INFO 6105 Data Science Eng Methods and Tools, Lecture 3 Day 1
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Homework

How to use Python Libraries

To install python libraries, you open your anaconda terminal (on Windows), and type:

```
conda install <the library>
```

or

```
pip install <the library>
```

In image processing, `Pillow` (or `pil`) is a very popular library. You'll do your homework for next week, with it. And at the same time, you'll train to become a Hollywood producer!

Building a comic book with python

I'll give you the main code blocks for your homework in this notebook, as well as some of the pictures. You'll have to make the code blocks work together to write a comic book in PDF format that consists of three pages of about 20 images each, with text.

The story needs to be a good story because you'll be graded on artistic merit, too!

Then I'll award Oscars to the best stories. The categories will be:

- best adapted screenplay
- best art direction
- best cinematography
- best Code
- best Code.zip
- best director
- best documentary
- best female
- best film editing
- best male
- best original screen play
- best picture
- best visual effects

中国学生将用中文写故事

भारतीय छात्र कहानी को भारतीय में लिखेंगे

All submissions need to be accompanied by the same story in english. In other words, your submission will consist to *two* pdf files, one with dialogue in *your* language, and one with dialogu3 in english. The pictures need to be the same.

Best भारतीय, 中国 comic books will be presented over zoom.

It is ***recommended*** to pick one of the themes in the accompanying zip file (`miyazaki` , `monkey king` , `jungle book` , or `avengers`). You may complete them with additional images in the same theme that you download on your own. If you think of a better theme, you *may change the theme*.

You need to write your own text. The comic book ***needs to be*** in pdf format (not an image).

No teamwork on this homework. Individual submissions per student.

You're going to use an amazing python library for image processing called pillow, `PIL` in short.

Here are the python code blocks:

Displaying images

```
In [1]:  from IPython.display import Image
         Image(filename='toons/miyazaki/spirited away/chihiro_parents.png', width=400)
```

Out[1]:

```
In [2]:  Image(filename='toons/monkey-king/Monkey_King.png', width=400)
```

Out[2]:

```
In [3]:  Image(filename='toons/jungle-book/_104680082_junglebook.jpg', width=400)
```

Out[3]:

```
In [4]:  Image(filename='toons/avengers/dims.jpg', width=400)
```

Out[4]:

Adding a border

We add a border to the image with the `PIL` library:

```
pip install pillow
```

In [5]:

```
from PIL import Image as pili, ImageOps as piliops

piliops.expand(pili.open('toons/avengers/dims.jpg'), border=(100,100),fill='white').save('toons/avengers/dim
```

In [6]:

```
Image(filename='toons/avengers/dims2.jpg', width=400)
```

Out[6]:

You can't see the border, but it's there, and you'll need it to create cartoon strips!

Text overlays

This is mutli-line text with an opaque background:

In [7]:

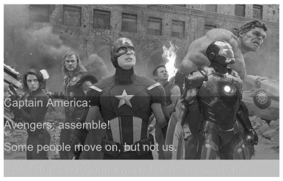
```
from PIL import Image as pili, ImageDraw as pild, ImageFont as pilf

caption = """Captain America:

Avengers: assemble!

Some people move on, but not us.

Cos if that's not gonna work, I don't know what is"""

TINT_COLOR = (0, 0, 0)  # Black
TRANSPARENCY = .25  # Degree of transparency, 0-100%
OPACITY = int(255 * TRANSPARENCY)

from PIL import Image, ImageFont, ImageDraw

img = pili.open('toons/avengers/dims2.jpg').convert('RGBA')

overlay = pili.new('RGBA', img.size, TINT_COLOR+(0,))
draw = pild.Draw(overlay)
font = pilf.truetype("arial.ttf", 66)
#x, y = (img.width - 510, img.height-100)
text = caption
w, h = font.getsize(text)
num_lines = len(text.split('\n'))
print(num_lines, w, h)
x, y = 100, img.height - (num_lines-0.1*num_lines)*h
#draw.rectangle((x, y, x + w, y + h), fill='black')
#draw.rectangle((x, y, x + w, y + 4*h), fill=TINT_COLOR+(OPACITY,))
draw.rectangle((x, y, x + img.width - 200, y + (num_lines-0.1*num_lines)*h), fill=TINT_COLOR+(OPACITY,))
draw.text((x, y), text, fill=(209, 239, 8), font=font)

# Alpha composite these two images together to obtain the desired result.
img = pili.alpha_composite(img, overlay)
img = img.convert("RGB") # Remove alpha for saving in jpg format.

img.save('toons/avengers/dims3.jpg')
```

```
7 3858 74
```

In [8]:

```
from IPython.display import Image
Image(filename='toons/avengers/dims3.jpg', width=400)
```

Out[8]:



Reading dialog file with pandas

Here, we use the `pandas` library to read a dialog script from a csv file, just like in Hollywood!

In [9]:

```
import pandas as pd
data = pd.read_csv('toons/avengers/dialog.csv')
data.head(10)
```

Out[9]:

	dialogs
0	Captain America:\n\nAvengers: assemble!\n\nSom...
1	Captain America:\n\nAvengers: assemble!\n\nSom...
2	Captain America:\n\nAvengers: assemble!\n\nSom...
3	Captain America:\n\nAvengers: assemble!\n\nSom...

In [10]:

```
import numpy as np
data.values[2][0]
```

Out[10]:

```
"Captain America:\n\nAvengers: assemble!\n\nSome people move on, but not us.\n\nCos if that's not gonna wor
k, I don't know what is"
```

Unicode fonts

You either have to look for preinstalled truetype fonts that support your language, or you have to download the fonts to support your language (e.g. google's noto (https://www.google.com/get/noto/) fonts). Otherwise, all you'll see as text on your image is just a bunch of tofu. No kidding, *tofu* is what these characters below are called:

Also, do not forget the `u` in front of the text!

Here for example for me:

In [11]:

```
from PIL import Image, ImageDraw, ImageFont, ImageFilter

#configuration
font_size=36
width=500
height=100
back_ground_color=(255,255,255)
font_size=36
font_color=(0,0,0)
unicode_text = u"जो भी तुमसे लग जाय लगा लेना!"

im  =  Image.new ( "RGB", (width,height), back_ground_color )
draw  =  ImageDraw.Draw ( im )
#unicode_font = ImageFont.truetype("DENGL.ttf", font_size)
unicode_font = ImageFont.truetype("c:/windows/fonts/nirmalas.ttf", font_size)
draw.text ( (10,10), unicode_text, font=unicode_font, fill=font_color )

im.save("toons/hindi.jpg")
```

In [12]:

```
from PIL import Image, ImageDraw, ImageFont, ImageFilter

#configuration
font_size=36
width=500
height=100
back_ground_color=(255,255,255)
font_size=36
font_color=(0,0,0)
unicode_text = u"白毛浮绿水，红掌拨清波"

im  =  Image.new ( "RGB", (width,height), back_ground_color )
draw  =  ImageDraw.Draw ( im )
#unicode_font = ImageFont.truetype("DENGL.ttf", font_size)
unicode_font = ImageFont.truetype("c:/windows/fonts/dengl.ttf", font_size)
draw.text ( (10,10), unicode_text, font=unicode_font, fill=font_color )

im.save("toons/zhongwen2.jpg")
```

In [67]:

```
from PIL import Image as pili, ImageDraw as pild, ImageFont as pilf

caption = u"""子曰：「學而時習之，不亦說乎？有朋自遠方來，

不亦樂乎？人不知而不慍，不亦君子乎？"""

TINT_COLOR = (0, 0, 0)  # Black
TRANSPARENCY = .25  # Degree of transparency, 0-100%
OPACITY = int(255 * TRANSPARENCY)

from PIL import Image, ImageFont, ImageDraw

img = pili.open('toons/avengers/dims2.jpg').convert('RGBA')

overlay = pili.new('RGBA', img.size, TINT_COLOR+(0,))
draw = pild.Draw(overlay)
font = pilf.truetype("c:/windows/fonts/dengl.ttf", 66)

#a=u"ひらがな - Hiragana, 히라가나"
#font=ImageFont.truetype("Arial Unicode.ttf", 66)

#x, y = (img.width - 510, img.height-100)
text = caption
w, h = font.getsize(text)
num_lines = len(text.split('\n'))
print(num_lines, w, h)
x, y = 100, img.height - (num_lines-0.1*num_lines)*h
#draw.rectangle((x, y, x + w, y + h), fill='black')
#draw.rectangle((x, y, x + w, y + 4*h), fill=TINT_COLOR+(OPACITY,))
draw.rectangle((x, y, x + img.width - 200, y + (num_lines-0.1*num_lines)*h), fill=TINT_COLOR+(OPACITY,))
draw.text((x, y), text, fill=(209, 239, 8), font=font)


# Alpha composite these two images together to obtain the desired result.
img = pili.alpha_composite(img, overlay)
img = img.convert("RGB") # Remove alpha for saving in jpg format.

img.save('toons/avengers/dims6.jpg')
```

```
3 2772 65
```

Horizontal strip

This is how to stitch images *horizontally*:

In [13]:

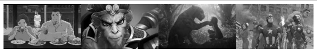
```
import numpy as np
import PIL

list_im = ['toons/miyazaki/spirited away/chihiro_parents.png',
           'toons/monkey-king/Monkey_King.png',
           'toons/jungle-book/_104680082_junglebook.jpg',
           'toons/avengers/dims.jpg']
imgs    = [ PIL.Image.open(i) for i in list_im ]

# pick the image which is the smallest, and resize the others to match it (can be arbitrary image shape here
min_shape = sorted( [(np.sum(i.size), i.size ) for i in imgs])[0][1]
imgs_comb = np.hstack( (np.asarray( i.resize(min_shape) ) for i in imgs ) )

# save that beautiful picture
imgs_comb = PIL.Image.fromarray( imgs_comb)
imgs_comb.save( 'toons/avengers/dims4.png' )
```

```
d:\Anaconda3.5.1\lib\site-packages\ipykernel_launcher.py:12: FutureWarning: arrays to stack must be passed
as a "sequence" type such as list or tuple. Support for non-sequence iterables such as generators is deprec
ated as of NumPy 1.16 and will raise an error in the future.
  if sys.path[0] == '':
```

In [14]:

```
from IPython.display import Image
Image(filename='toons/avengers/dims4.png', width=400)
```

Out[14]:



Don't forget to add the white border!

Vertical strip

This is how to stitch images *vertically*:

In [15]:

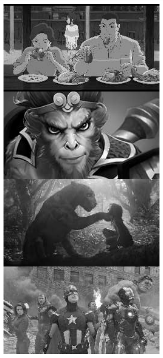
```
list_im = ['toons/miyazaki/spirited away/chihiro_parents.png',
           'toons/monkey-king/Monkey_King.png',
           'toons/jungle-book/_104680082_junglebook.jpg',
           'toons/avengers/dims.jpg']
imgs    = [ PIL.Image.open(i) for i in list_im ]

# pick the image which is the smallest, and resize the others to match it (can be arbitrary image shape here
min_shape = sorted( [(np.sum(i.size), i.size ) for i in imgs])[0][1]
imgs_comb = np.vstack( (np.asarray( i.resize(min_shape) ) for i in imgs ) )

# save that beautiful picture
imgs_comb = PIL.Image.fromarray( imgs_comb)
imgs_comb.save( 'toons/avengers/dims5.png' )
```

```
d:\Anaconda3.5.1\lib\site-packages\ipykernel_launcher.py:9: FutureWarning: arrays to stack must be passed a
s a "sequence" type such as list or tuple. Support for non-sequence iterables such as generators is depreca
ted as of NumPy 1.16 and will raise an error in the future.
  if __name__ == '__main__':
```

In [16]:

```
from IPython.display import Image
Image(filename='toons/avengers/dims5.png', width=200)
```

Out[16]:



Now, can you do the same thing with a white border between the images?

From images to pdfs

This is how to create a pdf from image pages:

```
pip install fpdf
```

In [17]:

```
from PIL import Image
from fpdf import FPDF

#pdf = FPDF()
cover = Image.open('toons/jungle-book/_104680082_junglebook.jpg')
width, height = cover.size
pdf = FPDF(unit = "pt", format = [width, height])

# imagelist is the list with all image filenames
imagelist = ['toons/avengers/dims5.png',
             'toons/avengers/dims5.png',
             'toons/avengers/dims5.png',
             'toons/avengers/dims5.png']

for image in imagelist:
    pdf.add_page()
    pdf.image(image, 0, 0, width, height)
pdf.output("toons/avengers/avengers.pdf", "F")
print("done!")
```

```
done!
```

Page with random number of images per line (from 3 to 5)

Comic books look a lot neater with a different number of iages per line.

Careful... *this is **advanced** python-fu!*

In [189]:

```
list_im = [str(x) for x in range(100)]

while 0 < len(list_im):
    lines = 0
    print("new page!")
    num_cols = old_num_cols = 0
    while lines < 6 and 0 < len(list_im):
        lines += 1
        while num_cols == old_num_cols:
            num_cols = np.random.randint(3, 6)
        old_num_cols = num_cols
        window = list_im[:num_cols]
        print(window)
        list_im = list_im[num_cols:]
```

```
new page!
['0', '1', '2', '3']
['4', '5', '6']
['7', '8', '9', '10']
['11', '12', '13']
['14', '15', '16', '17', '18']
['19', '20', '21']
new page!
['22', '23', '24', '25']
['26', '27', '28']
['29', '30', '31', '32', '33']
['34', '35', '36', '37']
['38', '39', '40', '41', '42']
['43', '44', '45']
new page!
['46', '47', '48']
['49', '50', '51', '52', '53']
['54', '55', '56', '57']
['58', '59', '60']
['61', '62', '63', '64']
['65', '66', '67', '68', '69']
new page!
['70', '71', '72', '73']
['74', '75', '76']
['77', '78', '79', '80', '81']
['82', '83', '84']
['85', '86', '87', '88']
```

```
['89', '90', '91', '92', '93']
new page!
['94', '95', '96']
['97', '98', '99']
```

In [ ]:

```
from os import listdir
from os.path import isfile, join

mypath = 'toons/avengers/'
onlyfiles = [f for f in listdir(mypath) if isfile(join(mypath, f))]

lines = 0
print("new page!")
num_cols = old_num_cols = 0
while lines < 6 and 0 < len(onlyfiles):
    lines += 1
    while num_cols == old_num_cols:
        num_cols = np.random.randint(3, 6)
    old_num_cols = num_cols
    window = onlyfiles[:num_cols]
    print(window)
    onlyfiles = onlyfiles[num_cols:]
```

What does a good cartoon page look like? Here is one example I worked on:

We will celebrate our Oscars the week after next week (so the TAs and I can judge them): Best screenplay, best cinematography, best male/animal actor, best female/animal actor.

If you win an Oscar, you need to prepare a speech. You know, something along the lines of:

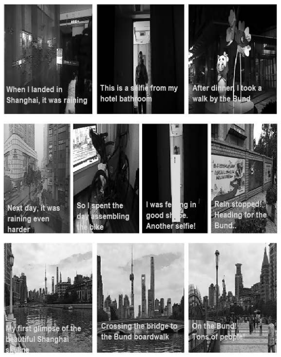
> **OSCAR SPEECH**: *I would like to thank my mum and my dad for having me, such a child prodigy, and I would like to thank god, too, for adding humility to my* *endless** list of qualities. Also, my girl/boy friend for putting up with me while I ork all weekend and nights too!, doing my python homework, etc, etc.

The fourth bi-annual INFO 6105 Oscars!

In [69]:

```
from IPython.display import Image
Image(filename='toons/bund-dino.png', width=400)
```

Out[69]:


When I landed in Shanghai, it was raining
This is a selfie from my hotel bathroom
After dinner, I took a walk by the Bund
Next day, it was raining even harder
So I spent the day assembling the bike
I was feeling in good shape. Another selfie!
Rain stopped! Heading for the Bund..
My first glimpse of the beautiful Shanghai skyline
Crossing the bridge to the Bund boardwalk
On the Bund! Tons of people!