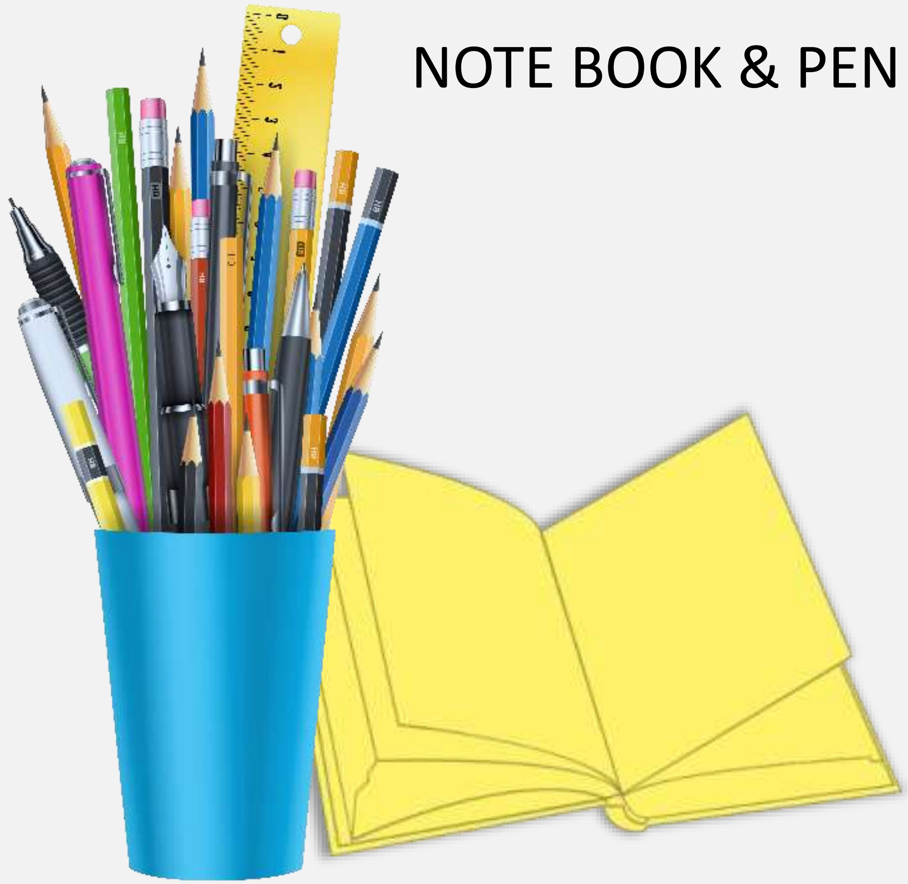
MANISH GODSE, Ph.D.(IIT Bombay)

Request & Instructions

PLEASE OPEN

CALCULATOR



NOTE BOOK & PEN

LAPTOP OR DESKTOP,
IF YOU HAVE.

PLEASE FOLLOW THIS

SILENCE

MUTE
MIC

RAISE
HAND

NO
CHAT

SILENT
MODE

DATA CLEANING

BOOKS & REFERENCES

- https://scikit-learn.org/stable/data_transforms.html
- https://machinelearningmastery.com/model-based-outlier-detection-and-removal-in-python/

<a href="https://www.freepik.com/free-photos-vectors/background">Background photo created by freepik - www.freepik.com</a>

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LOADING DATASET

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LOADING A DATASET

FILE FORMAT

Data file may be in **EXCEL** or **CSV** format.

COLUMN NAMES OR HEADERS

It may or not have column **names** or **headers**. These names are variable names.

PYTHON STATEMENT TO LOAD FILE

The below Python statement is used to read the file in CSV and EXCEL format.

```
df = pd.read_csv("file_path/data_file.csv")
df = pd.read_excel("file_path/data_file.xlsx")
```

HEADER IN DATASET

- The **column names** or **headers** are inferred from the **first line** of the **file.** This is done by using the keyword "**header**".
- The default value is **header=0**. Hence it is not necessary to mention it, if the file has headers in **first row**.
- The Python statement **with header** is as below.

```
df = pd.read_csv("file_path/data_file.csv" ", header=0)
df = pd.read_excel("file_path/data_file.xlsx" ", header=0)
```

- The Python statement **without header** is as below.

```
df = pd.read_csv("file_path/data_file.csv" ", header=None)
df = pd.read_excel("file_path/data_file.xlsx" ", header=None)
```

EXAMPLE – header=0

```
# import pandas library
import pandas as pd
# Get file path
sales_dataset = "E:/Courses/Machine_Learning_Python/data/Super_Store_Sales.csv"
# Read file and save as DataFrame
df_sales = pd.read_csv(sales_dataset, header=0)
# Check column heads or names
print(df_sales.columns)
# Get count of rows and column
print(df_sales.shape)
```

EXAMPLE – header=None

```
# import pandas library
import pandas as pd
# Get file path
sales_dataset = "E:/Courses/Machine_Learning_Python/data/Super_Store_Sales.csv"
# Read file and save as DataFrame
df_sales = pd.read_csv(sales_dataset, header=None)
# Check column heads
print(df_sales.columns)
# Get count of rows and column
print(df_sales.shape)
```

CHECK DATA

2

CHECK DATA (1/2)

```
# import pandas library
import pandas as pd
# Get file path
data = "E:/Courses/Machine_Learning_Python/data/MonthlySalesNone.csv"
# Read file and save as DataFrame
df = pd.read_csv(data, header=0)
# Print the dataset
print(df)
# Get count of rows and column
print(df.shape)
```

CHECK DATA (2/2)

```
# Check column heads
print(df.columns)
# Print datatype
print(df.dtypes)
# View data
print(df)
# View top 5 data
print(df.head(5))
# View bottom 5 data
print(df.tail(5))
```

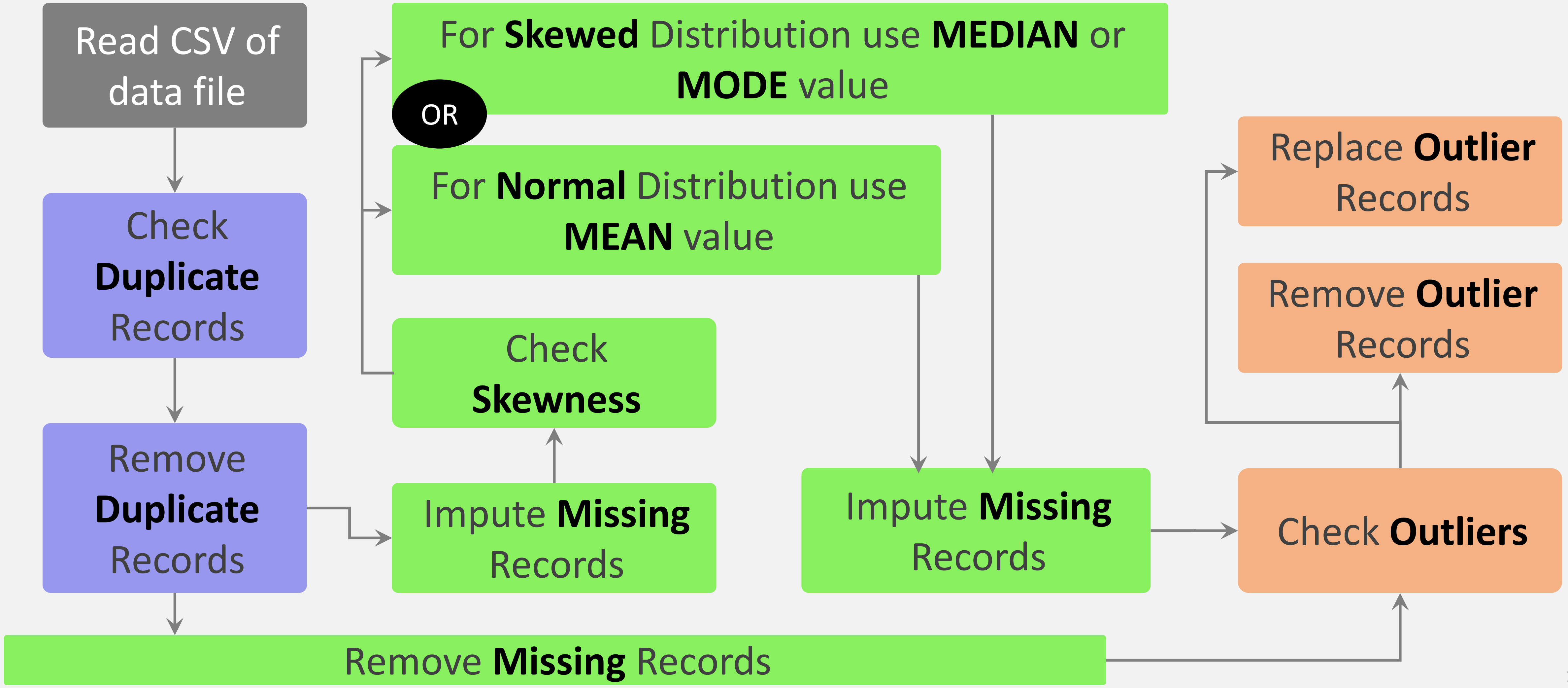
DATA CLEANING TASKS

3

DATA CLEANING TASKS

Data cleaning tasks are as below.

1. **Duplicate**
2. **Missing Value**
3. **Outlier**



Read CSV of data file
Check **Duplicate** Records
Remove **Duplicate** Records
Remove **Missing** Records
Impute **Missing** Records
Check **Skewness**
For **Skewed** Distribution use **MEDIAN** or **MODE** value
OR
For **Normal** Distribution use **MEAN** value
Impute **Missing** Records
Check **Outliers**
Replace **Outlier** Records
Remove **Outlier** Records

CHECK DATA (1/2)

```
# import pandas library
import pandas as pd
# Get file path
data = "E:/Courses/Machine_Learning_Python/data/MonthlySalesNone.csv"
# Read file and save as DataFrame
df = pd.read_csv(data, header=0)
# Print the dataset
print(df)
# Get count of rows and column
print(df.shape)
```

CHECK DATA (2/2)

```
# Check column heads
print(df.columns)
# Print datatype
print(df.dtypes)
# View data
print(df)
# View top 5 data
print(df.head(5))
# View bottom 5 data
print(df.tail(5))
```

MANAGE DUPLICATE RECORDS

4

READ FILE

```
# import pandas library
import pandas as pd

# Get file path
sales_data =
"E:/Courses/Machine_Learning_Python/data/MonthlySales_DuplicateData.csv"

# Read file and save as DataFrame
df = pd.read_csv(sales_data, header=0)
print('Original DataFrame of Input File\n',df)
```

CHECK DUPLICATE RECORDS

```
# Get all duplicate rows based on all columns
print('Duplicate records = ')
print(df[df.duplicated()])

# Get count of duplicate rows
print('\nCount of duplicate records = ',df.duplicated().sum())

# Get row count of data
count_row = df.shape[0]
print('\nNumber of records including duplicate records = ',count_row)
```

REMOVE DUPLICATE RECORDS

```
# % of duplicate rows
rec = 100*df.duplicated().sum()/count_row
print('\nPercentage of duplicate records = ',rec)

# Remove duplicate rows
df.drop_duplicates(inplace=True)

# Recheck duplicate rows
print('\nRecheck count of duplicate records after removal of duplicate records = 
',df.duplicated().sum())
```

MANAGE MISSING DATA

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MISSING DATA TREATMENT

REMOVE (OR **TRIM**) Missing Data

- The **dropna()** function is used to remove row having NaN or missing values.
- This method is advisable when very limited data has NaN. Removing missing data rows may lead to loss of information.

IMPUTE (or **REPLACE**) Missing Data

- Methods such as **mean()**, **median()** and **mode()** can be used on Dataframe for imputing missing values. However, choice of it depend on data distribution.
- Mean value is used to replace the missing value, when the data distribution is symmetric. Median or mode is used for skewed data distribution.
- Pandas Dataframe method **fillna()** can be used along with **mean()**, **median()** and **mode()** to replace the missing values.

REMOVE MISSING DATA

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READ FILE

```
# import pandas library
import pandas as pd

# Get the file path
data = "E:/Courses/Machine_Learning_Python/data/MonthlySales_MissingData.csv"

# Read the file and save as DataFrame
df = pd.read_csv(data, header=0)
print('Original DataFrame of input file',df)
```

COUNT MISSING (OR NONE) DATA

```
# Get count of missing values
print('Count of missing value in each column =')
print(df.isnull().sum())

# Calculate count of missing values
sum_NULL = df.isnull().sum()

# Calculate % of missing values
perc_NULL = (sum_NULL/df.isnull().count())*100
missing_data = pd.DataFrame({'Missing Data': sum_NULL,  '% Missing Data': perc_NULL})
print('\n% of missing values = \n')
print(missing_data)
```

REMOVE MISSING DATA

```
# Remove the rows where at least one element is missing
df.dropna()

# Get the count of missing values in each column
sum_NULL = df.isnull().sum()
print("\nCount of missing values in each column = ", sum_NULL)
print("\nNumber of rows before removing missing values = ", df.shape[0])
print("\nNumber of rows after removing missing values = ", df_new.shape[0])
print("\nNumber of rows removed = ", df.shape[0] - df_new.shape[0])
```

REPLACE OR IMPUTE MISSING DATA

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READ FILE

```
# import pandas library
import pandas as pd

# Get the file path
data = "E:/Courses/Machine_Learning_Python/data/MonthlySales_MissingData.csv"

# Read the file and save as DataFrame
df = pd.read_csv(data, header=0)
print('Original DataFrame of Input File\n',df)
```

COUNT MISSING DATA

```
# Get count of missing values
print('\nCount of missing value in each column =')
print(df.isnull().sum())

# Calculate count of missing values
sum_NULL = df.isnull().sum()

# Calculate % of missing values
perc_NULL = (sum_NULL/df.isnull().count())*100
missing_data = pd.DataFrame({'Missing Data': sum_NULL,  '% Missing Data': perc_NULL})
print('\n% of missing values = \n')
print(missing_data)
```

CALCULATE SKEWNESS & MEDIAN

```
# Calculate skewness of sales by skipping missing values
print('\nSkenwess = ',df['sales'].skew(skipna = True))

# Calculate median value
med = df['sales'].median()
print('\nMedian = ', med)
```

REPLACE MISSING DATA

```
# Fill NaN values in sales column by mean value or Replace missing value by mean
df['sales'] = df['sales'].fillna(med)

# Get the count of missing values in each column
print('\nCount of missing value in each column =')
print(df.isnull().sum())
```

MANAGE OUTLIERS

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READ FILE

```
# import pandas library
import pandas as pd

# Get file path
data = "E:/Courses/Machine_Learning_Python/data/MonthlySales_OutlierData.csv"

# Read file and save as DataFrame
df = pd.read_csv(data, header=0)
print('Original DataFrame of input file',df)
```

COUNT MISSING DATA

```
# Get count of missing values
print('\nCount of missing value in each column =')
print(df.isnull().sum())

# Calculate count of missing values
sum_NULL = df.isnull().sum()

# Calculate % of missing values
perc_NULL = (sum_NULL/df.isnull().count())*100
missing_data = pd.DataFrame({'Missing Data': sum_NULL,  '% Missing Data': perc_NULL})
print('\n% of missing values = \n')
print(missing_data)
```

CALCULATE SKEWNESS & MEDIAN

```
# Calculate skewness of sales by skipping missing values
print('\nSkenwess = ',df['sales'].skew(skipna = True))

# Calculate median value
med = df['sales'].median()
print('\nMedian = ', med)
```

REPLACE MISSING DATA

# Fill NaN values in sales column by mean value or Replace missing value by mean

```
df['sales'] = df['sales'].fillna(med)
```

# Get the count of missing values in each column

```
print('\nCount of missing value in each column =')
print(df.isnull().sum())
```

Z-Score can not be calculated, if any of the values is missing or NULL or NaN. If there is any missing value then it has to be removed before calculation of Z-Score.

Z-SCORE FOR OUTLIER DETECTION (1/2)

```
# Import numpy library
import numpy as np
# Import library to calculate z-score
from scipy import stats

# Calculate z-score
z_scores = stats.zscore(df['sales'])

# Get the absolute value of z-score
abs_z = np.abs(z_scores)
```

Z-SCORE FOR OUTLIER DETECTION (2/2)

```
# Create dataframe of absolute value of z-score
sp = pd.DataFrame(abs_z, columns=['z_score'])
print('\nValues of z-score = \n', sp)

# Print dataframe of outliers. Threshold value for outlies in above 3.
print('\nOutlier data \n', sp[abs_z > 3])
```

COMBINE Z-SCORE WITH ORIGINAL DATA

```
# Combine z-score data with original dataframe, and create new dataframe
df_col = pd.concat([df,sp], axis=1)
print('\nCombined dataframe \n', df_col)
```

IMPUTE OUTLIER WITH MEDIAN

```
# Calculate median value
med = df['sales'].median()
print('\nMedian = ', med)

# Replace outlier with median
df_col['sales'].mask((df_col['z_score'] > 3), med, inplace=True)
print('\nNew dataframe after ouliers are replaced with median. \n', df_col)
```

REMOVE Z-SCORE COLUMN FROM DATAFRAME

```
# Remove column name 'z_score'
df_col.drop(['z_score'], axis = 1)
```

QUESTION AND ANSWERS