Sklearn SimpleImputer Example – Impute Missing Data

```
In [188]: students = [[85, 'M', 'verygood'],
                      [95, 'F', 'excellent'],
                      [75, None, 'good'],
                      [np.NaN, 'M', 'average'],
                      [70, 'M', 'good'],
                      [np.NaN, None, 'verygood'],
                      [92, 'F', 'verygood'],
                      [98, 'M', 'excellent']]

In [189]: dfstd = pd.DataFrame(students)
          dfstd.columns = ['marks', 'gender', 'result']

In [190]: dfstd
```

Out[190]:

	marks	gender	result
0	85.0	M	verygood
1	95.0	F	excellent
2	75.0	None	good
3	NaN	M	average
4	70.0	M	good
5	NaN	None	verygood
6	92.0	F	verygood
7	98.0	M	excellent

Python's Sklearn SimpleImputer for imputing / replacing numerical & categorical missing data using different strategies.

Handling missing values is key part of data preprocessing and hence, it is of utmost importance for machine learning project

1. imputing / replacing numerical or categorical **missing values** with appropriate value based on appropriate strategies.

SimpleImputer

SimpleImputer is a class in the sklearn.impute module that can be used to replace missing values in a dataset, using a variety of input strategies.

SimpleImputer is designed to work with numerical data, but can also handle categorical data represented as strings.

SimpleImputer can be used as part of a scikit-learn Pipeline.

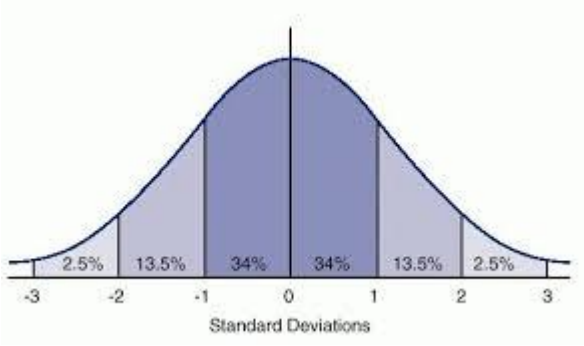
The default strategy is “mean”, which replaces missing values with the median value of the column.

Other options include

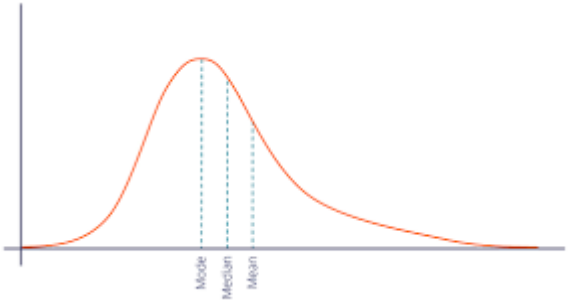
1. “most_frequent” (which replaces missing values with the most common value in the column)
2. “constant” (which replaces missing values with a constant value).
3. SimpleImputer can also be used to impute multiple columns at once by passing in a list of column names.
4. SimpleImputer will then replace missing values in all of the specified columns. When using SimpleImputer, it is important to consider whether or not imputing is the best option for your data.
5. In some cases, it may be better to drop rows or columns with missing values instead of imputing them.

SimpleImputer class is used to impute / replace the numerical or categorical missing data related to one or more features with appropriate values such as following:

- **Mean**: When SimpleImputer() is invoked without any arguments, it defaults to using the mean strategy. Missing values get replaced with the mean along each column. This strategy can only be used with numeric data.
  This strategy is better to use with proper normalize data.
  Useful when the missing data is < 5%



- **Median**: Missing values get replaced with the median along each column. This strategy can only be used with numeric data.
  If the normal distribution is skewed then use median



- **Most frequent (mode)**: Missing values get replaced with the most frequent value along each column. This strategy can be used with strings or numeric data.

- **Constant**: Missing values get replaced with the fill_value. This strategy canbe used with strings or numeric data.

Each of the above type represents **strategy** when creating an instance of SimpleImputer.

Python code sample representing the usage of SimpleImputor for replacing numerical missing value with the mean.
Create Dataframe representing marks, gender and result of students.

```
import pandas as pd
import numpy as np

students = [[85, 'M', 'verygood'],
            [95, 'F', 'excellent'],
            [75, None,'good'],
            [np.NaN, 'M', 'average'],
            [70, 'M', 'good'],
            [np.NaN, None, 'verygood'],
            [92, 'F', 'verygood'],
            [98, 'M', 'excellent']]

df = pd.DataFrame(students)
df.columns = ['marks', 'gender', 'result']
```

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In [188]: students = [[85, 'M', 'verygood'],
                      [95, 'F', 'excellent'],
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In [189]: dfstd = pd.DataFrame(students)
          dfstd.columns = ['marks', 'gender', 'result']

In [190]: dfstd
```

Out[190]:

	marks	gender	result
0	85.0	M	verygood
1	95.0	F	excellent
2	75.0	None	good
3	NaN	M	average
4	70.0	M	good
5	NaN	None	verygood
6	92.0	F	verygood
7	98.0	M	excellent

There are two columns / features (one numerical – marks, and another categorical – gender) which are having missing values and need to be imputed. In the code below, an instance of SimpleImputer is created with strategy as “mean”. The missing value is represented using NaN.

sklearn.impute package is used for importing **SimpleImputer** class.

- SimpleImputer takes two argument such as missing_values and strategy.
- fit_transform method is invoked on the instance of SimpleImputer to impute the missing values.

```
from sklearn.impute import SimpleImputer
#
# Missing values is represented using NaN and hence specified. If it
# is empty field, missing values will be specified as ''
#
imputer = SimpleImputer(missing_values=np.NaN, strategy='mean')

df.marks = imputer.fit_transform(df['marks'].values.reshape(-1,1))[:,0]

df
```

Here is how the output would look like. Note that missing value of marks is imputed / replaced with the mean value, 85.83333

```
In [187]: from sklearn.impute import SimpleImputer

          imputer = SimpleImputer(missing_values=np.NaN, strategy='mean')
          dfstd.marks = imputer.fit_transform(dfstd['marks'].values.reshape(-1,1))[:,0]
          dfstd
```

Out[187]:

	marks	gender	result
0	85.000000	M	verygood
1	95.000000	F	excellent
2	75.000000	F	None
3	85.833333	M	average
4	70.000000	M	good
5	85.833333	M	None
6	92.000000	F	verygood
7	98.000000	M	excellent

SimpleImputer for imputing Numerical Missing Data

For the numerical missing data, the following strategy can be used.

- Mean
- Median

- Most frequent (mode)
- Constant

The code example below represents the instantiation of SimpleImputer with appropriate strategies for imputing numerical missing data

```
#
# Imputing with mean value
#
imputer = SimpleImputer(missing_values=np.NaN, strategy='mean')
#
# Imputing with median value
#
imputer = SimpleImputer(missing_values=np.NaN,
strategy='median')
#
# Imputing with most frequent / mode value
#
imputer = SimpleImputer(missing_values=np.NaN,
strategy='most_frequent')
#
# Imputing with constant value; The command below replaces the
missing
# value with constant value such as 80
#
imputer = SimpleImputer(missing_values=np.NaN,
strategy='constant', fill_value=80)
```

SimpleImputer for imputing Categorical Missing Data

For handling categorical missing values, you could use one of the following strategies. However, it is the "most_frequent" strategy which is preferably used.

- Most frequent (strategy='most_frequent')
- Constant (strategy='constant', fill_value='someValue')

The code would look like when imputing missing value with strategy as **most_frequent**. In the code sample used, gender is having missing values. The missing value under gender column is replaced with 'M' which occurs most frequently.

```
from sklearn.impute import SimpleImputer

imputer = SimpleImputer(missing_values=None, strategy='most_frequent')
df.gender = imputer.fit_transform(dfstd['gender'].values.reshape(-
1,1))[:,0]
df
```

```
In [195]: from sklearn.impute import SimpleImputer

imputer = SimpleImputer(missing_values=None, strategy='most_frequent')
dfstd.gender = imputer.fit_transform(dfstd['gender'].values.reshape(-1,1))[:,0]
dfstd
```

Out[195]:

	marks	gender	result
0	85.0	M	verygood
1	95.0	F	excellent
2	75.0	M	good
3	NaN	M	average
4	70.0	M	good
5	NaN	M	verygood
6	92.0	F	verygood
7	98.0	M	excellent

when imputing missing value with strategy as **constant**. Note how the missing value under gender column is replaced with 'F' which is assigned using fill_value parameter.

```
from sklearn.impute import SimpleImputer

imputer = SimpleImputer(missing_values=None, strategy='constant',
fill_value='F')
df.gender = imputer.fit_transform(dfstd['gender'].values.reshape(-
1,1))[:,0]
dfstd
```

```
In [198]: from sklearn.impute import SimpleImputer

imputer = SimpleImputer(missing_values=None, strategy='constant', fill_value='F')
dfstd.gender = imputer.fit_transform(dfstd['gender'].values.reshape(-1,1))[:,0]
dfstd
```

Out[198]:

	marks	gender	result
0	85.0	M	verygood
1	95.0	F	excellent
2	75.0	F	good
3	NaN	M	average
4	70.0	M	good
5	NaN	F	verygood
6	92.0	F	verygood
7	98.0	M	excellent

Categorical missing values imputed with constant using SimpleImputer