = b, a
```

2

Loop Unpacking

```
for bundle in zip([1,2,3], 'abc'):  
    num, let = bundle  
    print(let * num)
```

```
for key in d:  
    val = d[key]  
    print('{}: {}'.format(key,  
                           val))
```

```
for num, let in  
zip([1,2,3], 'abc'):  
    print(let * num)
```

```
for key, val in d.items():  
    print('{}->{}'.format(key,  
                           val))
```

3

Enumerate Iterables

```
for index in range(len(arr)):
    elem = arr[index]
    print(elem)
```

```
for index in range(len(arr)):
    elem = array[index]
    print(index, elem)
```

```
for elem in arr:
    print(elem)
```

```
for index, elem in enumerate(arr):
    print(index, elem)
```

4

Joining Strings

```
s = ''  
for color in colors:  
    s += color
```

```
s = ''  
for color in colors:  
    s += color + ', '  
s = s[:-2]
```

```
s = ''.join(colors)
```

```
s = ','.join(colors)
```


5

Reduce In-Memory Buffering

```
' , '.join([color.upper()
             for color in colors])

map(lambda x: int(x) ** 2,
     [line.strip() for line in
file])

sum([n ** 2 for n in range(1000)])
```

```
' , '.join(color.upper()
            for color in colors)

map(lambda x: int(x) ** 2,
     (line.strip() for line in
file))

sum(n ** 2 for n in range(1000))
```

6

Chained Comparison Tests

```
return 0 < x and x < 10
```

```
return 0 < x < 10
```

Use **in** Where Possible

```
if d.has_key(key):  
    print("Here!")
```

```
if x == 1 or x == 2 or x == 3:  
    return True
```

```
if 'hello'.find('lo') != -1:  
    print("Found")
```

```
if key in d:  
    print("Here!")
```

```
if x in [1, 2, 3]:  
    return True
```

```
if 'lo' in 'hello':  
    print("Found")
```

Boolean Tests

```
if x == True:
    print("Yes")

if len(items) > 0:
    print("Nonempty")

if items != []:
    print("Nonempty")

if x != None:
    print("Something")
```

```
if x:
    print("Yes")

if items:
    print("Nonempty")

if items:
    print("Nonempty")

if x is not None:
    print("Something")
```

9

Use _ for ignored variables

```
for i in range(10):  
    x = input("> ")  
    print(x[::-1])
```

```
for _ in range(10):  
    x = input("> ")  
    print(x[::-1])
```

Loop Techniques

```
for i in range(len(colors)):
    color = colors[i]
    name = names[i]
    print(color, name)

for ind in range(len(elems) - 1,
                 -1, -1):
    print(elems[ind])
```

```
for color, name in zip(colors,
                       names):
    print(color, name)

for elem in reversed(elems):
    print(elem)
```

11

Initialize List with Minimum Capacity

```
nones = [None, None, None, None]
```

```
two_dim = [[None] * 4] * 5
```

```
nones = [None] * 4
```

```
two_dim = [[None] * 4  
            for _ in range(5)]
```

Mutable Default Parameters

```
def foo(n, x=[]):  
    x.append(n)  
    print(x)
```

```
foo(1, [4]) # => [4, 1]
```

```
foo(3) # => [3]
```

```
foo(3) # => [3, 3]
```

```
foo(3) # => [3, 3, 3]
```

```
def foo(n, x=None):  
    if x is None:  
        x = []  
    x.append(n)  
    print(x)
```

```
foo(1, [4]) # => [4, 1]
```

```
foo(3) # => [3]
```

```
foo(3) # => [3, 3]
```

```
foo(3) # => [3, 3, 3]
```


13

Format Strings (for now)

```
print("Hi %s, you have %i texts"  
      % ("Sam", 6))
```

```
print("Hi %(name)s, you have  
      %(num)i texts"  
      % {'name': 'Sam', 'num': 6})
```

```
print("Hi {}, you have {} texts"  
      .format("Sam", 6))
```

```
print("Hi {name}, you have {num}  
texts".format(name="Sam", num=6))
```

Comprehensions

```
out = []  
for word in lex:  
    if word.endswith('py'):  
        out.append(word[:-2])
```

```
lengths = set()  
for word in lex:  
    lengths.add(len(word))
```

```
out = [word[:-2] for word in lex  
       if word.endswith('py')]
```

```
lengths = {len(word) for word in  
lex}
```

15

Use `collections` and `itertools`

```
d = {}  
for word in lex:  
    if len(word) not in d:  
        d[len(word)] = []  
    d[len(word)].append(word)
```

```
d = collections.defaultdict(list)  
for word in lex:  
    d[len(word)].append(word)
```

Use Context Managers

```
f = open('path/to/file')
raw = f.read()
print(1/0)
f.close()
```

```
lock = threading.Lock()
lock.acquire()
try:
    print(1/0)
finally:
    lock.release()
```

```
with open('path/to/file') as f:
    raw = f.read()
    print(1/0)
```

```
with threading.Lock():
    print(1/0)
```

EAFP > LBYL

```
def safe_div(m, n):  
    if n == 0:  
        print("Can't divide by 0")  
        return None  
    return m / n
```

```
def safe_div(m, n):  
    try:  
        return m / n  
    except ZeroDivisionError:  
        print("Can't divide by 0")  
        return None
```

Avoid using Catch-Alls

```
while True:
    try:
        n = int(input("> "))
    except:
        print("Invalid input.")
    else:
        return n ** 2
```

```
while True:
    try:
        n = int(input("> "))
    except ValueError:
        print("Invalid input.")
    else:
        return n ** 2
```


Magic Methods for Custom Classes

```
class Vector():  
    def __init__(self, elems):  
        self.elems = elems  
  
    def size(self):  
        return len(self.elems)
```

```
v = Vector([1,2])  
len(v) # => fails
```

```
class Vector():  
    def __init__(self, elems):  
        self.elems = elems  
  
    def __len__(self):  
        return len(self.elems)
```

```
v = Vector([1,2])  
len(v) # => succeeds
```


Using `__name__` for scripts

```
def stall():  
    time.sleep(10)
```

```
stall()
```

```
def stall():  
    time.sleep(10)
```

```
if __name__ == '__main__':  
    stall()
```

Specific Advice

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- Use keyword arguments for optional, tunable parameters
- Utilize functional programming concepts to simplify code
- Employ decorators to factor out administrative logic
- Simplify resource management with context managers

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One line of code shouldn't be more than one English line

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"We are all responsible users"

Zen of Python


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>>> import this
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The Zen of Python, by Tim Peters

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Complex is better than complicated.

Flat is better than nested.

Sparse is better than dense.

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Explicit is better than implicit.

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Flat is better than nested.

Sparse is better than dense.

Readability counts.


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Namespaces are one honking great idea — let's do more of those!

Programmers are more
important than programs

Closing Remarks

