PyAudit: Python Data Audit Library API

Wenqiang Feng and Ming Chen

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Welcome to our **PyAudit: Python Data Audit Library API**! The PDF version can be downloaded from HERE.

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PREFACE

Chinese proverb

Good tools are prerequisite to the successful execution of a job. – old Chinese proverb

1.1 About

1.1.1 About this API

This document is the `API` book for our PyAudit: Python Data Audit Library [PyAudit] API. The PDF version can be downloaded from HERE. **You may download and distribute it. Please be aware, however, that the note contains typos as well as inaccurate or incorrect description.**

The `API` assumes that the reader has a preliminary knowledge of `python` programing and `Linux`. And this document is generated automatically by using sphinx.

1.1.2 About the author

- **Wenqiang Feng**
    - Sr. Data Scientist and PhD in Mathematics
    - University of Tennessee at Knoxville
    - Webpage: http://web.utk.edu/~wfeng1/
    - Email: von198@gmail.com
- **Ming Chen**
    - Data Scientist and PhD in Genome Science and Technology
    - University of Tennessee at Knoxville

– Email: ming.chen0919@gmail.com

- **Biography**

  Wenqiang Feng is Data Scientist within DST's Applied Analytics Group. Dr. Feng's responsibilities include providing DST clients with access to cutting-edge skills and technologies, including Big Data analytic solutions, advanced analytic and data enhancement techniques and modeling.

  Dr. Feng has deep analytic expertise in data mining, analytic systems, machine learning algorithms, business intelligence, and applying Big Data tools to strategically solve industry problems in a cross-functional business. Before joining DST, Dr. Feng was an IMA Data Science Fellow at The Institute for Mathematics and its Applications (IMA) at the University of Minnesota. While there, he helped startup companies make marketing decisions based on deep predictive analytics.

  Dr. Feng graduated from University of Tennessee, Knoxville, with Ph.D. in Computational Mathematics and Master's degree in Statistics. He also holds Master's degree in Computational Mathematics from Missouri University of Science and Technology (MST) and Master's degree in Applied Mathematics from the University of Science and Technology of China (USTC).

- **Declaration**

  The work of Wenqiang Feng was supported by the IMA, while working at IMA. However, any opinion, finding, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the IMA, UTK and DST.

1.2 Feedback and suggestions

Your comments and suggestions are highly appreciated. I am more than happy to receive corrections, suggestions or feedbacks through email (Wenqiang Feng: von198@gmail.com and Ming Chen: ming.chen0919@gmail.com) for improvements.

HOW TO INSTALL

2.1 Clone the Repository

```
git clone https://github.com/runawayhorse001/PyAudit.git
```

2.2 Install

```
cd PyAudit
pip install -r requirements.txt
python setup.py install
```

2.3 Uninstall

```
pip uninstall statspy
```

2.4 Test

```
cd PyAudit/test
python test1.py
```

test1.py

```python
from PyAudit.basics import missing_rate, zero_rate, dtypes_class
from PyAudit.basics import feature_variance, freq_items_df, feature_len
from PyAudit.basics import numeric_summary
import pandas as pd
```

```python
d = {'A': [1, 0, None, 3],
     'B': [1, 0, 0, 0],
     'C': ['a', None, 'c', 'd']}

# create DataFrame
df = pd.DataFrame(d)
print(missing_rate(df))
print(zero_rate(df))
print(feature_variance(df))
print(df)
print(feature_len(df))
(num_fields, cat_fields, bool_fields, data_types, type_class) = dtypes_
 →class(df)
print(numeric_summary(df[num_fields]))


d ={
    'num': list('1223334444'),
    'cat': list('wxxyyyzzzz')
}
df = pd.DataFrame(d)
df = df.astype({"num": int, "cat": object})
print(freq_items_df(df, top_n=4))

# read df
df = pd.read_csv('Heart.csv', dtype={'Sex': bool})
print(df.head(5))
(num_fields, cat_fields, bool_fields, data_types, type_class) = dtypes_
 →class(df)

print(num_fields)
print(cat_fields)
print(bool_fields)
print(data_types)
print(type_class)
print(missing_rate(df))
#print(zero_rate(df))

print(freq_items_df(df, top_n=4))
print(feature_len(df))
print(numeric_summary(df[num_fields]))
```

Results:

```
  feature  missing_rate
0       A          0.25
1       B          0.00
2       C          0.25
  feature  zero_rate
0       A   0.333333
1       B   0.750000
2       C   0.000000
  feature  feature_variance
0       A               1.0
1       B               0.5
2       C               1.0
   Age    Sex      ChestPain  RestBP  Chol  ...  Oldpeak  Slope   Ca    ␣
↪    Thal  AHD
0   63   True        typical     145   233  ...      2.3      3  0.0    ␣
↪   fixed   No
1   67   True   asymptomatic     160   286  ...      1.5      2  3.0    ␣
↪  normal  Yes
2   67   True   asymptomatic     120   229  ...      2.6      2  2.0 ␣
↪reversable  Yes
3   37   True     nonanginal     130   250  ...      3.5      3  0.0    ␣
↪  normal   No
4   41  False     nontypical     130   204  ...      1.4      1  0.0    ␣
↪  normal   No

[5 rows x 14 columns]
['Age', 'RestBP', 'Chol', 'Fbs', 'RestECG', 'MaxHR', 'ExAng', 'Oldpeak
↪', 'Slope', 'Ca']
['ChestPain', 'Thal', 'AHD']
['Sex']
     feature   dtypes
0        Age    int64
1        Sex     bool
2   ChestPain  object
3     RestBP    int64
4       Chol    int64
5        Fbs    int64
6    RestECG    int64
7      MaxHR    int64
8      ExAng    int64
9    Oldpeak  float64
10     Slope    int64
11        Ca  float64
12      Thal   object
13       AHD   object
     feature   dtypes     class
```

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```
0         Age      int64    numeric
1         Sex       bool        bool
2   ChestPain     object   category
3      RestBP      int64    numeric
4        Chol      int64    numeric
5         Fbs      int64    numeric
6     RestECG      int64    numeric
7       MaxHR      int64    numeric
8       ExAng      int64    numeric
9     Oldpeak    float64    numeric
10      Slope      int64    numeric
11         Ca    float64    numeric
12       Thal     object   category
13        AHD     object   category
      feature  missing_rate
0         Age      0.000000
1         Sex      0.000000
2   ChestPain      0.000000
3      RestBP      0.000000
4        Chol      0.000000
5         Fbs      0.000000
6     RestECG      0.000000
7       MaxHR      0.000000
8       ExAng      0.000000
9     Oldpeak      0.000000
10      Slope      0.000000
11         Ca      0.013201
12       Thal      0.006601
13        AHD      0.000000

Process finished with exit code 0
```

Chapter 2. How to Install

PYTHON DATA AUDIT FUNCTIONS

3.1 `dtypes_class`

PyAudit.basics.**dtypes_class**(*df_in*)
>   numerical, categorical and bool name list in the DataFrame

>>   **Parameters** **df_in** – input pandas DataFrame

>>   **Returns** numerical, categorical and bool name list

>>   **Author** Wenqiang Feng and Ming Chen

>>   **Email** von198@gmail.com

```
>>> from PyAudit.basics import dtypes_class
>>> df = pd.read_csv('Heart.csv', dtype={'Sex': bool})
>>> (num_fields, cat_fields, bool_fields, data_types, type_class)
= dtypes_class(df)
>>> num_fields
['Age', 'RestBP', 'Chol', 'Fbs', 'RestECG', 'MaxHR', 'ExAng',
'Oldpeak', 'Slope', 'Ca']
```

3.2 `missing_rate`

PyAudit.basics.**missing_rate**(*df_in*)
>   calculate missing rate for each feature in the DataFrame

>>   **Parameters** **df_in** – input pandas DataFrame

>>   **Returns** missing rate

>>   **Author** Wenqiang Feng and Ming Chen

>>   **Email** von198@gmail.com

```
>>> import pandas as pd
>>> d = {'A': [1, 0, None, 3],
         'B': [1, 0, 0, 0],
         'C': ['a', None, 'c', 'd']}
>>> # create DataFrame
>>> df = pd.DataFrame(d)
>>> from PyAudit.basics import missing_rate
>>> missing_rate(df)
      feature  missing_rate
   0        A          0.25
   1        B          0.00
   2        C          0.25
```

3.3 `zero_rate`

PyAudit.basics.**zero_rate**(*df_in*)

    calculate the percentage of 0 value for each feature in the DataFrame

        Parameters `df_in` – input pandas DataFrame

        Returns zero rate

        Author Wenqiang Feng and Ming Chen

        Email von198@gmail.com

```
>>> import pandas as pd
>>> d = {'A': [1, 0, None, 3],
         'B': [1, 0, 0, 0],
         'C': ['a', None, 'c', 'd']}
>>> # create DataFrame
>>> df = pd.DataFrame(d)
>>> from PyAudit.basics import zero_rate
>>> zero_rate(df)
      feature  zero_rate
   0        A   0.333333
   1        B   0.750000
   2        C   0.000000
```

3.4 `feature_variance`

PyAudit.basics.**feature_variance**(*df_in*)

    calculate the variance for each feature

Parameters `df_in` – input pandas DataFrame

Returns feature variance

Author Wenqiang Feng and Ming Chen

Email von198@gmail.com

```
>>> import pandas as pd
>>> d = {'A': [1, 0, None, 3],
         'B': [1, 0, 0, 0],
         'C': ['a', None, 'c', 'd']}
>>> # create DataFrame
>>> df = pd.DataFrame(d)
>>> from PyAudit.basics import zero_rate
>>> zero_rate(df)
      feature   feature_variance
    0       A                1.0
    1       B                0.5
    2       C                1.0
```

3.5 `freq_items_df`

PyAudit.basics.**freq_items_df**(*df_in*, *top_n=3*)
    find out the top n values and the corresponding frequency for each feature

Parameters

- `df_in` – input pandas DataFrame

- `top_n` – the number of the top values

Returns top n values and the corresponding frequency for each feature

```
>>> d ={
>>>     'num': list('1223334444'),
>>>     'cat': list('wxxyyyzzzz')
>>>     }
>>> df = pd.DataFrame(d)
>>> df = df.astype({"num": int, "cat": object})
>>> print(freq_items_df(df, top_n=4))
    feature      top_items       top_freqs
  0     num   [4, 3, 2, 1]   [4, 3, 2, 1]
  1     cat   [z, y, x, w]   [4, 3, 2, 1]
```

3.6 `feature_len`

PyAudit.basics.**feature_len**(*df_in*)
    find out the min and max length of values for each feature

> **Parameters df_in** – input pandas DataFrame

> **Returns** min and max length DataFrame

```
>>> d = {'A': [1, 0, None, 3],
>>>      'B': [1, 0, 0, 0],
>>>      'C': ['a', None, 'c', 'd']}
>>> # create DataFrame
>>> df = pd.DataFrame(d)
>>> print(df)
        A   B      C
    0  1.0  1      a
    1  0.0  0   None
    2  NaN  0      c
    3  3.0  0      d
>>> print(feature_len(df))
    feature  min_length  max_length
  0       A           3           3
  1       B           1           1
  2       C           1           4
```

3.7 `numeric_summary`

PyAudit.basics.**numeric_summary**(*df_in*, *deciles=False*)
    generate statistical summary for numerical DateFrame

> **Parameters**
>
> > • **df_in** –
> >
> > • **deciles** – flag for percentiles style

> **Returns** statistical summary for numerical data

```
>>> d = {'A': [1, 0, None, 3],
>>>      'B': [1, 0, 0, 0],
>>>      'C': ['a', None, 'c', 'd']}
>>> # create DataFrame
>>> df = pd.DataFrame(d)
>>> (num_fields, cat_fields, bool_fields, data_types, type_class)
↪= dtypes_class(df)
```

```
>>> print(numeric_summary(df[num_fields]))
  feature  min       percentiles  max  ...        std  lower_95_ci ␣
↪upper_95_ci  sum
0       A  0.0   [0.5, 1.0, 2.0]  3.0  ...  1.527525    -0.395224 ␣
↪   3.061891  4.0
1       B  0.0  [0.0, 0.0, 0.25]  1.0  ...  0.500000    -0.240000 ␣
↪   0.740000  1.0
```

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DEMOS

This is a usage of *PyAudit.basics.dtypes_class()*:

For example:

```
>>> from PyAudit.basics import missing_rate, zero_rate, dtypes_class
>>> df = pd.read_csv('Heart.csv', dtype={'Sex': bool})
>>> (num_fields, cat_fields, bool_fields, data_types, type_class) =
↪dtypes_class(df)
['Age', 'RestBP', 'Chol', 'Fbs', 'RestECG', 'MaxHR', 'ExAng', 'Oldpeak
↪', 'Slope', 'Ca']
['ChestPain', 'Thal', 'AHD']
['Sex']
      feature   dtypes
0         Age    int64
1         Sex     bool
2   ChestPain   object
3      RestBP    int64
4        Chol    int64
5         Fbs    int64
6     RestECG    int64
7       MaxHR    int64
8       ExAng    int64
9     Oldpeak  float64
10      Slope    int64
11         Ca  float64
12       Thal   object
13        AHD   object
      feature   dtypes     class
0         Age    int64   numeric
1         Sex     bool      bool
2   ChestPain   object  category
3      RestBP    int64   numeric
4        Chol    int64   numeric
5         Fbs    int64   numeric
```

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```
6      RestECG    int64    numeric
7       MaxHR    int64    numeric
8       ExAng    int64    numeric
9      Oldpeak  float64    numeric
10      Slope    int64    numeric
11         Ca  float64    numeric
12       Thal   object   category
13        AHD   object   category
```

This is a usage of *PyAudit.basics.feature_variance()*:

For example:

```
      .,,.
    ,;;*;;;;,
   .-'``;-');;.
  /'  .-.  /*;;
 .'    \d    \;;                   .;;;,
/ o      `    \;          ,__.     ,;*;;;*;,
\__, _.__,'   \_.-') __)--.;;;;;*;;;;,
 `""`;;;\       /-')_) __)  `\' ';;;;;;
    ;*;;;       -') `)_)  |\ |   ;;;;*;
    ;;;;|        `---`    O | |   ;;*;;;
    *;*;\|                 O / ;;;;;*
   ;;;;;/|    .------------\       /  ;*;;;;;
  ;;;*;/ \    |            '.   (`. ;;;*;;;
  ;;;;;'. ;   |             )    \ | ;;;;;;
  ,;*;;;;\/   |.           /    /` | ';;;*;
   ;;;;;;/    |/          /    /__/   ';;;
   '*wf*/     |          /    |       ;*;
       `""""`          `""""`      ;'
```

MAIN REFERENCE

BIBLIOGRAPHY

[PyAudit] Wenqiang Feng and Ming Chen. Python Data Audit Library API, 2019.

PYTHON MODULE INDEX

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