NLP with Pytorch Tutorial 0

Python Basics

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About this tutorial

- 11 parts (ideally)
  - Book
  - Additional Material (if necessary)
- Each time:
  - During the tutorial: learn something new (チュートリアルで：新しい内容)
  - At home: Do a programming exercise (宿題：プログラミング演習)
- Working in pair is encouraged (ペアで話し合いをする)

- If English is difficult for you, you don’t need to attend
  - However, I encourage to do the exercises at home if you have time

Plan for Today

- Python Basics

Slides and examples borrowed/adapted from:

Kevin Duh: http://cs.jhu.edu/~kevinduh/index.html

Graham Neubig: http://www.phontron.com/index.php?lang=en

(Both are great NLP researchers and I recommend everybody to read their papers)

So let’s start!

What is NLP?

Natural Language Processing (NLP) studies how computers can **interpret** and **manipulate** text

From: https://github.com/kevinduh/nlp-course/blob/master/assets/lectures/01-Intro.pdf

Intro

- For writing programs for NLP, people often use **Python**

What is python?

- general-purpose, high-level scripting language
- Used in a variety of purposes: e.g. networking, web applications
- Most popular in the scientific community

Pros vs Cons

- Pros
  - Easy to understand (similar to English)
  - Works across systems (Windows, Mac, Linux)
  - Object Oriented
  - Great standard and additional libraries
- Cons
  - Python can be slow

Setting up your python environment

- If you are on Linux or Mac

  Open the “terminal”

- If you are on Windows

  Install cygwin

- Or use “ssh” to login to the one of the Linux servers

Install Software (if necessary)

1) Python: the programming language

   Recommended: https://www.anaconda.com/distribution/#download-section

2) A text editor (vim, emacs, etc.)
3) IDE: PyCharm, Sublime, VS Code

Download the Tutorial Files from Github

- Use the git “clone” command

```
$ git clone https://github.com/lis-kp/tutorial
```

1) Python on terminal

Go to terminal:

Type **python**

Type **print(“hello!”)**

Type **2 + 2**

2) Using Vim

Open vim:

```
$ vi test.txt
```

Press **“i”** to start input

Write **“test”**

Press **“esc”**

Type **“:wq”** to save and quit (“:w” is save; “:q” is quit)

3) Using an IDE

- To write longer programs, people often use IDEs

  Pycharm, Sublime, VSCode

- IDEs include features like as code completion and syntax checking

- If you choose to just use a text editor, you can run your program from terminal by using the command:

  python <filename.py>

Hello World!

1) Open hello.py in an editor (e.g. vim)
2) Type the following program

   print(“Hello World!”)

3) Run the program

```
lis@fermat:~$ python  hello.py
Hello World!
```

Main data types used

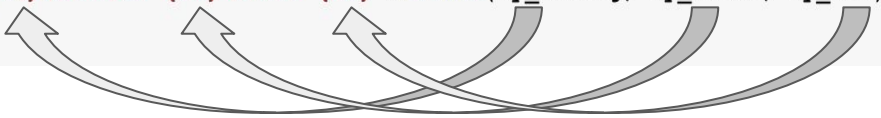
Strings: “hello”, “goodbye”

Integers: -1,0,1,3

Floats: -4.2, 0.0, 3.14

```
my_int = 4
my_float = 2.5
my_string = "hello"

print('string: {:s}\tfloat: {:f}\tint: {:d}'.format(my_string, my_float, my_int))
```



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```

```
string: hello   float: 2.500000 int: 4
```

Loop (for) and Control Flow (if/else)

If this condition if true

Then do this

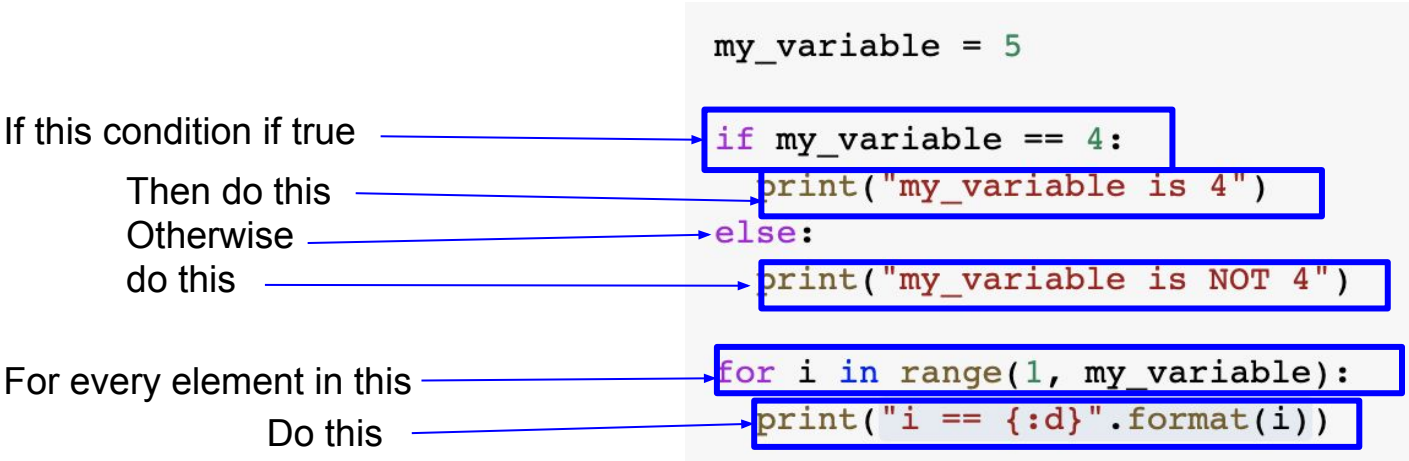
Otherwise
do this

```
my_variable = 5

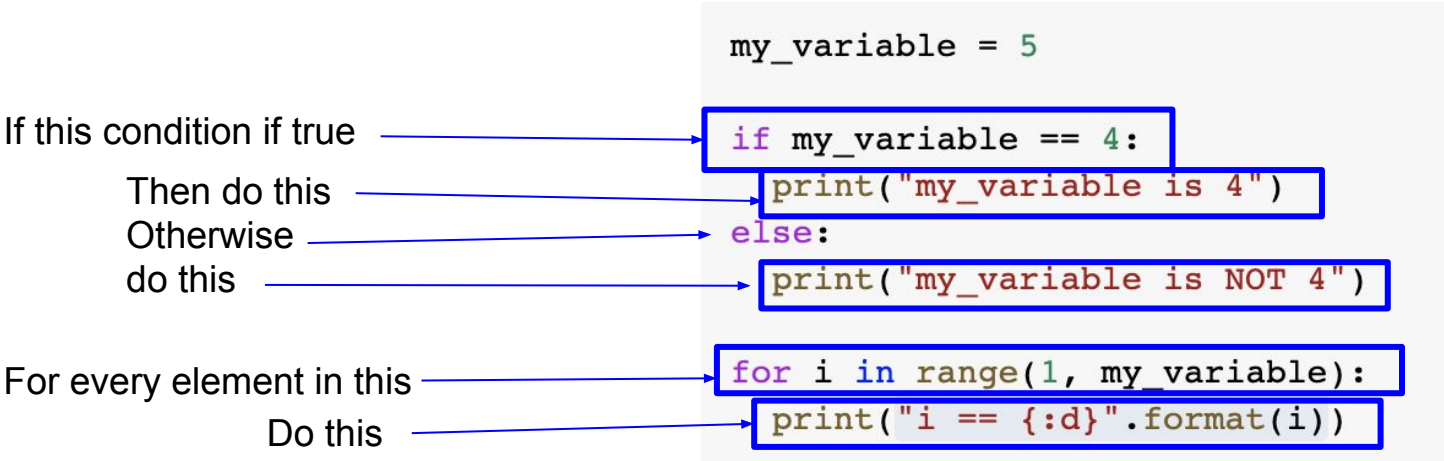
if my_variable == 4:
  print("my_variable is 4")
else:
  print("my_variable is NOT 4")

for i in range(1, my_variable):
  print("i == {:d}".format(i))
```

Loop (for) and Control Flow (if/else)



Loop (for) and Control Flow (if/else)




```
my_variable is NOT 4
i == 1
i == 2
i == 3
i == 4
```

Loop (for) and Control Flow (if/else)

If this condition if true

Then do this

Otherwise
do this

For every element in this

Do this

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my_variable = 5

if my_variable == 4:
    print("my_variable is 4")
else:
    print("my_variable is NOT 4")

for i in range(1, my_variable):
    print("i == {:d}".format(i))
```

Be careful!
Range (1,5) == (1,2,3,4)

```
my_variable is NOT 4
i == 1
i == 2
i == 3
i == 4
```

Arrays (or “lists” in Python)

```
my_list = [1,2,4,8,16]

my_list.append(32)

print(len(my_list))

print(my_list[3])
print("")

for value in my_list:
  print(value)
```

Make a list with 5 elements

Add one or more elements to the end of the list

Print the length of the list

Print the 4th element

Loop through and print every element of the list

Arrays (or “lists” in Python)

Index is an integer, starting at 0

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Print the length of the list

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Loop through and print every element of the list

Index	Value
0	1
1	2
2	4
3	8
4	16

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Make a list with 5 elements

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Print the length of the list

Print the 4th element

Loop through and print every element of the list

Index	Value
0	1
1	2
2	4
3	8
4	16

```
6
8

1
2
4
8
16
32
```

Sorting Lists

```
random_list = [3,12,5,6]
sorted_list = sorted(random_list)

print(sorted_list)
```

sorted function lets you sort a list

Sorting Lists

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print(sorted_list)
```

sorted function lets you sort a list

```
[3, 5, 6, 12]
```

Maps (or “dictionaries” in Python)

```
my_dict = {"olivia": 22, "maria": 30, "sophia": 18, "emily": 45}

my_dict["rachel"] = 15

print(len(my_dict))
print(my_dict["emily"])
print("")

if "elizabeth" in my_dict:
  print("elizabeth exists in my_dict")

print("my_dict sorted by key")
for key, value in sorted(my_dict.items()):
  print('{:s} --> {:d}'.format(key, value))

print("")
print("my_dict sorted by value")
for key, value in sorted(my_dict.items(), key=lambda x:x[1]):
  print('{:s} --> {:d}'.format(key, value))
```

Add a new entry

Print size

Print one entry

Check if a key exists

Print key/value pairs by key order

Print key/value pairs by value order

Key	Value
olivia	22
maria	30
sophia	18
emily	45

Maps (or “dictionaries” in Python)

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my_dict["rachel"] = 15

print(len(my_dict))
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for key, value in sorted(my_dict.items()):
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print("")
print("my_dict sorted by value")
for key, value in sorted(my_dict.items(), key=lambda x:x[1]):
  print('{:s} --> {:d}'.format(key, value))
```

```
5
45

my_dict sorted by key
emily --> 45
maria --> 30
olivia --> 22
rachel --> 15
sophia --> 18

my_dict sorted by value
rachel --> 15
sophia --> 18
olivia --> 22
maria --> 30
emily --> 45
```

More on lists and dictionaries

```
my_list = [1,2,"3","four", "four"]
my_set = set(my_list)
my_dict = {"olivia": 22, "maria": 30, "sophia": 18, "emily": 45}

print(my_list)
print(my_set)

print("")

for key, value in sorted(my_dict.items()):
  print('{:s} --> {:d}'.format(key, value))
```

Lists and dictionaries do not have a fixed type: can contain anything

sets will remove duplicates: only one copy of “four”

```
[1, 2, '3', 'four', 'four']
{'3', 1, 2, 'four'}

emily --> 45
maria --> 30
olivia --> 22
sophia --> 18
```

Splitting and joining strings

In NLP: often split sentences into words

```
sentence = "this is a book"
words = sentence.split(" ")

for word in words:
  print(word)

print("")
print(" ||| ".join(words))
```

Split string at white space into an array of words

Combine the array into a single string, separating with " ||| "

Splitting and joining strings

In NLP: often split sentences into words

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sentence = "this is a book"
words = sentence.split(" ")

for word in words:
  print(word)

print("")
print(" ||| ".join(words))
```

Split string at whitespace into an array of words

Combine the array into a single string, separating with " ||| "

```
this
is
a
book

this ||| is ||| a ||| book
```

More string functions

```
my_string1 = "book"

print(my_string.upper())

my_string2 = "JAPAN"

print(my_string.lower())

print("")

if my_string1.startswith("b"):
  print("my_string1 starts with \"b\"")
else:
  print("my_string1 does NOT starts with \"b\"")

if my_string2.endswith("S"):
  print("my_string2 ends with \"S\"")
else:
  print("my_string2 does NOT end with \"S\"")

print("")
mystring3 =  "  desk   "
print(mystring3.strip())
```

Convert string to uppercase

Convert string to lowercase

Checks if string starts with “b”

Checks if string ends with “S”

Delete the whitespaces

More string functions

```
my_string1 = "book"

print(my_string.upper())

my_string2 = "JAPAN"

print(my_string.lower())

print("")

if my_string1.startswith("b"):
  print("my_string1 starts with \"b\"")
else:
  print("my_string1 does NOT starts with \"b\"")

if my_string2.endswith("S"):
  print("my_string2 ends with \"S\"")
else:
  print("my_string2 does NOT end with \"S\"")

print("")
mystring3 =  "  desk   "
print(mystring3.strip())
```

```
HELLO
hello

my_string1 starts with "b"
my_string2 does NOT end with "S"

desk
```

Functions

Functions take an **input**, **transform** the input, and **return** and output

```
def mult_and_abs(x, y):
  z = x * y

  if z >= 0:
    return z
  else:
    return z * -1

print(mult_and_abs(-3, 2))
```

```
6
```

function mult_and_abs takes “x” and “y” as input

Multiplies x and y together and return the absolute value

Call mult_and_abs with x=-3 and y=2

Using command line arguments/ Reading files

```
import sys
my_file= open(sys.argv[1])

for line in my_file:

    line = line.strip()

    if len(line) != 0:
        print(line)
```

First argument

Read the file one line at a time

Delete the symbol “\n”

If the line is not empty, print

```
$ python 10_readfile.py test.txt
```

Testing your code

Write code to test each function

Test several cases

```
def test_mult_and_abs():
  assert(mult_and_abs(-3,2) == 6), "Error"
  return "Test passed!"

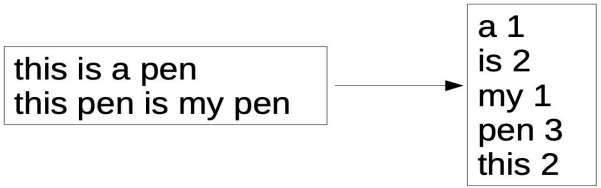
print(test_mult_and_abs())
```

```
Test passed!
```

Practice Exercise

Practice Exercise

Make a program that counts the frequency of words in a file



Test it on test/00-input.txt, test/00-answer.txt

Run the program on the file data/wiki-en-train.word

Report:

- The number of unique words
- The frequency of each word

Pseudo-code

create a dictionary *counts* create a map to hold counts

open a file

for each *line* **in** the file
    split *line* **into** *words*

    for *w* **in** *words*
        if *w* exists in *counts*, **add** 1 to *counts*[*w*]
        else set *counts*[*w*] = 1

print key, value of *counts*

For next week:

Try to practice the examples

Try to solve the exercise

To learn more:

Python documentation: https://www.python.org/doc/