Lecture 8

May 24, 2023

1 Statistics

1.1 Importing necessary libraries

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

1.2 Load dataset

[2]:
```
data = sns.load_dataset('tips')
```

[3]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 244 entries, 0 to 243
Data columns (total 7 columns):
 #   Column      Non-Null Count  Dtype   
---  ------      --------------  -----   
 0   total_bill  244 non-null    float64 
 1   tip         244 non-null    float64 
 2   sex         244 non-null    category
 3   smoker      244 non-null    category
 4   day         244 non-null    category
 5   time        244 non-null    category
 6   size        244 non-null    int64   
dtypes: category(4), float64(2), int64(1)
memory usage: 7.4 KB
```

[4]:
```
data.shape
```

[4]:
```
(244, 7)
```

1.3 Measure of central tendency - Mean, Median and Mode

[5]:
```
data.mean()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/531903386.py:1:
FutureWarning: The default value of numeric_only in DataFrame.mean is
deprecated. In a future version, it will default to False. In addition,
specifying 'numeric_only=None' is deprecated. Select only valid columns or
specify the value of numeric_only to silence this warning.
  data.mean()
```

[5]:
```
total_bill    19.785943
tip            2.998279
size           2.569672
dtype: float64
```

[6]:
```
data.median()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/4184645713.py:1:
FutureWarning: The default value of numeric_only in DataFrame.median is
deprecated. In a future version, it will default to False. In addition,
specifying 'numeric_only=None' is deprecated. Select only valid columns or
specify the value of numeric_only to silence this warning.
  data.median()
```

[6]:
```
total_bill    17.795
tip            2.900
size           2.000
dtype: float64
```

[7]:
```
data.mode()
```

[7]:

	total_bill	tip	sex	smoker	day	time	size
0	13.42	2.0	Male	No	Sat	Dinner	2

1.4 Skewness

[8]:
```
data.skew()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/1188251951.py:1:
FutureWarning: The default value of numeric_only in DataFrame.skew is
deprecated. In a future version, it will default to False. In addition,
specifying 'numeric_only=None' is deprecated. Select only valid columns or
specify the value of numeric_only to silence this warning.
  data.skew()
```

[8]:
```
total_bill    1.133213
tip           1.465451
size          1.447882
dtype: float64
```

1.5 Distribution plot

[9]:
```
sns.distplot(data['tip'])
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/1692055996.py:1:
UserWarning:

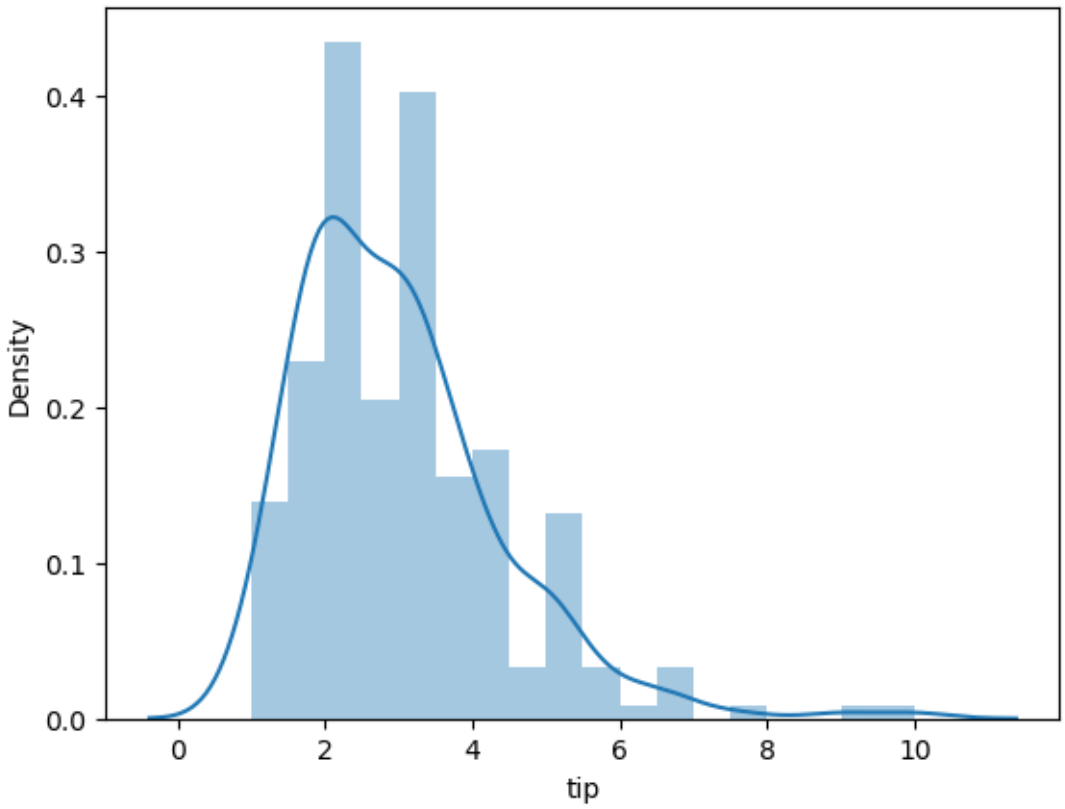
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(data['tip'])
```

[9]: <Axes: xlabel='tip', ylabel='Density'>



[10]:
```
sns.distplot(data['total_bill'], color = 'b')
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/3112811999.py:1:
```

```
UserWarning:

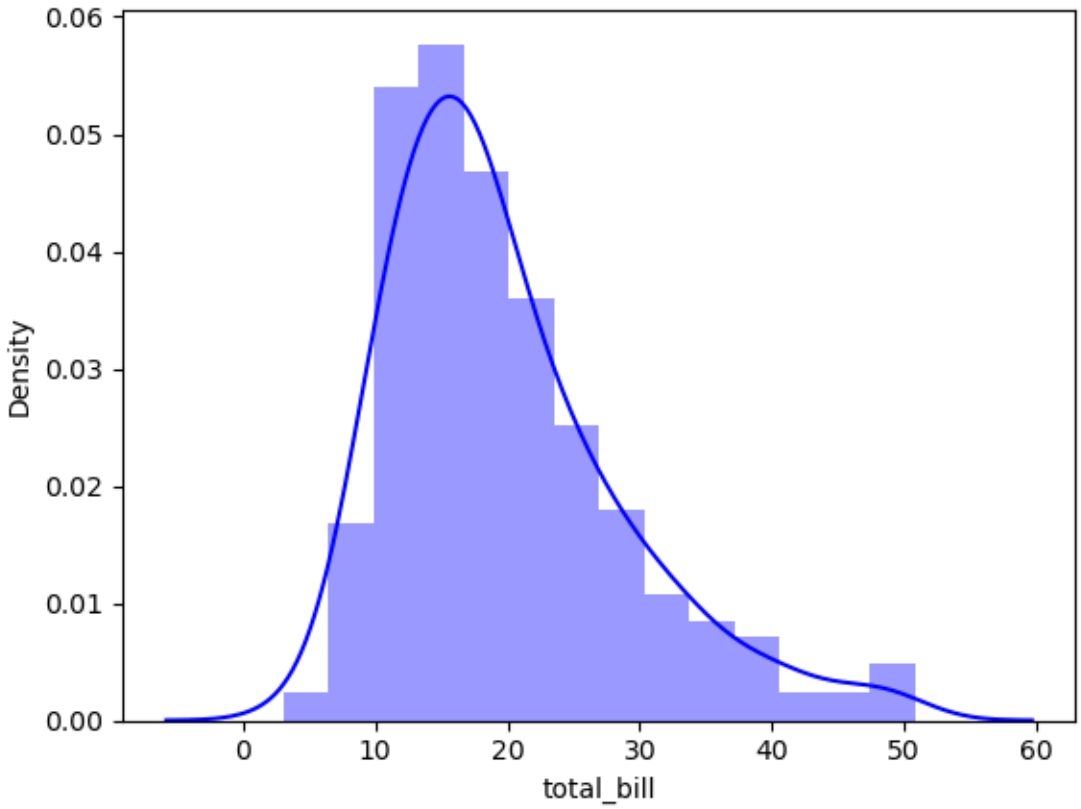
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(data['total_bill'], color = 'b')
```

[10]: <Axes: xlabel='total_bill', ylabel='Density'>



1.6 Kurtosis

[11]:
```
data.kurt()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/2907027414.py:1:
FutureWarning: The default value of numeric_only in DataFrame.kurt is
deprecated. In a future version, it will default to False. In addition,
specifying 'numeric_only=None' is deprecated. Select only valid columns or
```

```
specify the value of numeric_only to silence this warning.
  data.kurt()
```

[11]:
```
total_bill    1.218484
tip           3.648376
size          1.731700
dtype: float64
```

1.7 Range

[12]:
```
data.max()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/2904433368.py:1:
FutureWarning: The default value of numeric_only in DataFrame.max is deprecated.
In a future version, it will default to False. In addition, specifying
'numeric_only=None' is deprecated. Select only valid columns or specify the
value of numeric_only to silence this warning.
  data.max()
```

[12]:
```
total_bill    50.81
tip           10.00
size           6.00
dtype: float64
```

[13]:
```
data.min()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/927168777.py:1:
FutureWarning: The default value of numeric_only in DataFrame.min is deprecated.
In a future version, it will default to False. In addition, specifying
'numeric_only=None' is deprecated. Select only valid columns or specify the
value of numeric_only to silence this warning.
  data.min()
```

[13]:
```
total_bill    3.07
tip           1.00
size          1.00
dtype: float64
```

[14]:
```
Range = data.max() - data.min()
print(Range)
```

```
total_bill    47.74
tip            9.00
size           5.00
dtype: float64
```

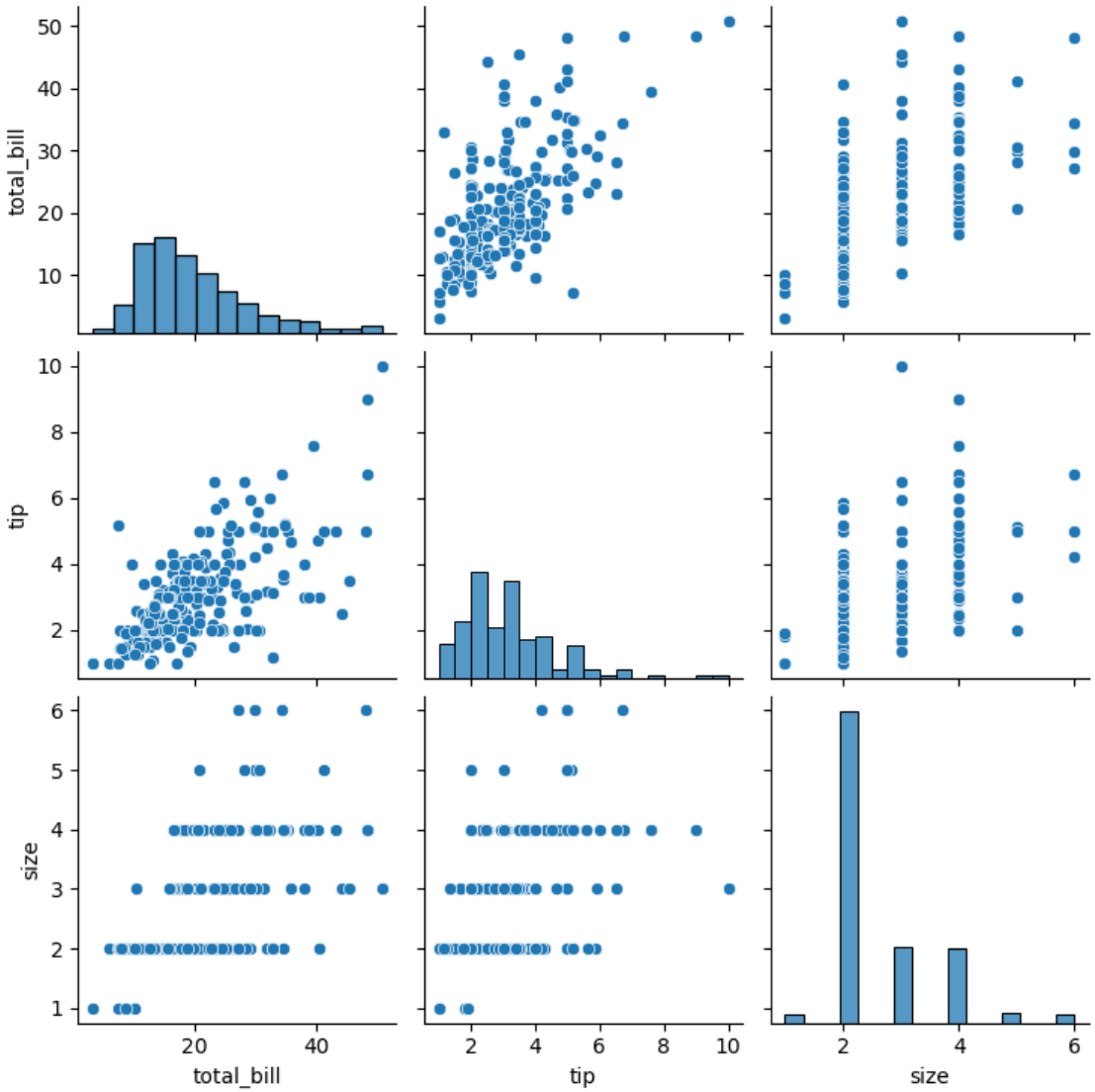
```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/2656667832.py:1:
FutureWarning: The default value of numeric_only in DataFrame.max is deprecated.
In a future version, it will default to False. In addition, specifying
'numeric_only=None' is deprecated. Select only valid columns or specify the
```

```
value of numeric_only to silence this warning.
  Range = data.max() - data.min()
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/2656667832.py:1:
FutureWarning: The default value of numeric_only in DataFrame.min is deprecated.
In a future version, it will default to False. In addition, specifying
'numeric_only=None' is deprecated. Select only valid columns or specify the
value of numeric_only to silence this warning.
  Range = data.max() - data.min()
```

1.8 Pairplot

[15]:
```
sns.pairplot(data)
```

[15]:
```
<seaborn.axisgrid.PairGrid at 0x130d38250>
```



1.9 Interquartile range

[16]:
```
quantiles = data.quantile(q=[0.75, 0.25])
quantiles
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/2995186764.py:1:
FutureWarning: The default value of numeric_only in DataFrame.quantile is
deprecated. In a future version, it will default to False. Select only valid
columns or specify the value of numeric_only to silence this warning.
  quantiles = data.quantile(q=[0.75, 0.25])
```

[16]:

	total_bill	tip	size
0.75	24.1275	3.5625	3.0
0.25	13.3475	2.0000	2.0

[17]:
```
#Q3
quantiles.iloc[0]
```

[17]:
```
total_bill    24.1275
tip            3.5625
size           3.0000
Name: 0.75, dtype: float64
```

[18]:
```
#Q1
quantiles.iloc[1]
```

[18]:
```
total_bill    13.3475
tip            2.0000
size           2.0000
Name: 0.25, dtype: float64
```

[19]:
```
IQR = quantiles.iloc[0]-quantiles.iloc[1]
IQR
```

[19]:
```
total_bill    10.7800
tip            1.5625
size           1.0000
dtype: float64
```

1.10 Upper extreme

Q3 + 1.5*IQR

[20]:
```
quantiles.iloc[0] + (1.5*IQR)
```

[20]:
```
total_bill    40.29750
tip            5.90625
```

```
size           4.50000
dtype: float64
```

1.11 Lower extreme

Q1 - 1.5*IQR

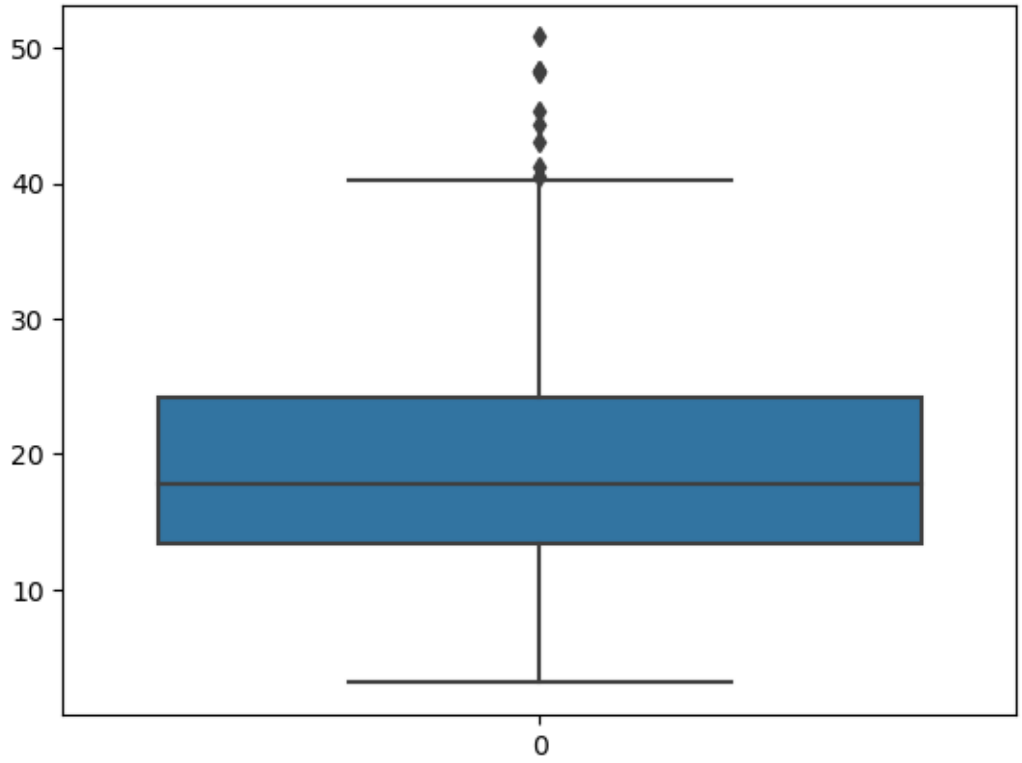
[21]:
```
quantiles.iloc[1] - (1.5*IQR)
```

[21]:
```
total_bill   -2.82250
tip          -0.34375
size          0.50000
dtype: float64
```

1.12 Boxplot

[22]:
```
sns.boxplot(data['total_bill'])
```

[22]:
```
<Axes: >
```



1.13 Standard deviation

[23]:
```
data.std()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/2723740006.py:1:
FutureWarning: The default value of numeric_only in DataFrame.std is deprecated.
In a future version, it will default to False. In addition, specifying
'numeric_only=None' is deprecated. Select only valid columns or specify the
value of numeric_only to silence this warning.
  data.std()
```

[23]:
```
total_bill    8.902412
tip           1.383638
size          0.951100
dtype: float64
```

1.14 Variance

[24]:
```
data.var()
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/445316826.py:1:
FutureWarning: The default value of numeric_only in DataFrame.var is deprecated.
In a future version, it will default to False. In addition, specifying
'numeric_only=None' is deprecated. Select only valid columns or specify the
value of numeric_only to silence this warning.
  data.var()
```

[24]:
```
total_bill    79.252939
tip            1.914455
size           0.904591
dtype: float64
```

1.15 Scaling

[25]:
```
from sklearn.preprocessing import StandardScaler
scale = StandardScaler()
```

[26]:
```
x = data[['tip', 'total_bill']]
```

[27]:
```
x.head()
```

[27]:

	tip	total_bill
0	1.01	16.99
1	1.66	10.34
2	3.50	21.01
3	3.31	23.68
4	3.61	24.59

[28]:
```
st_scale = scale.fit_transform(x)
st_scale
```

[28]:
```
array([[-1.43994695e+00, -3.14711305e-01],
       [-9.69205340e-01, -1.06323531e+00],
       [ 3.63355539e-01,  1.37779900e-01],
       [ 2.25754144e-01,  4.38315103e-01],
       [ 4.43019505e-01,  5.40744704e-01],
       [ 1.23965916e+00,  6.19536705e-01],
       [-7.22971264e-01, -1.23995452e+00],
       [ 8.81527488e-02,  7.98507107e-01],
       [-7.51939979e-01, -5.34203307e-01],
       [ 1.67816714e-01, -5.63468908e-01],
       [-9.32994446e-01, -1.07111451e+00],
       [ 1.44968234e+00,  1.74175992e+00],
       [-1.03438495e+00, -4.91430507e-01],
       [ 1.24660453e-03, -1.52624903e-01],
       [ 1.57309619e-02, -5.57840908e-01],
       [ 6.67527044e-01,  2.01939101e-01],
       [-9.61963161e-01, -1.06436091e+00],
       [ 5.15441291e-01, -3.93503306e-01],
       [ 3.63355539e-01, -3.16962505e-01],
       [ 2.54722859e-01,  9.72582994e-02],
       [ 7.83401903e-01, -2.10030504e-01],
       [-1.79807863e-01,  5.67366990e-02],
       [-5.56401155e-01, -4.52034507e-01],
       [ 3.31816444e+00,  2.21000952e+00],
       [ 1.31605821e-01,  3.83349840e-03],
       [-4.76737189e-01, -2.22412104e-01],
       [-7.22971264e-01, -7.22178510e-01],
       [-7.22971264e-01, -7.98719310e-01],
       [ 9.42729834e-01,  2.15446301e-01],
       [ 1.24660453e-03, -1.53017018e-02],
       [-1.12129109e+00, -1.15215771e+00],
       [-3.60862330e-01, -1.61629703e-01],
       [ 1.24660453e-03, -5.31952107e-01],
       [-3.97073223e-01,  1.01760699e-01],
       [ 1.96785429e-01, -2.25788904e-01],
       [ 4.35777326e-01,  4.81087904e-01],
       [-7.22971264e-01, -3.91252106e-01],
       [ 5.19418554e-02, -3.21464905e-01],
       [-4.98463725e-01, -1.23359303e-01],
       [ 1.44968234e+00,  1.29264551e+00],
       [-5.49158976e-01, -4.21643306e-01],
       [-3.31893615e-01, -2.61808105e-01],
       [ 4.46996767e-02, -6.58019309e-01],
       [-1.21543942e+00, -1.13752491e+00],
```

```
[ 1.88421306e+00,  1.19471831e+00],
[ 1.24660453e-03, -1.68383303e-01],
[ 1.44968234e+00,  2.75103101e-01],
[ 2.17390021e+00,  1.41983831e+00],
[-6.86760371e-01,  9.86482309e-01],
[ 1.24660453e-03, -1.96523304e-01],
[-3.60862330e-01, -8.15603311e-01],
[-2.88440543e-01, -1.06886331e+00],
[ 1.59452592e+00,  1.69110792e+00],
[-1.04162713e+00, -1.10825931e+00],
[ 9.71698549e-01,  6.49927905e-01],
[ 3.70597718e-01, -3.33113020e-02],
[ 1.24660453e-03,  2.05129992e+00],
[-1.08508020e+00,  7.45603907e-01],
[-8.96783553e-01, -9.61931312e-01],
[ 2.70257926e+00,  3.20616553e+00],
[ 1.53332357e-01,  5.67366990e-02],
[-7.22971264e-01, -6.72652109e-01],
[-7.37455622e-01, -9.86694512e-01],
[ 5.51652185e-01, -1.68383303e-01],
[-2.59471828e-01, -2.47175304e-01],
[ 1.09879285e-01,  3.30990987e-02],
[-3.82588866e-01, -3.75493706e-01],
[-1.44718913e+00, -1.88154652e+00],
[-7.15729086e-01,  4.99830989e-02],
[-6.57791656e-01, -5.37580108e-01],
[-7.44697800e-01, -8.74134511e-01],
[ 1.24660453e-03, -3.05706505e-01],
[ 1.02637106e-01,  7.96255907e-01],
[ 1.44968234e+00,  6.18411105e-01],
[-5.78127691e-01, -5.69096908e-01],
[-1.26613467e+00, -1.04410011e+00],
[ 5.91840340e-02, -2.10030504e-01],
[ 7.25464473e-01,  8.34526308e-01],
[ 1.24660453e-03,  3.34759902e-01],
[-2.08776577e-01, -2.80943305e-01],
[ 1.24660453e-03, -3.89393021e-02],
[ 2.90933752e-01, -3.51856105e-01],
[-8.46088302e-01, -1.09362651e+00],
[ 1.44968234e+00,  1.45135511e+00],
[-7.01244728e-01, -4.28396906e-01],
[ 1.57279938e+00,  1.69335912e+00],
[-7.22971264e-01, -7.60448910e-01],
[ 7.25464473e-01, -1.69508903e-01],
[ 2.06526753e+00,  5.54251904e-01],
[ 1.24660453e-03,  1.54663900e-01],
[ 1.24660453e-03,  1.03375751e+00],
```

```
[ 3.63355539e-01,  3.04368702e-01],
[-1.44718913e+00, -1.57988572e+00],
[ 9.42729834e-01, -3.90126506e-01],
[ 1.82301072e-01,  3.33634302e-01],
[ 1.25414352e+00,  2.29442952e+00],
[ 7.25464473e-01,  8.43531108e-01],
[-1.08508020e+00, -8.73008911e-01],
[ 1.24660453e-03,  1.37779900e-01],
[-1.08508020e+00, -8.24608111e-01],
[-3.60862330e-01, -9.49549712e-01],
[ 1.24660453e-03, -4.95932907e-01],
[-3.60862330e-01,  2.75930233e+00],
[ 3.48871182e-01,  2.96489502e-01],
[ 7.83401903e-01,  1.27649500e-01],
[-9.83689697e-01, -4.98184107e-01],
[ 7.68917546e-01,  7.92486992e-02],
[ 9.35487655e-01,  6.10531905e-01],
[ 5.51652185e-01, -1.74011304e-01],
[ 7.25464473e-01, -6.16372108e-01],
[ 1.24660453e-03, -6.51265709e-01],
[-1.44718913e+00, -1.41104572e+00],
[ 7.25464473e-01,  2.05805352e+00],
[-3.24651436e-01,  4.68706304e-01],
[ 7.25464473e-01,  6.66811906e-01],
[ 3.63355539e-01, -2.78692105e-01],
[ 1.50037759e+00,  1.14181511e+00],
[-1.08508020e+00, -1.02834171e+00],
[-8.67814838e-01, -8.27984911e-01],
[-5.66908250e-02,  4.83339104e-01],
[-4.98463725e-01, -9.11279312e-01],
[-9.54720982e-01, -7.16550509e-01],
[-3.60862330e-01, -6.22000108e-01],
[-7.22971264e-01, -4.31773706e-01],
[-3.46377973e-01, -8.22356911e-01],
[ 8.70308047e-01,  1.12718231e+00],
[-1.09956456e+00, -1.26809452e+00],
[-7.22971264e-01, -5.92734508e-01],
[-7.22971264e-01, -9.46172912e-01],
[-5.92612048e-01,  3.41513502e-01],
[-1.08508020e+00, -7.94609025e-02],
[-1.21870433e-01,  5.44854990e-02],
[-1.08508020e+00, -9.69810512e-01],
[-7.22971264e-01, -8.47120111e-01],
[ 1.82301072e-01, -1.71760104e-01],
[-1.26613467e+00, -1.26922012e+00],
[-7.22971264e-01, -1.06436091e+00],
[-7.22971264e-01, -6.34381709e-01],
```

```
[-7.22971264e-01, -4.26145706e-01],
[-1.79807863e-01, -7.45816110e-01],
[ 3.63355539e-01, -2.60682504e-01],
[ 2.68085272e+00,  1.63370232e+00],
[ 1.44968234e+00,  2.40924072e+00],
[ 1.44968234e+00,  8.17642307e-01],
[-5.05705904e-01, -3.77744906e-01],
[-1.08508020e+00, -1.28722972e+00],
[-1.18647070e+00, -1.28987303e-01],
[-9.90931876e-01, -8.91018511e-01],
[-9.18510089e-01, -1.12626891e+00],
[-7.22971264e-01, -1.38178012e+00],
[-3.60862330e-01, -6.43386509e-01],
[-7.22971264e-01, -7.49192910e-01],
[-1.87050041e-01, -2.84320105e-01],
[-7.22971264e-01,  5.36242304e-01],
[-7.22971264e-01, -1.79450166e-03],
[ 1.55107284e+00,  1.13281031e+00],
[ 1.44968234e+00,  3.19490953e+00],
[ 5.44410006e-01,  5.86894305e-01],
[-2.81198364e-01, -7.19927310e-01],
[-7.22971264e-01, -3.70991306e-01],
[ 3.63355539e-01,  1.92934300e-01],
[-3.60862330e-01, -8.02096110e-01],
[-7.22971264e-01, -4.02508106e-01],
[-7.22971264e-01, -6.72652109e-01],
[ 1.24660453e-03, -2.56180104e-01],
[ 3.48871182e-01,  5.32865504e-01],
[-5.49158976e-01,  1.09639900e-01],
[ 1.08757341e+00,  1.34217191e+00],
[-1.00541623e+00, -1.03509531e+00],
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[ 3.99566432e-01,  1.67084712e+00],
[ 4.93714755e-01,  1.67309832e+00],
[ 1.92042396e+00,  3.98919103e-01],
[ 3.63355539e-01,  2.87749033e+00],
[ 2.53600915e+00,  3.80909503e-01],
[ 1.24660453e-03,  2.33720232e+00],
```

```
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[ 3.63355539e-01,  1.25398300e-01],
[-7.22971264e-01,  1.20147191e+00],
[ 3.63355539e-01, -1.84141704e-01],
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[ 7.25464473e-01, -3.60860906e-01],
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[-7.22971264e-01, -7.63825710e-01],
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[ 1.24660453e-03,  2.13234312e+00],
[-7.01244728e-01,  5.04725504e-01],
[-5.56401155e-01, -7.90840110e-01],
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[ 4.34655382e+00,  3.21291913e+00],
[-3.60862330e-01, -7.33434510e-01],
[ 2.53600915e+00,  9.43709509e-01],
[-1.37476735e+00, -7.75081710e-01],
[ 1.24660453e-03,  9.41458309e-01],
[-1.08508020e+00, -9.22535312e-01],
[-1.12853327e+00, -1.35589132e+00],
[ 6.64262127e-02,  1.16545271e+00],
[-5.78127691e-01, -8.58376111e-01],
[ 3.48871182e-01, -7.16550509e-01],
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[ 1.24660453e-03, -4.28396906e-01],
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```

```
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       [-1.26613467e+00, -1.09362651e+00],
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       [-1.32407210e+00,  1.46823911e+00],
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       [ 2.11596278e+00,  1.04051111e+00],
       [-7.22971264e-01,  8.32275107e-01],
       [-7.22971264e-01,  3.24629502e-01],
       [-9.04025732e-01, -2.21286504e-01],
       [ 1.24660453e-03, -1.13228903e-01]])
```

1.16 Normalization

[29]:
```
from sklearn.preprocessing import MinMaxScaler
minmaxscale = MinMaxScaler()
```

[30]:
```
norm_scale = minmaxscale.fit_transform(x)
norm_scale
```

[30]:
```
array([[0.00111111, 0.29157939],
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```

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```

```
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       [0.22222222, 0.32907415]])
```

1.17 Robust Scaler

[31]:
```
from sklearn.preprocessing import RobustScaler
robustscale = RobustScaler()
```

[32]:
```
rob_scale = robustscale.fit_transform(x)
rob_scale
```

[32]:
```
array([[-1.20960000e+00, -7.46753247e-02],
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       [ 4.54400000e-01,  6.30333952e-01],
       [ 1.15840000e+00,  6.95269017e-01],
       [-5.76000000e-01, -8.37198516e-01],
       [ 1.40800000e-01,  8.42764378e-01],
```

```
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[ 7.68000000e-02, -2.75046382e-01],
[ 6.52800000e-01,  3.51113173e-01],
[-7.87200000e-01, -6.92486085e-01],
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[ 3.84000000e-01, -7.65306122e-02],
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[ 7.55200000e-01,  1.15955473e-02],
[-9.60000000e-02,  2.31447124e-01],
[-4.28800000e-01, -1.87847866e-01],
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[ 1.79200000e-01,  1.87847866e-01],
[-3.58400000e-01,  1.39146568e-03],
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[-5.76000000e-01, -4.73562152e-01],
[ 8.96000000e-01,  3.62244898e-01],
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[-2.30400000e-01, -3.10760668e-02],
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[ 1.72800000e+00,  1.16929499e+00],
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[ 1.34400000e+00,  4.11410019e-01],
[ 1.98400000e+00,  1.35482375e+00],
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[ 9.21600000e-01,  7.20315399e-01],
```

```
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[-8.96000000e-01, -5.34786642e-01],
[ 6.40000000e-02,  2.98237477e-01],
[-8.96000000e-01, -4.94897959e-01],
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[ 6.40000000e-02, -2.24025974e-01],
```

```
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```

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[ 1.34400000e+00,  2.81771800e+00],
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```

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[ 1.13280000e+00,  1.67300557e+00],
[ 1.93280000e+00,  1.04220779e+00],
[-5.76000000e-01,  8.70593692e-01],
[-5.76000000e-01,  4.52226345e-01],
[-7.36000000e-01,  2.31910946e-03],
```

```
       [ 6.40000000e-02,  9.13729128e-02]])
```

1.18 Distribution

1.18.1 Uniform distribution

[33]:
```
rand = np.random.rand(1000)
sns.distplot(rand)
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/3868814289.py:2:
UserWarning:

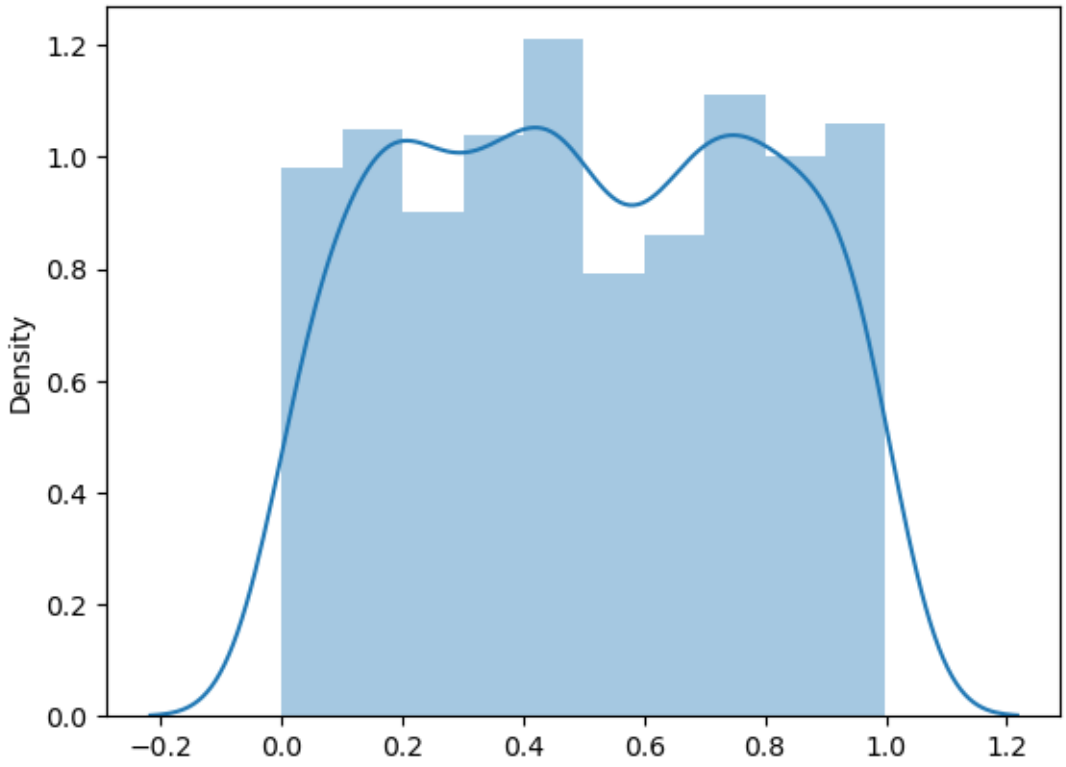
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(rand)
```

[33]: `<Axes: ylabel='Density'>`



1.18.2 Exponential distribution

[34]:
```
sns.distplot(np.log(rand))
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/1300547632.py:1:
UserWarning:

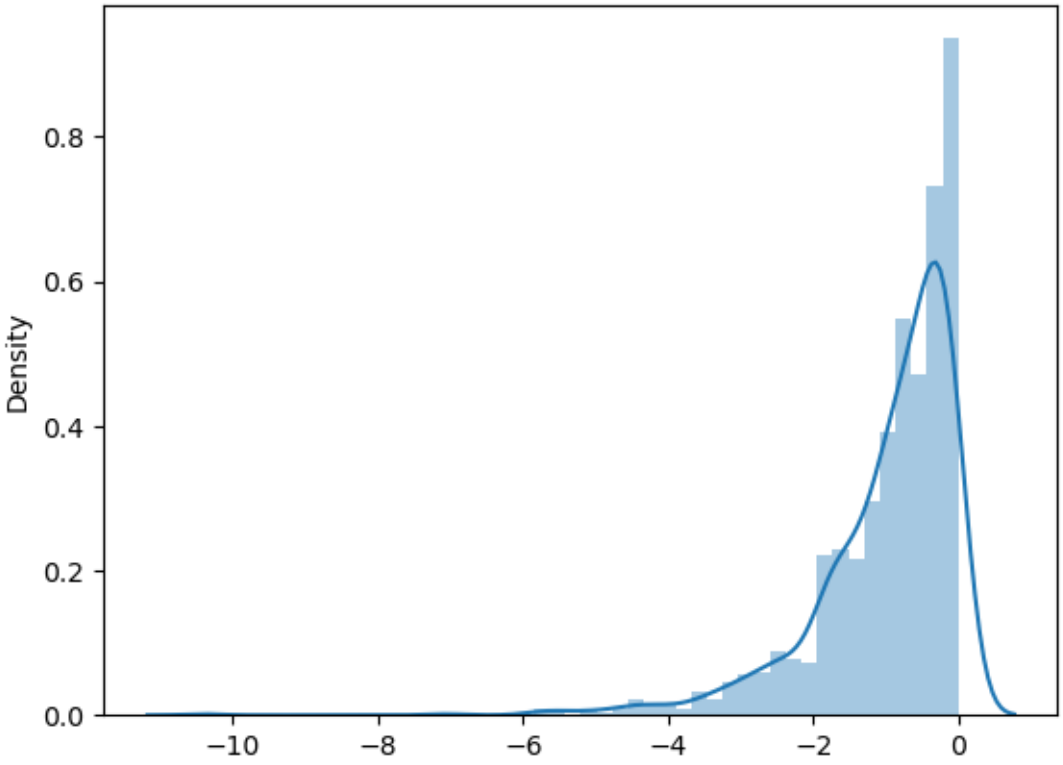
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(np.log(rand))
```

[34]:
```
<Axes: ylabel='Density'>
```



1.18.3 Normal distribution

[35]:
```
sns.distplot(data.total_bill)
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/805800272.py:1:
UserWarning:

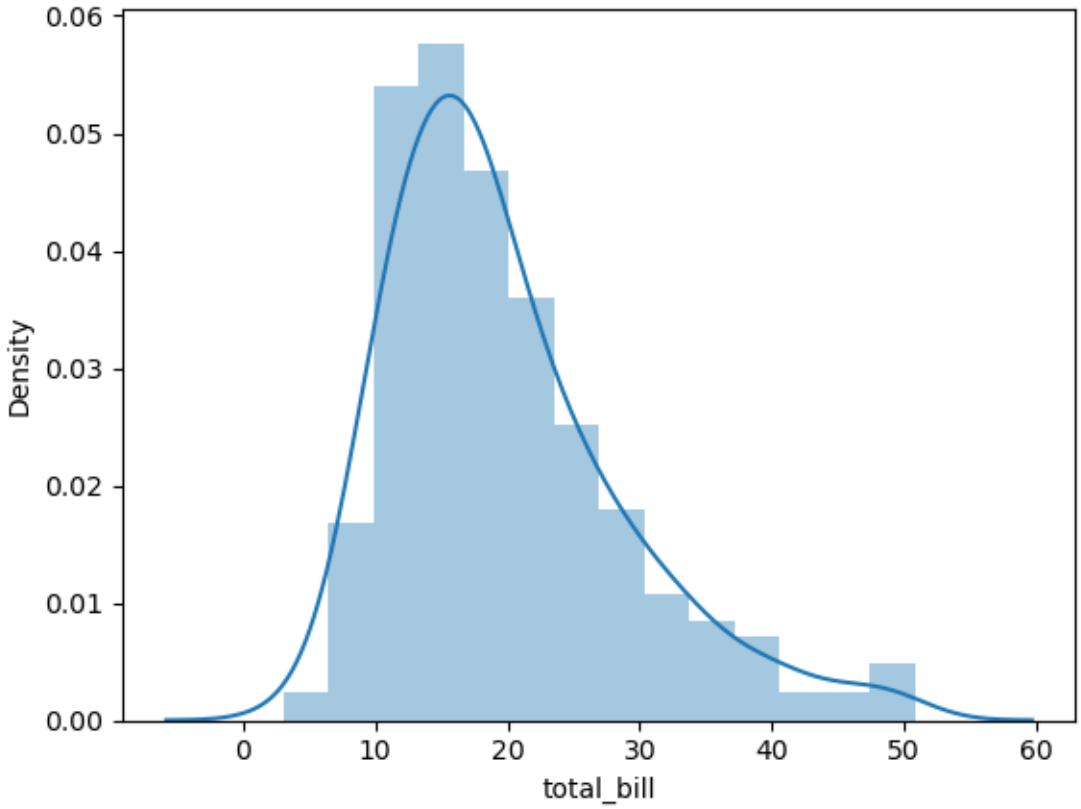
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(data.total_bill)
```

[35]:
```
<Axes: xlabel='total_bill', ylabel='Density'>
```



1.19 Central limit theorem

The central limit theorem says that the sampling distribution of the mean will always be normally distributed, as long as the sample size is large enough.

[36]:
```
np.mean(np.random.uniform(0,1, 100))
```

[36]:
```
0.5124591034716817
```

[37]:
```
sample = lambda: np.mean(np.random.uniform(0,1, 100))
```

[38]:
```
x = [sample() for _ in range(1000)]
sns.distplot(x)
```

```
/var/folders/03/k1p5_v6d69bg7b999gdktlgw0000gn/T/ipykernel_5030/3349669341.py:2:
UserWarning:

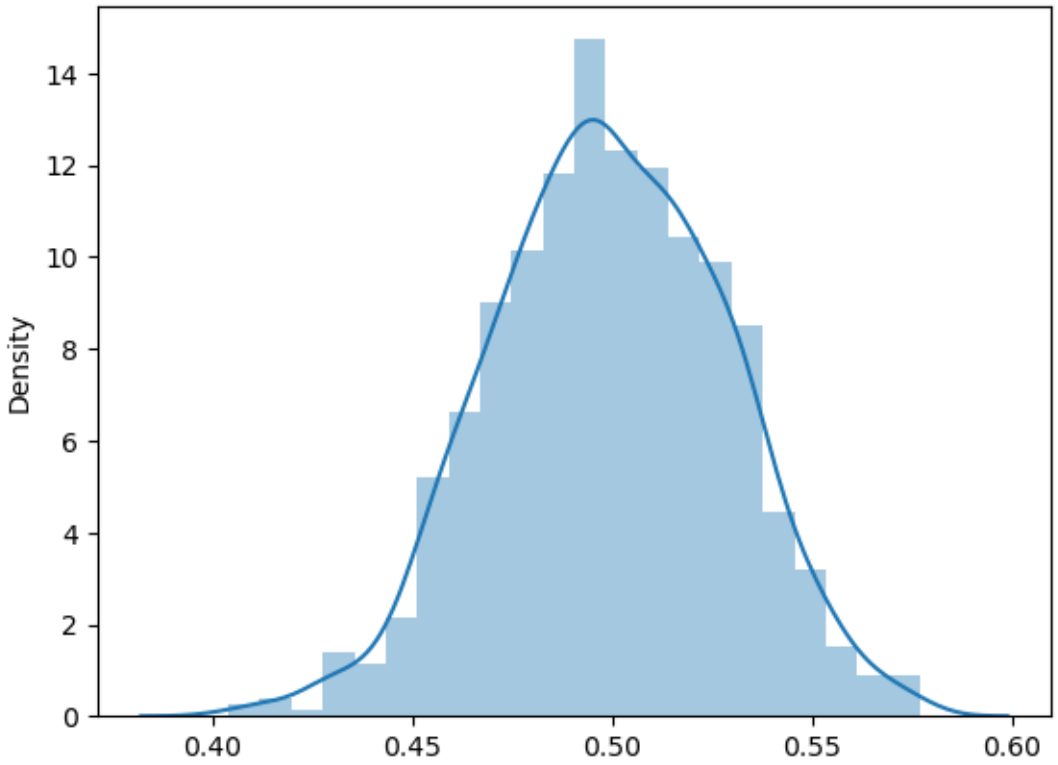
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(x)
```

[38]:
```
<Axes: ylabel='Density'>
```


Density
0
2
4
6
8
10
12
14
0.40
0.45
0.50
0.55
0.60