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Data Engineering

Data engineering is one of the most critical and foundational skills in any data scientist’s toolkit.

Data Engineering Process

There are several steps in Data Engineering process.

1. **Extract** - Data extraction is getting data from multiple sources. Ex. Data extraction from a website using Web scraping or gathering information from the data that are stored in different formats(JSON, CSV, XLSX etc.).

2. **Transform** - Transforming the data means removing the data that we don't need for further analysis and converting the data in the format that all the data from the multiple sources is in the same format.

3. **Load** - Loading the data inside a data warehouse. Data warehouse essentially contains large volumes of data that are accessed to gather insights.

Working with different file formats

In the real-world, people rarely get neat tabular data. Thus, it is mandatory for any data scientist (or data engineer) to be aware of different file formats, common challenges in handling them and the best, most efficient ways to handle this data in real life. We have reviewed some of this content in other modules.

File Format

A file format is a standard way in which information is encoded for storage in a file. First, the file format specifies whether the file is a binary or ASCII file. Second, it shows how the information is organized. For example, the comma-separated values (CSV) file format stores tabular data in plain text.

To identify a file format, you can usually look at the file extension to get an idea. For example, a file saved with name "Data" in "CSV" format will appear as **Data.csv**. By noticing the **.csv** extension, we can clearly identify that it is a **CSV** file and the data is stored in a tabular format.

There are various formats for a dataset, .csv, .json, .xlsx etc. The dataset can be stored in different places, on your local machine or sometimes online.

In this section, you will learn how to load a dataset into our Jupyter Notebook.

Now, we will look at some file formats and how to read them in Python:

Comma-separated values (CSV) file format

The **Comma-separated values** file format falls under a spreadsheet file format.

In a spreadsheet file format, data is stored in cells. Each cell is organized in rows and columns. A column in the spreadsheet file can have different types. For example, a column can be of string type, a date type, or an integer type.

Each line in CSV file represents an observation, or commonly called a record. Each record may contain one or more fields which are separated by a comma.

Reading data from CSV in Python

The **Pandas** Library is a useful tool that enables us to read various datasets into a Pandas data frame

Let us look at how to read a CSV file in Pandas Library.

We use **pandas.read_csv()** function to read the csv file. In the parentheses, we put the file path along with a quotation mark as an argument, so that pandas will read the file into a data frame from that address. The file path can be either a URL or your local file address.

In [ ]:
```
import piplite
await piplite.install(['seaborn', 'lxml', 'openpyxl'])

import pandas as pd
```

In [ ]:
```
from pyodide.http import pyfetch

filename = "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-PY0101

async def download(url, filename):
    response = await pyfetch(url)
    if response.status == 200:
        with open(filename, "wb") as f:
            f.write(await response.bytes())

await download(filename, "addresses.csv")

df = pd.read_csv("addresses.csv", header=None)
```

In [ ]:
```
df
```

Out[ ]:

	0	1	2	3	4	5
0	John	Doe	120 jefferson st.	Riverside	NJ	8075
1	Jack	McGinnis	220 hobo Av.	Phila	PA	9119
2	John "Da Man"	Repici	120 Jefferson St.	Riverside	NJ	8075
3	Stephen	Tyler	7452 Terrace "At the Plaza" road	SomeTown	SD	91234
4	NaN	Blankman	NaN	SomeTown	SD	298
5	Joan "the bone", Anne	Jet	9th, at Terrace plc	Desert City	CO	123

Adding column name to the DataFrame

We can add columns to an existing DataFrame using its **columns** attribute.

In [ ]:
```
df.columns =['First Name', 'Last Name', 'Location ', 'City','State','Area Code']
```

In [ ]:
```
df
```

Out[ ]:

	First Name	Last Name	Location	City	State	Area Code
0	John	Doe	120 jefferson st.	Riverside	NJ	8075
1	Jack	McGinnis	220 hobo Av.	Phila	PA	9119
2	John "Da Man"	Repici	120 Jefferson St.	Riverside	NJ	8075
3	Stephen	Tyler	7452 Terrace "At the Plaza" road	SomeTown	SD	91234
4	NaN	Blankman	NaN	SomeTown	SD	298
5	Joan "the bone", Anne	Jet	9th, at Terrace plc	Desert City	CO	123

Selecting a single column

To select the first column 'First Name', you can pass the column name as a string to the indexing operator.

In [ ]:
```
df["First Name"]
```

Out[ ]:
```
0                     John
1                     Jack
2           John "Da Man"
3                  Stephen
4                      NaN
5    Joan "the bone", Anne
Name: First Name, dtype: object
```

Selecting multiple columns

To select multiple columns, you can pass a list of column names to the indexing operator.

In [ ]:
```
df = df[['First Name', 'Last Name', 'Location ', 'City','State','Area Code']]
df
```

Out[ ]:

	First Name	Last Name	Location	City	State	Area Code
0	John	Doe	120 jefferson st.	Riverside	NJ	8075
1	Jack	McGinnis	220 hobo Av.	Phila	PA	9119
2	John "Da Man"	Repici	120 Jefferson St.	Riverside	NJ	8075
3	Stephen	Tyler	7452 Terrace "At the Plaza" road	SomeTown	SD	91234
4	NaN	Blankman	NaN	SomeTown	SD	298
5	Joan "the bone", Anne	Jet	9th, at Terrace plc	Desert City	CO	123

Selecting rows using .iloc and .loc

Now, let's see how to use .loc for selecting rows from our DataFrame.

loc() : loc() is label based data selecting method which means that we have to pass the name of the row or column which we want to select.

In [ ]:
```
# To select the first row
df.loc[0]
```

Out[ ]:
```
First Name                   John
Last Name                     Doe
Location      120 jefferson st.
City                    Riverside
State                          NJ
Area Code                    8075
Name: 0, dtype: object
```

In [ ]:
```
# To select the 0th,1st and 2nd row of "First Name" column only
df.loc[[0,1,2], "First Name" ]
```

Out[ ]:
```
0             John
1             Jack
2    John "Da Man"
Name: First Name, dtype: object
```

Now, let's see how to use .iloc for selecting rows from our DataFrame.

iloc() : iloc() is a indexed based selecting method which means that we have to pass integer index in the method to select specific row/column.

In [ ]:
```
# To select the 0th,1st and 2nd row of "First Name" column only
df.iloc[[0,1,2], 0]
```

Out[ ]:
```
0             John
1             Jack
2    John "Da Man"
Name: First Name, dtype: object
```

For more information please read the documentation.

Let's perform some basic transformation in pandas.

Transform Function in Pandas

Python's Transform function returns a self-produced dataframe with transformed values after applying the function specified in its parameter.

Let's see how Transform function works.

In [ ]:
```
#import library
```

```python
import pandas as pd
import numpy as np
```

In [ ]:
```python
#creating a dataframe
df=pd.DataFrame(np.array([[1, 2, 3], [4, 5, 6], [7, 8, 9]]), columns=['a', 'b', 'c'])
df
```

Out[ ]:

	a	b	c
0	1	2	3
1	4	5	6
2	7	8	9

Let’s say we want to add 10 to each element in a dataframe:

In [ ]:
```python
#applying the transform function
df = df.transform(func = lambda x : x + 10)
df
```

Out[ ]:

	a	b	c
0	11	12	13
1	14	15	16
2	17	18	19

Now we will use DataFrame.transform() function to find the square root to each element of the dataframe.

In [ ]:
```python
result = df.transform(func = ['sqrt'])
```

In [ ]:
```python
result
```

Out[ ]:

	a	b	c
	sqrt	**sqrt**	**sqrt**
0	3.316625	3.464102	3.605551
1	3.741657	3.872983	4.000000
2	4.123106	4.242641	4.358899

For more information about the **transform()** function please read the documentation.

JSON file Format

JSON (JavaScript Object Notation) is a lightweight data-interchange format. It is easy for humans to read and write.

JSON is built on two structures:

1. A collection of name/value pairs. In various languages, this is realized as an object, record, struct, dictionary, hash table, keyed list, or associative array.
2. An ordered list of values. In most languages, this is realized as an array, vector, list, or sequence.

JSON is a language-independent data format. It was derived from JavaScript, but many modern programming languages include code to generate and parse JSON-format data. It is a very common data format with a diverse range of applications.

The text in JSON is done through quoted string which contains the values in key-value mappings within { }. It is similar to the dictionary in Python.

Python supports JSON through a built-in package called **json**. To use this feature, we import the json package in Python script.

In [ ]:
```python
import json
```

Writing JSON to a File

This is usually called **serialization**. It is the process of converting an object into a special format which is suitable for transmitting over the network or storing in file or database.

To handle the data flow in a file, the JSON library in Python uses the **dump()** or **dumps()** function to convert the Python objects into their respective JSON object. This makes it easy to write data to files.

In [ ]:
```
import json
person = {
    'first_name' : 'Mark',
    'last_name' : 'abc',
    'age' : 27,
    'address': {
        "streetAddress": "21 2nd Street",
        "city": "New York",
        "state": "NY",
        "postalCode": "10021-3100"
    }
}
```

serialization using dump() function

json.dump() method can be used for writing to JSON file.

Syntax: json.dump(dict, file_pointer)

Parameters:

1. **dictionary** – name of the dictionary which should be converted to JSON object.
2. **file pointer** – pointer of the file opened in write or append mode.

In [ ]:
```
with open('person.json', 'w') as f:  # writing JSON object
    json.dump(person, f)
```

serialization using dumps() function

json.dumps() that helps in converting a dictionary to a JSON object.

It takes two parameters:

1. **dictionary** – name of the dictionary which should be converted to JSON object.
2. **indent** – defines the number of units for indentation

In [ ]:
```
# Serializing json
json_object = json.dumps(person, indent = 4)

# Writing to sample.json
with open("sample.json", "w") as outfile:
    outfile.write(json_object)
```

In [ ]:
```
print(json_object)
```

```
{
    "first_name": "Mark",
    "last_name": "abc",
    "age": 27,
    "address": {
        "streetAddress": "21 2nd Street",
        "city": "New York",
        "state": "NY",
        "postalCode": "10021-3100"
    }
}
```

Our Python objects are now serialized to the file. For deserialize it back to the Python object, we use the load() function.

Reading JSON to a File

This process is usually called **Deserialization** - it is the reverse of serialization. It converts the special format returned by the serialization back into a usable object.

Using json.load()

The JSON package has json.load() function that loads the json content from a json file into a dictionary.

It takes one parameter:

File pointer : A file pointer that points to a JSON file.

In [ ]:
```
import json

# Opening JSON file
with open('sample.json', 'r') as openfile:
    # Reading from json file
    json_object = json.load(openfile)

print(json_object)
print(type(json_object))
```

```
{'first_name': 'Mark', 'last_name': 'abc', 'age': 27, 'address': {'streetAddress': '21 2nd Street', 'city': 'New
York', 'state': 'NY', 'postalCode': '10021-3100'}}
<class 'dict'>
```

XLSX file format

XLSX is a Microsoft Excel Open XML file format. It is another type of Spreadsheet file format.

In XLSX data is organized under the cells and columns in a sheet.

Reading the data from XLSX file

Let's load the data from XLSX file and define the sheet name. For loading the data you can use the Pandas library in python.

In [ ]:
```
import pandas as pd
```

In [ ]:
```
# Not needed unless you're running locally
# import urllib.request
# urllib.request.urlretrieve("https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSk

filename = "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-PY0101

async def download(url, filename):
    response = await pyfetch(url)
    if response.status == 200:
        with open(filename, "wb") as f:
            f.write(await response.bytes())

await download(filename, "file_example_XLSX_10.xlsx")

df = pd.read_excel("file_example_XLSX_10.xlsx")
```

In [ ]:
```
df
```

Out[ ]:

	0	First Name	Last Name	Gender	Country	Age	Date	Id
0	1	Dulce	Abril	Female	United States	32	15/10/2017	1562
1	2	Mara	Hashimoto	Female	Great Britain	25	16/08/2016	1582
2	3	Philip	Gent	Male	France	36	21/05/2015	2587
3	4	Kathleen	Hanner	Female	United States	25	15/10/2017	3549
4	5	Nereida	Magwood	Female	United States	58	16/08/2016	2468
5	6	Gaston	Brumm	Male	United States	24	21/05/2015	2554
6	7	Etta	Hurn	Female	Great Britain	56	15/10/2017	3598
7	8	Earlean	Melgar	Female	United States	27	16/08/2016	2456
8	9	Vincenza	Weiland	Female	United States	40	21/05/2015	6548

XML file format

XML is also known as Extensible Markup Language. As the name suggests, it is a markup language. It has certain rules for encoding data. XML file format is a human-readable and machine-readable file format.

Pandas does not include any methods to read and write XML files. Here, we will take a look at how we can use other modules to read data from an XML file, and load it into a Pandas DataFrame.

Writing with xml.etree.ElementTree

The **xml.etree.ElementTree** module comes built-in with Python. It provides functionality for parsing and creating XML documents. **ElementTree** represents the XML document as a tree. We can move across the document using nodes which are elements and sub-elements of the XML file.

For more information please read the xml.etree.ElementTree documentation.

In [ ]:
```
import xml.etree.ElementTree as ET

# create the file structure
employee = ET.Element('employee')
details = ET.SubElement(employee, 'details')
first = ET.SubElement(details, 'firstname')
second = ET.SubElement(details, 'lastname')
third = ET.SubElement(details, 'age')
first.text = 'Shiv'
second.text = 'Mishra'
third.text = '23'

# create a new XML file with the results
mydata1 = ET.ElementTree(employee)
# myfile = open("items2.xml", "wb")
# myfile.write(mydata)
with open("new_sample.xml", "wb") as files:
    mydata1.write(files)
```

Reading with xml.etree.ElementTree

Let's have a look at a one way to read XML data and put it in a Pandas DataFrame. You can see the XML file in the Notepad of your local machine.

In [ ]:
```
# Not needed unless running locally
# !wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-PY0101EN-S

import xml.etree.ElementTree as etree

filename = "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-PY0101

async def download(url, filename):
    response = await pyfetch(url)
    if response.status == 200:
        with open(filename, "wb") as f:
            f.write(await response.bytes())

await download(filename, "Sample-employee-XML-file.xml")
```

You would need to firstly parse an XML file and create a list of columns for data frame, then extract useful information from the XML file and add to a pandas data frame.

Here is a sample code that you can use.:

In [ ]:
```
tree = etree.parse("Sample-employee-XML-file.xml")

root = tree.getroot()
columns = ["firstname", "lastname", "title", "division", "building","room"]

datatframe = pd.DataFrame(columns = columns)

for node in root:

    firstname = node.find("firstname").text

    lastname = node.find("lastname").text

    title = node.find("title").text

    division = node.find("division").text

    building = node.find("building").text

    room = node.find("room").text

    datatframe = datatframe.append(pd.Series([firstname, lastname, title, division, building, room], index = co
<ipython-input-27-9c199f010708>:22: FutureWarning: The frame.append method is deprecated and will be removed fro
m pandas in a future version. Use pandas.concat instead.
  datatframe = datatframe.append(pd.Series([firstname, lastname, title, division, building, room], index = colum
ns), ignore_index = True)
<ipython-input-27-9c199f010708>:22: FutureWarning: The frame.append method is deprecated and will be removed fro
m pandas in a future version. Use pandas.concat instead.
  datatframe = datatframe.append(pd.Series([firstname, lastname, title, division, building, room], index = colum
ns), ignore_index = True)
<ipython-input-27-9c199f010708>:22: FutureWarning: The frame.append method is deprecated and will be removed fro
m pandas in a future version. Use pandas.concat instead.
  datatframe = datatframe.append(pd.Series([firstname, lastname, title, division, building, room], index = colum
ns), ignore_index = True)
<ipython-input-27-9c199f010708>:22: FutureWarning: The frame.append method is deprecated and will be removed fro
m pandas in a future version. Use pandas.concat instead.
  datatframe = datatframe.append(pd.Series([firstname, lastname, title, division, building, room], index = colum
ns), ignore_index = True)
```

In [ ]:
```
datatframe
```

Out[ ]:

	firstname	lastname	title	division	building	room
0	Shiv	Mishra	Engineer	Computer	301	11
1	Yuh	Datta	developer	Computer	303	02
2	Rahil	Khan	Tester	Computer	304	10
3	Deep	Parekh	Designer	Computer	305	14

Reading xml file using pandas.read_xml function

We can also read the downloaded xml file using the read_xml function present in the pandas library which returns a Dataframe object.

For more information read the pandas.read_xml documentation.

In [ ]:
```
# Herein xpath we mention the set of xml nodes to be considered for migrating  to the dataframe which in this ca
df=pd.read_xml("Sample-employee-XML-file.xml", xpath="/employees/details")
```

Save Data

Correspondingly, Pandas enables us to save the dataset to csv by using the **dataframe.to_csv()** method, you can add the file path and name along with quotation marks in the parentheses.

For example, if you would save the dataframe df as **employee.csv** to your local machine, you may use the syntax below:

In [ ]:
```
datatframe.to_csv("employee.csv", index=False)
```

We can also read and save other file formats, we can use similar functions to `pd.read_csv()` and `df.to_csv()` for other data formats. The functions are listed in the following table:

Read/Save Other Data Formats

Data Formate	Read	Save
csv	`pd.read_csv()`	`df.to_csv()`
json	`pd.read_json()`	`df.to_json()`
excel	`pd.read_excel()`	`df.to_excel()`
hdf	`pd.read_hdf()`	`df.to_hdf()`
sql	`pd.read_sql()`	`df.to_sql()`
...	...	...

Let's move ahead and perform some **Data Analysis**.

Binary File Format

"Binary" files are any files where the format isn't made up of readable characters. It contain formatting information that only certain applications or processors can understand. While humans can read text files, binary files must be run on the appropriate software or processor before humans can read them.

Binary files can range from image files like JPEGs or GIFs, audio files like MP3s or binary document formats like Word or PDF.

Let's see how to read an **Image** file.

Reading the Image file

Python supports very powerful tools when it comes to image processing. Let's see how to process the images using the **PIL** library.

PIL is the Python Imaging Library which provides the python interpreter with image editing capabilities.

In [ ]:
```
# importing PIL
from PIL import Image

# Uncomment if running locally
# import urllib.request
# urllib.request.urlretrieve("https://hips.hearstapps.com/hmg-prod.s3.amazonaws.com/images/dog-puppy-on-garden-

filename = "https://hips.hearstapps.com/hmg-prod.s3.amazonaws.com/images/dog-puppy-on-garden-royalty-free-image

async def download(url, filename):
    response = await pyfetch(url)
    if response.status == 200:
        with open(filename, "wb") as f:
            f.write(await response.bytes())

await download(filename, "dog.jpg")
```

In [ ]:
```
# Read image
img = Image.open('dog.jpg')

# Output Images
display(img)
```

Data Analysis

In this section, you will learn how to approach data acquisition in various ways and obtain necessary insights from a dataset. By the end of this lab, you will successfully load the data into Jupyter Notebook and gain some fundamental insights via the Pandas Library.

In our case, the **Diabetes Dataset** is an online source and it is in CSV (comma separated value) format. Let's use this dataset as an example to practice data reading.

About this Dataset

Context: This dataset is originally from the **National Institute of Diabetes and Digestive and Kidney Diseases**. The objective of the dataset is to diagnostically predict whether or not a patient has diabetes, based on certain diagnostic measurements included in the dataset. Several constraints were placed on the selection of these instances from a larger database. In particular, all patients here are females at least 21 years of age of Pima Indian heritage.

Content: The datasets consists of several medical predictor variables and one target variable, Outcome. Predictor variables includes the number of pregnancies the patient has had, their BMI, insulin level, age, and so on.

We have 768 rows and 9 columns. The first 8 columns represent the features and the last column represent the target/label.

In [ ]:
```
# Import pandas library
import pandas as pd
```

In [ ]:
```
filename = "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-PY0101

async def download(url, filename):
    response = await pyfetch(url)
    if response.status == 200:
        with open(filename, "wb") as f:
            f.write(await response.bytes())

await download(filename, "diabetes.csv")
df = pd.read_csv("diabetes.csv")
```

After reading the dataset, we can use the **dataframe.head(n)** method to check the top n rows of the dataframe, where n is an integer. Contrary to **dataframe.head(n)**, **dataframe.tail(n)** will show you the bottom n rows of the dataframe.

In [ ]:
```
# show the first 5 rows using dataframe.head() method
print("The first 5 rows of the dataframe")
df.head(5)
```

```
The first 5 rows of the dataframe
```

Out[ ]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1

To view the dimensions of the dataframe, we use the `.shape` parameter.

In [ ]:

```
df.shape
```

Out[ ]:

```
(768, 9)
```

Statistical Overview of dataset

In [ ]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype  
---  ------                    --------------  -----  
 0   Pregnancies               768 non-null    int64  
 1   Glucose                   768 non-null    int64  
 2   BloodPressure             768 non-null    int64  
 3   SkinThickness             768 non-null    int64  
 4   Insulin                   768 non-null    int64  
 5   BMI                       768 non-null    float64
 6   DiabetesPedigreeFunction  768 non-null    float64
 7   Age                       768 non-null    int64  
 8   Outcome                   768 non-null    int64  
dtypes: float64(2), int64(7)
memory usage: 54.1 KB
```

This method prints information about a DataFrame including the index dtype and columns, non-null values and memory usage.

In [ ]:

```
df.describe()
```

Out[ ]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	0.471876	33.240885
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	0.331329	11.760232
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.078000	21.000000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	0.243750	24.000000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	0.372500	29.000000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	0.626250	41.000000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.420000	81.000000

Pandas **describe()** is used to view some basic statistical details like percentile, mean, standard deviation, etc. of a data frame or a series of numeric values. When this method is applied to a series of strings, it returns a different output

Identify and handle missing values

We use Python's built-in functions to identify these missing values. There are two methods to detect missing data:

.isnull()

.notnull()

The output is a boolean value indicating whether the value that is passed into the argument is in fact missing data.

In [ ]:

```
missing_data = df.isnull()
missing_data.head(5)
```

Out[ ]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
0	False	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False	False

"True" stands for missing value, while "False" stands for not missing value.

Count missing values in each column

Using a for loop in Python, we can quickly figure out the number of missing values in each column. As mentioned above, "True" represents a missing value, "False" means the value is present in the dataset. In the body of the for loop the method ".value_counts()" counts the number of "True" values.

In [ ]:
```
for column in missing_data.columns.values.tolist():
    print(column)
    print (missing_data[column].value_counts())
    print("")
```

```
Pregnancies
False    768
Name: Pregnancies, dtype: int64

Glucose
False    768
Name: Glucose, dtype: int64

BloodPressure
False    768
Name: BloodPressure, dtype: int64

SkinThickness
False    768
Name: SkinThickness, dtype: int64

Insulin
False    768
Name: Insulin, dtype: int64

BMI
False    768
Name: BMI, dtype: int64

DiabetesPedigreeFunction
False    768
Name: DiabetesPedigreeFunction, dtype: int64

Age
False    768
Name: Age, dtype: int64

Outcome
False    768
Name: Outcome, dtype: int64
```

As you can see above, there is no missing values in the dataset.

Correct data format

Check all data is in the correct format (int, float, text or other).

In Pandas, we use

.dtype() to check the data type

.astype() to change the data type

Numerical variables should have type **'float'** or **'int'**.

In [ ]:
```
df.dtypes
```

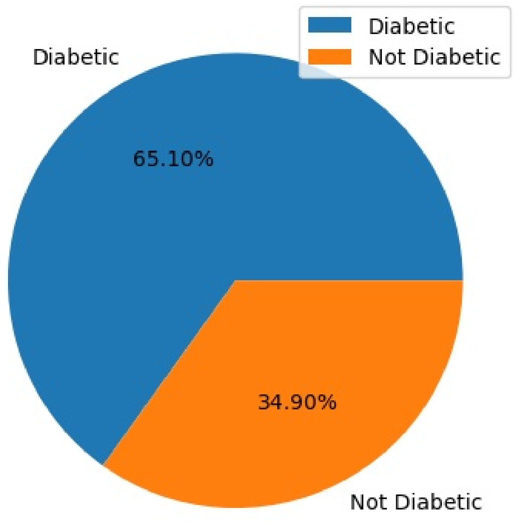
As we can see above, All columns have the correct data type.

Visualization

Visualization is one of the best way to get insights from the dataset. **Seaborn** and **Matplotlib** are two of Python's most powerful visualization libraries.

In [ ]:
```
# import libraries
import matplotlib.pyplot as plt
import seaborn as sns
```

In [ ]:
```
labels= 'Diabetic','Not Diabetic'
plt.pie(df['Outcome'].value_counts(),labels=labels,autopct='%0.02f%%')
plt.legend()
plt.show()
```



As you can see above, 65.10% females are Diabetic and 34.90% are Not Diabetic.

Thank you for completing this Notebook

Change Log

Date (YYYY-MM-DD)	Version	Changed By	Change Description
2023-06-11	1.0	Akansha yadav	Spell check
2022-01-25	0.1	Lakshmi Holla	added read_xml

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