File Handling in Python

File handling in python is simply `reading`, `writing`, and `managing` a file.

What exactly are we writing into file?

We can write anything we want. But whatever we write - is termed as `data`; the crucial thing for understanding and processing the resources.

Procedure to handle files

Credits - Image from Internet

Main functions / methods

```
open() # function
obj.close() # method
```

In [1]:

```
help(open)
```

```
Help on built-in function open in module io:

open(file, mode='r', buffering=-1, encoding=None, errors=None, newline=None, closefd=True, opener=None)
    Open file and return a stream.  Raise OSError upon failure.

    file is either a text or byte string giving the name (and the path
    if the file isn't in the current working directory) of the file to
    be opened or an integer file descriptor of the file to be
    wrapped. (If a file descriptor is given, it is closed when the
    returned I/O object is closed, unless closefd is set to False.)

    mode is an optional string that specifies the mode in which the file
    is opened. It defaults to 'r' which means open for reading in text
    mode.  Other common values are 'w' for writing (truncating the file if
    it already exists), 'x' for creating and writing to a new file, and
    'a' for appending (which on some Unix systems, means that all writes
    append to the end of the file regardless of the current seek position).
    In text mode, if encoding is not specified the encoding used is platform
    dependent: locale.getpreferredencoding(False) is called to get the
    current locale encoding. (For reading and writing raw bytes use binary
    mode and leave encoding unspecified.) The available modes are:

    ========= ===============================================================
    Character Meaning
    --------- ---------------------------------------------------------------
    'r'       open for reading (default)
    'w'       open for writing, truncating the file first
    'x'       create a new file and open it for writing
    'a'       open for writing, appending to the end of the file if it exists
    'b'       binary mode
    't'       text mode (default)
    '+'       open a disk file for updating (reading and writing)
    'U'       universal newline mode (deprecated)
    ========= ===============================================================

    The default mode is 'rt' (open for reading text). For binary random
    access, the mode 'w+b' opens and truncates the file to 0 bytes, while
    'r+b' opens the file without truncation. The 'x' mode implies 'w' and
    raises an `FileExistsError` if the file already exists.

    Python distinguishes between files opened in binary and text modes,
    even when the underlying operating system doesn't. Files opened in
    binary mode (appending 'b' to the mode argument) return contents as
    bytes objects without any decoding. In text mode (the default, or when
    't' is appended to the mode argument), the contents of the file are
    returned as strings, the bytes having been first decoded using a
    platform-dependent encoding or using the specified encoding if given.

    'U' mode is deprecated and will raise an exception in future versions
    of Python.  It has no effect in Python 3.  Use newline to control
    universal newlines mode.

    buffering is an optional integer used to set the buffering policy.
    Pass 0 to switch buffering off (only allowed in binary mode), 1 to select
    line buffering (only usable in text mode), and an integer > 1 to indicate
    the size of a fixed-size chunk buffer.  When no buffering argument is
    given, the default buffering policy works as follows:

    * Binary files are buffered in fixed-size chunks; the size of the buffer
      is chosen using a heuristic trying to determine the underlying device's
      "block size" and falling back on `io.DEFAULT_BUFFER_SIZE`.
      On many systems, the buffer will typically be 4096 or 8192 bytes long.

    * "Interactive" text files (files for which isatty() returns True)
      use line buffering.  Other text files use the policy described above
      for binary files.

    encoding is the name of the encoding used to decode or encode the
    file. This should only be used in text mode. The default encoding is
    platform dependent, but any encoding supported by Python can be
    passed.  See the codecs module for the list of supported encodings.

    errors is an optional string that specifies how encoding errors are to
    be handled---this argument should not be used in binary mode. Pass
    'strict' to raise a ValueError exception if there is an encoding error
    (the default of None has the same effect), or pass 'ignore' to ignore
    errors. (Note that ignoring encoding errors can lead to data loss.)
    See the documentation for codecs.register or run 'help(codecs.Codec)'
    for a list of the permitted encoding error strings.

    newline controls how universal newlines works (it only applies to text
    mode). It can be None, '', '\n', '\r', and '\r\n'.  It works as
    follows:

    * On input, if newline is None, universal newlines mode is
      enabled. Lines in the input can end in '\n', '\r', or '\r\n', and
      these are translated into '\n' before being returned to the
      caller. If it is '', universal newline mode is enabled, but line
      endings are returned to the caller untranslated. If it has any of
      the other legal values, input lines are only terminated by the given
      string, and the line ending is returned to the caller untranslated.

    * On output, if newline is None, any '\n' characters written are
      translated to the system default line separator, os.linesep. If
      newline is '' or '\n', no translation takes place. If newline is any
      of the other legal values, any '\n' characters written are translated
      to the given string.

    If closefd is False, the underlying file descriptor will be kept open
    when the file is closed. This does not work when a file name is given
    and must be True in that case.

    A custom opener can be used by passing a callable as *opener*. The
    underlying file descriptor for the file object is then obtained by
    calling *opener* with (*file*, *flags*). *opener* must return an open
    file descriptor (passing os.open as *opener* results in functionality
    similar to passing None).

    open() returns a file object whose type depends on the mode, and
    through which the standard file operations such as reading and writing
    are performed. When open() is used to open a file in a text mode ('w',
    'r', 'wt', 'rt', etc.), it returns a TextIOWrapper. When used to open
    a file in a binary mode, the returned class varies: in read binary
    mode, it returns a BufferedReader; in write binary and append binary
    modes, it returns a BufferedWriter, and in read/write mode, it returns
    a BufferedRandom.

    It is also possible to use a string or bytearray as a file for both
    reading and writing. For strings StringIO can be used like a file
    opened in a text mode, and for bytes a BytesIO can be used like a file
    opened in a binary mode.
```

Well known modes to handle files

- `r` - reading
- `w` - writing
- `a` - appending
- `r+` - for both reading and writing

Reading

In [2]:

```
my_file = open(file='basic_sample.txt', mode='r')
##########

data = my_file.read()

##########
my_file.close()
```

In [3]:

```
# print data
print(len(data))
```

```
16
```

In [4]:

```
data
```

Out[4]:

```
'Python is superb'
```

The data is `Nil` because there is no content in it. Let's add some content in the file.

- content to add → **Python is superb**
- Open the file and type manually

In [5]:

```
my_file = open(file='basic_sample.txt', mode='r')
##########

data = my_file.read()

##########
my_file.close()
```

In [6]:

```
# print data
print(len(data))
print(data)
print("type - ", type(data))
```

```
16
Python is superb
type -  <class 'str'>
```

Writing

Let's write something in a new file. We use the mode `w` for writing into a file.

- content to write → **Python is amazing for data science**
- Writing happens from python code

In [7]:

```
my_file = open(file='writing_sample.txt', mode='w')
##########

my_file.write('Python is amazing for data science')

##########
my_file.close()
```

Let's read `writing_sample.txt` in python

In [8]:

```
my_file = open(file='writing_sample.txt', mode='r')
##########

data = my_file.read()

##########
my_file.close()
```

In [9]:

```
# print data
print(len(data))
print(data)
```

```
34
Python is amazing for data science
```

Appending

In [10]:

```
a = 10
b = 20
print(a)
print(b)
```

```
10
20
```

In [11]:

```
print(a, "\n", b)
```

```
10
 20
```

In [12]:

```
my_file = open(file='append_sample.txt', mode='a')
##########

my_file.write("\nSimple is better than complex")
my_file.write("\nComplex is better than complicated")

##########
my_file.close()
```

- When used `a` - append mode, make sure to provide `\n` to make the data written in next line, otherwise it will consider to continue writing in the same line.
- Every time we open a file, we have to make sure it is closed as well. We do this manually and sometimes we may forget to close the file which is the most essential thing not to forget. Is there any alternative??
- If used `with` statement, we need not close the file manually. It will automatically close the file when the entire process is finished.

Example of using `with`

In [13]:

```
with open(file='writing_sample.txt', mode='r') as my_file:
    data = my_file.read()
    dl = data.lower()

print(dl)
```

```
python is amazing for data science
```

In [14]:

```
# print data
print(len(data))
print(data)
```

```
34
Python is amazing for data science
```

We can apply the same modes like `a`, `w`, `r` and so on.

But, what about `readlines()` function?

In [15]:

```
with open(file='sheep_rhyme.txt', mode='r') as sheep:
    poem = sheep.readlines()
```

In [16]:

```
poem
```

Out[16]:

```
['Baa, baa, black sheep,\n',
 'Have you any wool?\n',
 'Yes sir, yes sir,\n',
 'Three bags full.\n',
 'One for the master,\n',
 'One for the dame,\n',
 'One for the little boy\n',
 'Who lives down the lane.\n',
 'Baa, baa, white sheep,\n',
 'Have you any wool?\n',
 'Yes sir, yes sir,\n',
 'Three bags full.\n',
 'One for the master,\n',
 'One for the dame,\n',
 'And one for the little Girl\n',
 'Who lives down the lane.\n',
 'Baa, baa, brown sheep,\n',
 'Have you any wool?\n',
 'Yes sir, yes sir,\n',
 'Three bags full.\n',
 'One for the master,\n',
 'One for the dame,\n',
 'And one for the Old Man\n',
 'Who lives down the lane.']
```

Alternative - `.split()`

In [17]:

```
with open(file='sheep_rhyme.txt', mode='r') as sheep:
    p_ = sheep.read()
```

In [18]:

```
p_
```

Out[18]:

```
'Baa, baa, black sheep,\nHave you any wool?\nYes sir, yes sir,\nThree bags full.\nOne for the master,\nOne f
or the dame,\nOne for the little boy\nWho lives down the lane.\nBaa, baa, white sheep,\nHave you any wool?\n
Yes sir, yes sir,\nThree bags full.\nOne for the master,\nOne for the dame,\nAnd one for the little Girl\nWh
o lives down the lane.\nBaa, baa, brown sheep,\nHave you any wool?\nYes sir, yes sir,\nThree bags full.\nOne
for the master,\nOne for the dame,\nAnd one for the Old Man\nWho lives down the lane.'
```

In [19]:

```
p_.split('\n')
```

Out[19]:

```
['Baa, baa, black sheep,',
 'Have you any wool?',
 'Yes sir, yes sir,',
 'Three bags full.',
 'One for the master,',
 'One for the dame,',
 'One for the little boy',
 'Who lives down the lane.',
 'Baa, baa, white sheep,',
 'Have you any wool?',
 'Yes sir, yes sir,',
 'Three bags full.',
 'One for the master,',
 'One for the dame,',
 'And one for the little Girl',
 'Who lives down the lane.',
 'Baa, baa, brown sheep,',
 'Have you any wool?',
 'Yes sir, yes sir,',
 'Three bags full.',
 'One for the master,',
 'One for the dame,',
 'And one for the Old Man',
 'Who lives down the lane.']
```

In [20]:

```
type(poem)
```

Out[20]:

```
list
```

Alice and the wonderland

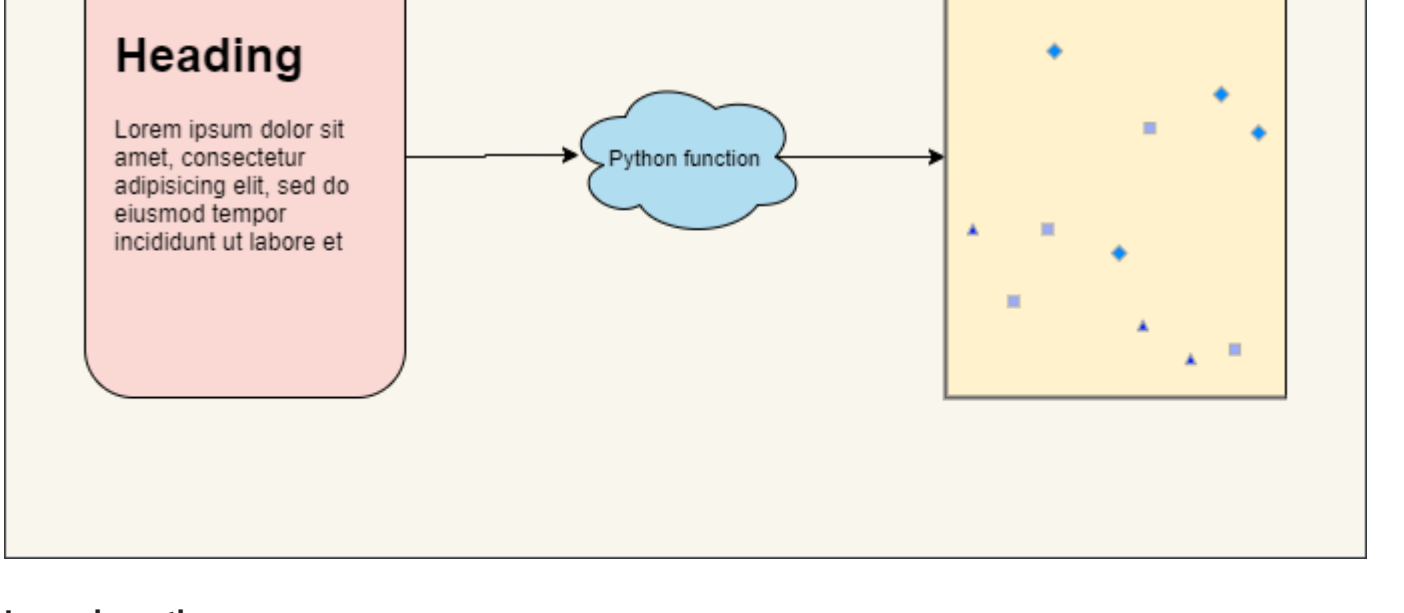


Image by author

In [21]:

```
with open(file='alice_wonderland.txt', mode='r') as alice:
    alice_story = alice.readlines()
```

In [22]:

```
# display first 10 items
alice_story[:10]
```

Out[22]:

```
["Alice's Adventures in Wonderland\n",
 '\n',
 "                ALICE'S ADVENTURES IN WONDERLAND\n",
 '\n',
 '                          Lewis Carroll\n',
 '\n',
 '               THE MILLENNIUM FULCRUM EDITION 3.0\n',
 '\n',
 '\n',
 '\n']
```

In [23]:

```
# check length
len(alice_story)
```

Out[23]:

```
3600
```

Data cleaning

In [24]:

```
# remove "\n" (single item)

non_slash_new_lines = []
for each_line in alice_story:
    if (each_line != '\n'):
        non_slash_new_lines.append(each_line)
```

In [25]:

```
# display first 10 items
non_slash_new_lines[:10]
```

Out[25]:

```
["Alice's Adventures in Wonderland\n",
 "                ALICE'S ADVENTURES IN WONDERLAND\n",
 '                          Lewis Carroll\n',
 '               THE MILLENNIUM FULCRUM EDITION 3.0\n',
 '                            CHAPTER I\n',
 '                      Down the Rabbit-Hole\n',
 '  Alice was beginning to get very tired of sitting by her sister\n',
 'on the bank, and of having nothing to do:  once or twice she had\n',
 'peeped into the book her sister was reading, but it had no\n',
 "pictures or conversations in it, `and what is the use of a book,'\n"]
```

In [26]:

```
# check length
len(non_slash_new_lines)
```

Out[26]:

```
2726
```

In [27]:

```
s = "                ALICE'S ADVENTURES IN WONDERLAND\n"
s[:-1].strip().lower()
```

Out[27]:

```
"alice's adventures in wonderland"
```

In [28]:

```
# remove "\n" from each item at the end
# remove extra spaces from each item (at start and at end)
# convert each item into lower case

non_slash_lines = []
for each_line in non_slash_new_lines:
    each_line = each_line[:-1].strip().lower()
    non_slash_lines.append(each_line)
```

In [29]:

```
# display first 10 items
non_slash_lines[:11]
```

Out[29]:

```
["alice's adventures in wonderland",
 "alice's adventures in wonderland",
 'lewis carroll',
 'the millennium fulcrum edition 3.0',
 'chapter i',
 'down the rabbit-hole',
 'alice was beginning to get very tired of sitting by her sister',
 'on the bank, and of having nothing to do:  once or twice she had',
 'peeped into the book her sister was reading, but it had no',
 "pictures or conversations in it, `and what is the use of a book,'",
 "thought alice `without pictures or conversation?'"]
```

In [30]:

```
# check length
len(non_slash_lines)
```

Out[30]:

```
2726
```

Data formatting

Image by author

In [31]:

```
# show enumerate example with list
s = ["s", "d", "f"]
f = dict(enumerate(s))
print(f)
f.items()
```

```
{0: 's', 1: 'd', 2: 'f'}
```

Out[31]:

```
dict_items([(0, 's'), (1, 'd'), (2, 'f')])
```

In [32]:

```
# make a dictionary with enumerate and count the word

word = input("Enter word : ")
word = ' ' + word + ' '

line_word_count = {}
for (idx, line) in enumerate(non_slash_lines):
    line_word_count[idx + 1] = line.count(word)
```

```
Enter word : in
```

In [33]:

```
# line_word_count
```

In [34]:

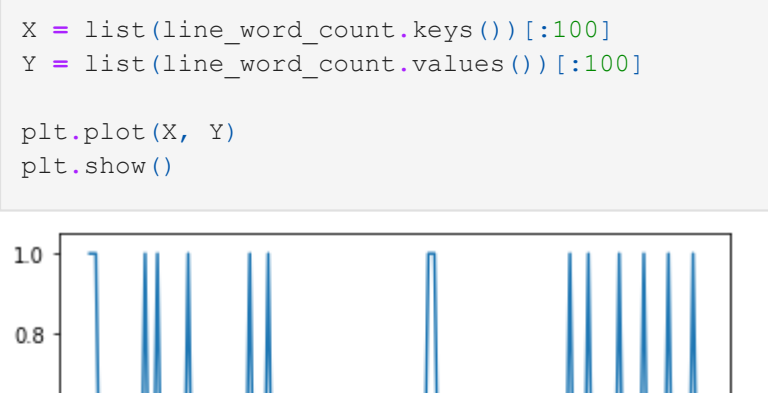
```
# check length
len(line_word_count)
```

Out[34]:

```
2726
```

In [35]:

```
# plot the result for the first 100 items
# py -m pip install matplotlib --user

from matplotlib import pyplot as plt

X = list(line_word_count.keys())[:100]
Y = list(line_word_count.values())[:100]

plt.plot(X, Y)
plt.show()
```



Customization

In [36]:

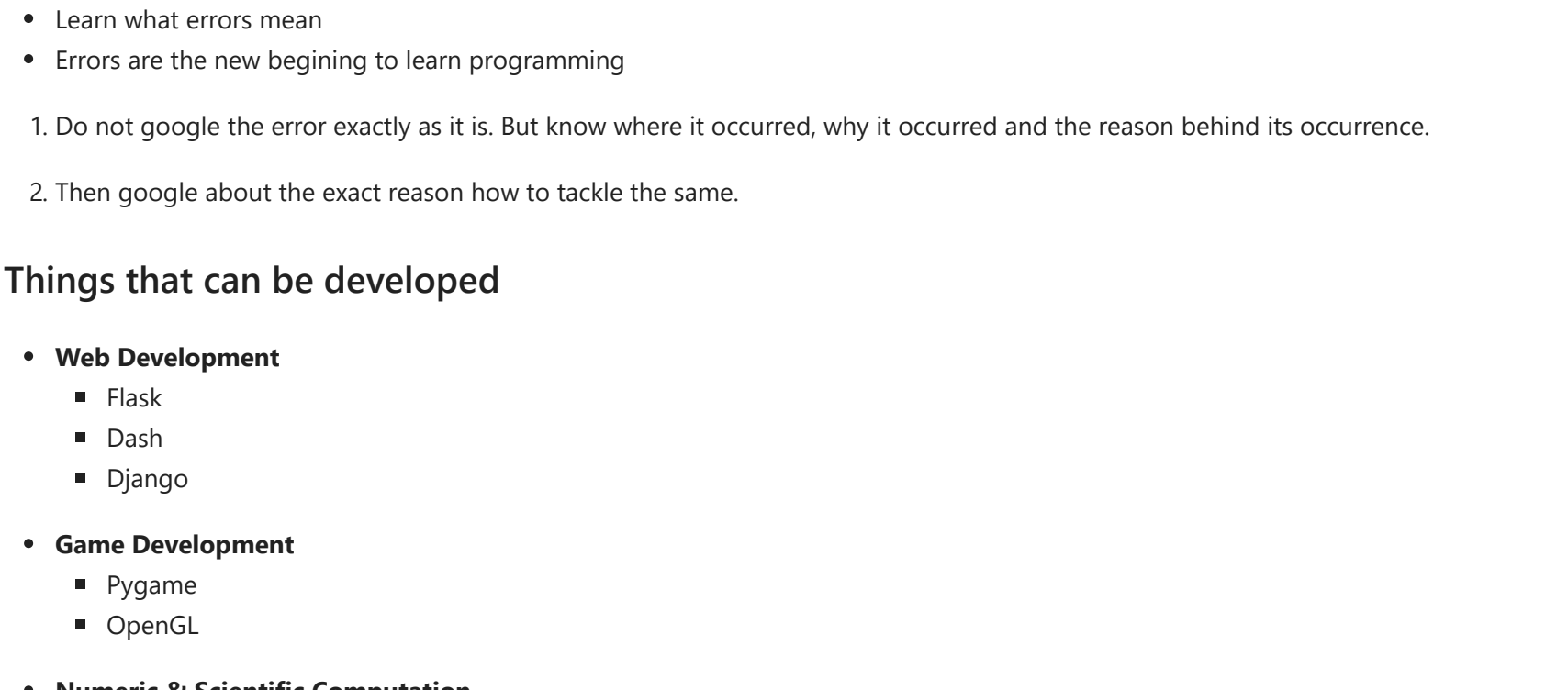
```
def word_plot_from_txt(filename_):
    """
    Plot the word from the text file which appears in every possible line
    :param str filename_: The name of the file saved in the folder (.txt)
    :param str word_: The actual word that appears in each line
    :return bool None:
    """
    word_ = input("Enter word : ")
    word_ = ' ' + word_ + ' '

    ## read the file saved in the folder
    with open(file=filename_, mode='r') as txt:
        story_ = txt.readlines()

    ########## ~ data cleaning ~ ############

    ## remove extra '\n' as a line
    non_new_line_ = []
    for each_line in story_:
        if each_line != '\n':
            non_new_line_.append(each_line)

    ## remove '\n' from a line
    new_data_ = []
    for each_line in non_new_line_:
        each_data = each_line.strip().lower().replace('\n', '')
        new_data_.append(each_data)

    ## count the required word_ from each line
    story_dict_ = {}
    for index_, line_ in dict(enumerate(new_data_)).items():
        story_dict_[index_ + 1] = line_.count(word_)

    ########### ~ data plotting ~ ###########

    import random
    from matplotlib import pyplot as plt
    from matplotlib import style
    style.use('seaborn-deep')

    X = list(story_dict_.keys())
    Y = list(story_dict_.values())

    num = random.randint(100, 300)
    print("Taking the first {} values from X and Y".format(num))
    x_ = X[:num]
    y_ = Y[:num]

    ## figure size
    plt.figure(figsize=(15, 8))
    ## line plot
    plt.plot(x_, y_, color='green', lw=2, label='line plot')
    ## scatter plot
    plt.scatter(x_, y_, color='red', label='scatter markers')
    ## x-axis name
    plt.xlabel("Lines")
    ## y-axis name
    plt.ylabel(word_ + " - count")
    ## title of the plot
    plt.title("The Word Count Plot from the File")
    ## legend of the plot
    plt.legend(loc='best')
    ## displaying the plot
    plt.show()

    return True
```

Function call

In [37]:

```
word_plot_from_txt(
    filename_='alice_wonderland.txt'
)
```

```
Enter word : in
Taking the first 127 values from X and Y
```



Out[37]:

```
True
```

How to debug errors?

- Know about the errors
- Learn what errors mean
- Errors are the new begining to learn programming

1. Do not google the error exactly as it is. But know where it occurred, why it occurred and the reason behind its occurrence.
2. Then google about the exact reason how to tackle the same.

Things that can be developed

- **Web Development**
  - Flask
  - Dash
  - Django
- **Game Development**
  - Pygame
  - OpenGL
- **Numeric & Scientific Computation**
  - Numpy
  - Scipy
  - OpenCV
  - Pandas
- **Data Analysis**
  - Pandas
  - Statsmodel
  - Statistics
- **Data Visualization**
  - Matplotlib
  - Plotly
  - Bokeh
- **Machine Learning and Artificial Intelligence (Research & Development)**
  - Scikit-learn
  - Tensorflow
  - Pytorch
  - Keras
  - Scikit-image
- **Mobile App Development**
  - Kivy
- **Desktop Application**
  - Tkinter
- **Web Scraping**
  - BeautifulSoup
  - Selenium (Automation)
  - Scrapy

The list goes on ...

" Always try to learn something new everyday "