

Heamnath

20104028

Basic Analysis using Numpy and Pandas

Importing libraries

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

importing datasets

In [2]:

```
df=pd.read_csv("8_BreastCancerPrediction.csv")
df
```

Out[2]:

| | id | diagnosis | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean | ... |
|-----|----------|-----------|-------------|--------------|----------------|-----------|-----------------|-----|
| 0 | 842302 | M | 17.99 | 10.38 | 122.80 | 1001.0 | 0.11840 | |
| 1 | 842517 | M | 20.57 | 17.77 | 132.90 | 1326.0 | 0.08474 | |
| 2 | 84300903 | M | 19.69 | 21.25 | 130.00 | 1203.0 | 0.10960 | |
| 3 | 84348301 | M | 11.42 | 20.38 | 77.58 | 386.1 | 0.14250 | |
| 4 | 84358402 | M | 20.29 | 14.34 | 135.10 | 1297.0 | 0.10030 | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 564 | 926424 | M | 21.56 | 22.39 | 142.00 | 1479.0 | 0.11100 | |
| 565 | 926682 | M | 20.13 | 28.25 | 131.20 | 1261.0 | 0.09780 | |
| 566 | 926954 | M | 16.60 | 28.08 | 108.30 | 858.1 | 0.08455 | |
| 567 | 927241 | M | 20.60 | 29.33 | 140.10 | 1265.0 | 0.11780 | |
| 568 | 92751 | B | 7.76 | 24.54 | 47.92 | 181.0 | 0.05263 | |

569 rows × 33 columns

To display first 10 rows

In [3]:

```
df.head(10)
```

Out[3]:

| | id | diagnosis | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean | cor |
|----------|-----------|------------------|--------------------|---------------------|-----------------------|------------------|------------------------|------------|
| 0 | 842302 | M | 17.99 | 10.38 | 122.80 | 1001.0 | 0.11840 | |
| 1 | 842517 | M | 20.57 | 17.77 | 132.90 | 1326.0 | 0.08474 | |
| 2 | 84300903 | M | 19.69 | 21.25 | 130.00 | 1203.0 | 0.10960 | |
| 3 | 84348301 | M | 11.42 | 20.38 | 77.58 | 386.1 | 0.14250 | |
| 4 | 84358402 | M | 20.29 | 14.34 | 135.10 | 1297.0 | 0.10030 | |
| 5 | 843786 | M | 12.45 | 15.70 | 82.57 | 477.1 | 0.12780 | |
| 6 | 844359 | M | 18.25 | 19.98 | 119.60 | 1040.0 | 0.09463 | |
| 7 | 84458202 | M | 13.71 | 20.83 | 90.20 | 577.9 | 0.11890 | |
| 8 | 844981 | M | 13.00 | 21.82 | 87.50 | 519.8 | 0.12730 | |
| 9 | 84501001 | M | 12.46 | 24.04 | 83.97 | 475.9 | 0.11860 | |

10 rows × 33 columns

To display last 5 rows

In [4]:

df.tail(5)

Out[4]:

| | id | diagnosis | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean | cor |
|------------|-----------|------------------|--------------------|---------------------|-----------------------|------------------|------------------------|------------|
| 564 | 926424 | M | 21.56 | 22.39 | 142.00 | 1479.0 | 0.11100 | |
| 565 | 926682 | M | 20.13 | 28.25 | 131.20 | 1261.0 | 0.09780 | |
| 566 | 926954 | M | 16.60 | 28.08 | 108.30 | 858.1 | 0.08455 | |
| 567 | 927241 | M | 20.60 | 29.33 | 140.10 | 1265.0 | 0.11780 | |
| 568 | 92751 | B | 7.76 | 24.54 | 47.92 | 181.0 | 0.05263 | |

5 rows × 33 columns

Statistical Summary

In [5]:

df.mean()

Out[5]:

| | |
|-------------------------|--------------|
| id | 3.037183e+07 |
| radius_mean | 1.412729e+01 |
| texture_mean | 1.928965e+01 |
| perimeter_mean | 9.196903e+01 |
| area_mean | 6.548891e+02 |
| smoothness_mean | 9.636028e-02 |
| compactness_mean | 1.043410e-01 |

```
concavity_mean           8.879932e-02
concave points_mean      4.891915e-02
symmetry_mean            1.811619e-01
fractal_dimension_mean   6.279761e-02
radius_se                4.051721e-01
texture_se                1.216853e+00
perimeter_se              2.866059e+00
area_se                  4.033708e+01
smoothness_se             7.040979e-03
compactness_se            2.547814e-02
concavity_se              3.189372e-02
concave points_se         1.179614e-02
symmetry_se               2.054230e-02
fractal_dimension_se     3.794904e-03
radius_worst              1.626919e+01
texture_worst              2.567722e+01
perimeter_worst           1.072612e+02
area_worst                8.805831e+02
smoothness_worst          1.323686e-01
compactness_worst          2.542650e-01
concavity_worst           2.721885e-01
concave points_worst      1.146062e-01
symmetry_worst             2.900756e-01
fractal_dimension_worst   8.394582e-02
Unnamed: 32                  NaN
dtype: float64
```

```
In [6]: df.median()
```

```
Out[6]: id                  906024.000000
radius_mean            13.370000
texture_mean            18.840000
perimeter_mean          86.240000
area_mean               551.100000
smoothness_mean          0.095870
compactness_mean         0.092630
concavity_mean           0.061540
concave points_mean      0.033500
symmetry_mean             0.179200
fractal_dimension_mean   0.061540
radius_se                0.324200
texture_se                1.108000
perimeter_se              2.287000
area_se                  24.530000
smoothness_se             0.006380
compactness_se            0.020450
concavity_se              0.025890
concave points_se         0.010930
symmetry_se               0.018730
fractal_dimension_se     0.003187
radius_worst              14.970000
texture_worst              25.410000
perimeter_worst           97.660000
area_worst                686.500000
smoothness_worst          0.131300
compactness_worst          0.211900
concavity_worst            0.226700
concave points_worst      0.099930
symmetry_worst             0.282200
fractal_dimension_worst   0.080040
Unnamed: 32                  NaN
dtype: float64
```

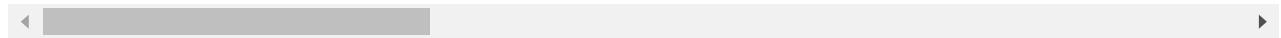
In [7]:

`df.mode()`

Out[7]:

| | id | diagnosis | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean |
|------------|-----------|------------------|--------------------|---------------------|-----------------------|------------------|------------------------|
| 0 | 8670 | B | 12.34 | 14.93 | 82.61 | 512.2 | 0.1007 |
| 1 | 8913 | NaN | NaN | 15.70 | 87.76 | NaN | NaN |
| 2 | 8915 | NaN | NaN | 16.84 | 134.70 | NaN | NaN |
| 3 | 9047 | NaN | NaN | 16.85 | NaN | NaN | NaN |
| 4 | 85715 | NaN | NaN | 17.46 | NaN | NaN | NaN |
| ... | ... | ... | ... | ... | ... | ... | ... |
| 564 | 911157302 | NaN | NaN | NaN | NaN | NaN | NaN |
| 565 | 911296201 | NaN | NaN | NaN | NaN | NaN | NaN |
| 566 | 911296202 | NaN | NaN | NaN | NaN | NaN | NaN |
| 567 | 911320501 | NaN | NaN | NaN | NaN | NaN | NaN |
| 568 | 911320502 | NaN | NaN | NaN | NaN | NaN | NaN |

569 rows × 33 columns



In [8]:

`df.sum()`

Out[8]:

| | |
|-------------------------------|-----------------------------|
| id | 17281572085 |
| diagnosis | MMMMMM.....BBBBB.....B..... |
| radius_mean | 8038.429 |
| texture_mean | 10975.81 |
| perimeter_mean | 52330.38 |
| area_mean | 372631.9 |
| smoothness_mean | 54.829 |
| compactness_mean | 59.37002 |
| concavity_mean | 50.526811 |
| concave_points_mean | 27.834994 |
| symmetry_mean | 103.0811 |
| fractal_dimension_mean | 35.73184 |
| radius_se | 230.5429 |
| texture_se | 692.3896 |
| perimeter_se | 1630.7877 |
| area_se | 22951.798 |
| smoothness_se | 4.006317 |
| compactness_se | 14.497061 |
| concavity_se | 18.147525 |
| concave_points_se | 6.712002 |
| symmetry_se | 11.688568 |
| fractal_dimension_se | 2.1593 |
| radius_worst | 9257.169 |
| texture_worst | 14610.34 |
| perimeter_worst | 61031.63 |
| area_worst | 501051.8 |
| smoothness_worst | 75.31773 |
| compactness_worst | 144.67681 |
| concavity_worst | 154.875247 |

```
concave points_worst          65.210941
symmetry_worst                165.053
fractal_dimension_worst       47.76517
Unnamed: 32                     0.0
dtype: object
```

In [9]: df.cumsum()

Out[9]:

| | id | diagnosis | ra |
|------------|-------------|------------------|-----------|
| 0 | 842302 | | M |
| 1 | 1684819 | | MM |
| 2 | 85985722 | | MMM |
| 3 | 170334023 | | MMMM |
| 4 | 254692425 | | MMMMM |
| ... | ... | | ... |
| 564 | 17278698457 | MMMMMM | BBBBB |
| 565 | 17279625139 | BBBBB | BBBBB |
| 566 | 17280552093 | BBBBB | BBBBB |
| 567 | 17281479334 | BBBBB | BBBBB |
| 568 | 17281572085 | BBBBB | BBBBB |

569 rows × 33 columns

```
df.count()
```

```
Out[10]: id  
diagnosis  
radius_mean  
texture_mean  
perimeter_mean  
area_mean  
smoothness_mean  
compactness_mean  
concavity_mean  
concave points_mean  
symmetry_mean  
fractal_dimension_mean  
radius_se  
texture_se  
perimeter_se  
area_se  
smoothness_se  
compactness_se  
concavity_se  
concave points_se  
symmetry_se  
fractal_dimension_se  
radius_worst  
texture_worst
```

```
perimeter_worst      569  
area_worst          569  
smoothness_worst    569  
compactness_worst   569  
concavity_worst     569  
concave points_worst 569  
symmetry_worst      569  
fractal_dimension_worst 569  
Unnamed: 32           0  
dtype: int64
```

```
In [11]: df.min()
```

```
Out[11]: id              8670  
diagnosis          B  
radius_mean        6.981  
texture_mean       9.71  
perimeter_mean    43.79  
area_mean          143.5  
smoothness_mean   0.05263  
compactness_mean  0.01938  
concavity_mean    0.0  
concave points_mean 0.0  
symmetry_mean     0.106  
fractal_dimension_mean 0.04996  
radius_se          0.1115  
texture_se         0.3602  
perimeter_se      0.757  
area_se            6.802  
smoothness_se     0.001713  
compactness_se    0.002252  
concavity_se      0.0  
concave points_se 0.0  
symmetry_se       0.007882  
fractal_dimension_se 0.000895  
radius_worst       7.93  
texture_worst      12.02  
perimeter_worst   50.41  
area_worst         185.2  
smoothness_worst  0.07117  
compactness_worst 0.02729  
concavity_worst   0.0  
concave points_worst 0.0  
symmetry_worst    0.1565  
fractal_dimension_worst 0.05504  
Unnamed: 32         NaN  
dtype: object
```

```
In [12]: df.max()
```

```
Out[12]: id              911320502  
diagnosis          M  
radius_mean        28.11  
texture_mean       39.28  
perimeter_mean    188.5  
area_mean          2501.0  
smoothness_mean   0.1634  
compactness_mean  0.3454  
concavity_mean    0.4268  
concave points_mean 0.2012  
symmetry_mean     0.304  
fractal_dimension_mean 0.09744
```

```

radius_se           2.873
texture_se          4.885
perimeter_se        21.98
area_se              542.2
smoothness_se       0.03113
compactness_se      0.1354
concavity_se         0.396
concave points_se   0.05279
symmetry_se          0.07895
fractal_dimension_se 0.02984
radius_worst         36.04
texture_worst         49.54
perimeter_worst      251.2
area_worst            4254.0
smoothness_worst     0.2226
compactness_worst    1.058
concavity_worst       1.252
concave points_worst 0.291
symmetry_worst        0.6638
fractal_dimension_worst 0.2075
Unnamed: 32             NaN
dtype: object

```

In [13]:

```
from numpy import cov
```

In [14]:

```
cov(df['radius_mean'], df['texture_mean'])
```

Out[14]:

```
array([[12.41892013,  4.90758156],
       [ 4.90758156, 18.49890868]])
```

In [15]:

```
from scipy.stats import pearsonr
pearsonr(df['radius_mean'], df['texture_mean'])
```

Out[15]:

```
(0.323781890927733, 2.360374375922593e-15)
```

In [16]:

```
from scipy.stats import spearmanr
spearmanr(df['radius_mean'], df['texture_mean'])
```

Out[16]:

```
SpearmanResult(correlation=0.3409562685372812, pvalue=5.900189597213798e-17)
```

In [17]:

```
df.describe()
```

Out[17]:

| | id | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean | com |
|--------------|--------------|--------------------|---------------------|-----------------------|------------------|------------------------|------------|
| count | 5.690000e+02 | 569.000000 | 569.000000 | 569.000000 | 569.000000 | 569.000000 | |
| mean | 3.037183e+07 | 14.127292 | 19.289649 | 91.969033 | 654.889104 | 0.096360 | |
| std | 1.250206e+08 | 3.524049 | 4.301036 | 24.298981 | 351.914129 | 0.014064 | |
| min | 8.670000e+03 | 6.981000 | 9.710000 | 43.790000 | 143.500000 | 0.052630 | |
| 25% | 8.692180e+05 | 11.700000 | 16.170000 | 75.170000 | 420.300000 | 0.086370 | |
| 50% | 9.060240e+05 | 13.370000 | 18.840000 | 86.240000 | 551.100000 | 0.095870 | |

| | id | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean | compactness_mean |
|------------|--------------|--------------------|---------------------|-----------------------|------------------|------------------------|-------------------------|
| 75% | 8.813129e+06 | 15.780000 | 21.800000 | 104.100000 | 782.700000 | 0.105300 | |
| max | 9.113205e+08 | 28.110000 | 39.280000 | 188.500000 | 2501.000000 | 0.163400 | |

8 rows × 32 columns

To print no of rows and columns

In [18]: `df.shape`

Out[18]: (569, 33)

To print total no of elements

In [19]: `df.size`

Out[19]: 18777

To find the null value

In [20]: `df.isna()`

| | id | diagnosis | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean | compactness_mean |
|------------|-----------|------------------|--------------------|---------------------|-----------------------|------------------|------------------------|-------------------------|
| 0 | False | False | False | False | False | False | False | False |
| 1 | False | False | False | False | False | False | False | False |
| 2 | False | False | False | False | False | False | False | False |
| 3 | False | False | False | False | False | False | False | False |
| 4 | False | False | False | False | False | False | False | False |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 564 | False | False | False | False | False | False | False | False |
| 565 | False | False | False | False | False | False | False | False |
| 566 | False | False | False | False | False | False | False | False |
| 567 | False | False | False | False | False | False | False | False |
| 568 | False | False | False | False | False | False | False | False |

569 rows × 33 columns

To fill the missing value

In [21]:

```
df.fillna(value=0)
```

Out[21]:

| | id | diagnosis | radius_mean | texture_mean | perimeter_mean | area_mean | smoothness_mean | compactness_mean | concavity_mean | concave points_mean | symmetry_mean | fractal_dimension_mean | radius_se | texture_se | perimeter_se | area_se | smoothness_se | compactness_se | concavity_se | concave points_se | symmetry_se | fractal_dimension_se | radius_worst | texture_worst | perimeter_worst | area_worst | smoothness_worst | compactness_worst | concavity_worst | concave points_worst | symmetry_worst | fractal_dimension_worst | Unnamed: 32 |
|------------|-----------|------------------|--------------------|---------------------|-----------------------|------------------|------------------------|-------------------------|-----------------------|----------------------------|----------------------|-------------------------------|------------------|-------------------|---------------------|----------------|----------------------|-----------------------|---------------------|--------------------------|--------------------|-----------------------------|---------------------|----------------------|------------------------|-------------------|-------------------------|--------------------------|------------------------|-----------------------------|-----------------------|--------------------------------|--------------------|
| 0 | 842302 | M | 17.99 | 10.38 | 122.80 | 1001.0 | 0.11840 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 842517 | M | 20.57 | 17.77 | 132.90 | 1326.0 | 0.08474 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 84300903 | M | 19.69 | 21.25 | 130.00 | 1203.0 | 0.10960 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 84348301 | M | 11.42 | 20.38 | 77.58 | 386.1 | 0.14250 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 84358402 | M | 20.29 | 14.34 | 135.10 | 1297.0 | 0.10030 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | | |
| 564 | 926424 | M | 21.56 | 22.39 | 142.00 | 1479.0 | 0.11100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 565 | 926682 | M | 20.13 | 28.25 | 131.20 | 1261.0 | 0.09780 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 566 | 926954 | M | 16.60 | 28.08 | 108.30 | 858.1 | 0.08455 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 567 | 927241 | M | 20.60 | 29.33 | 140.10 | 1265.0 | 0.11780 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 568 | 92751 | B | 7.76 | 24.54 | 47.92 | 181.0 | 0.05263 | | | | | | | | | | | | | | | | | | | | | | | | | | |

569 rows × 33 columns

Print column names

In [22]:

```
df.columns
```

Out[22]:

```
Index(['id', 'diagnosis', 'radius_mean', 'texture_mean', 'perimeter_mean',
       'area_mean', 'smoothness_mean', 'compactness_mean', 'concavity_mean',
       'concave points_mean', 'symmetry_mean', 'fractal_dimension_mean',
       'radius_se', 'texture_se', 'perimeter_se', 'area_se', 'smoothness_se',
       'compactness_se', 'concavity_se', 'concave points_se', 'symmetry_se',
       'fractal_dimension_se', 'radius_worst', 'texture_worst',
       'perimeter_worst', 'area_worst', 'smoothness_worst',
       'compactness_worst', 'concavity_worst', 'concave points_worst',
       'symmetry_worst', 'fractal_dimension_worst', 'Unnamed: 32'],
      dtype='object')
```

To print particular column names

In [23]:

```
data=df[['radius_mean', 'texture_mean']]
data
```

Out[23]:

| | radius_mean | texture_mean |
|----------|--------------------|---------------------|
| 0 | 17.99 | 10.38 |

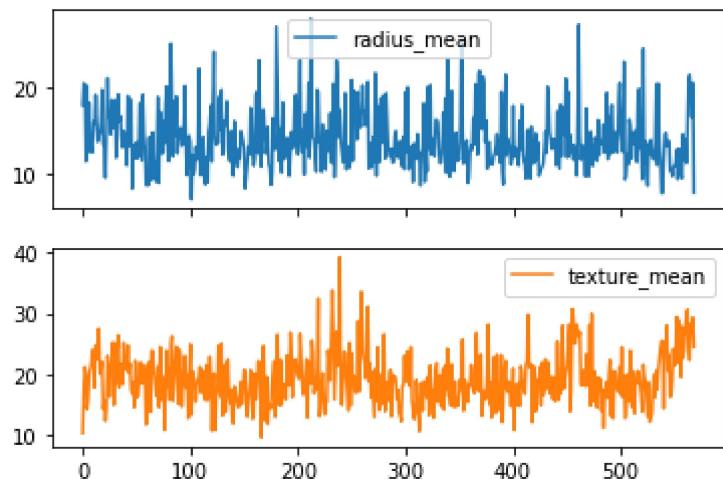
| 1 | radius_mean | texture_mean |
|-----|-------------|--------------|
| 2 | 19.69 | 21.25 |
| 3 | 11.42 | 20.38 |
| 4 | 20.29 | 14.34 |
| ... | ... | ... |
| 564 | 21.56 | 22.39 |
| 565 | 20.13 | 28.25 |
| 566 | 16.60 | 28.08 |
| 567 | 20.60 | 29.33 |
| 568 | 7.76 | 24.54 |

569 rows × 2 columns

Line chart with subplots

In [24]: `data.plot.line(subplots=True)`

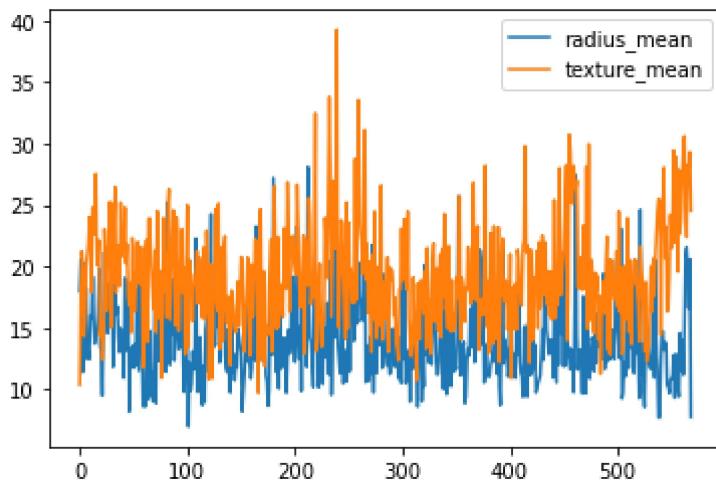
Out[24]: `array([<AxesSubplot:>, <AxesSubplot:>], dtype=object)`



Line chart

In [25]: `data.plot.line()`

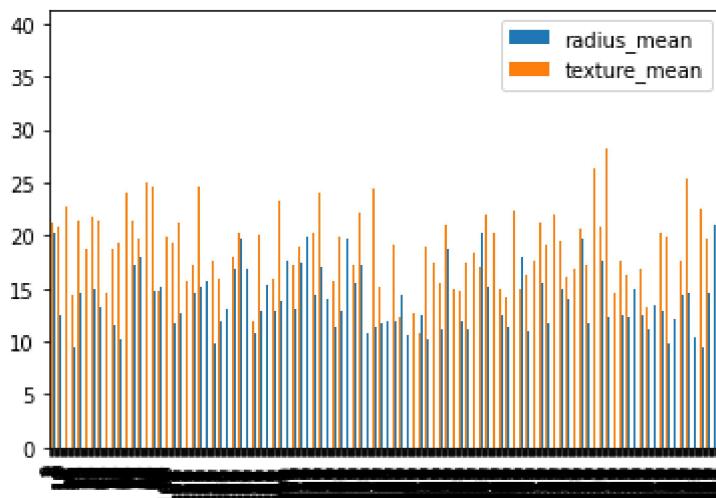
Out[25]: `<AxesSubplot:>`



Bar chart

In [26]: `data.plot.bar()`

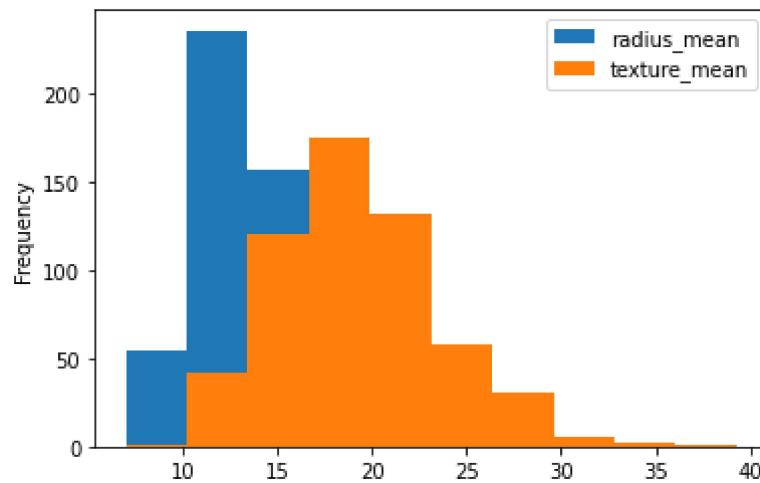
Out[26]: <AxesSubplot:>



Histogram

In [27]: `data.plot.hist()`

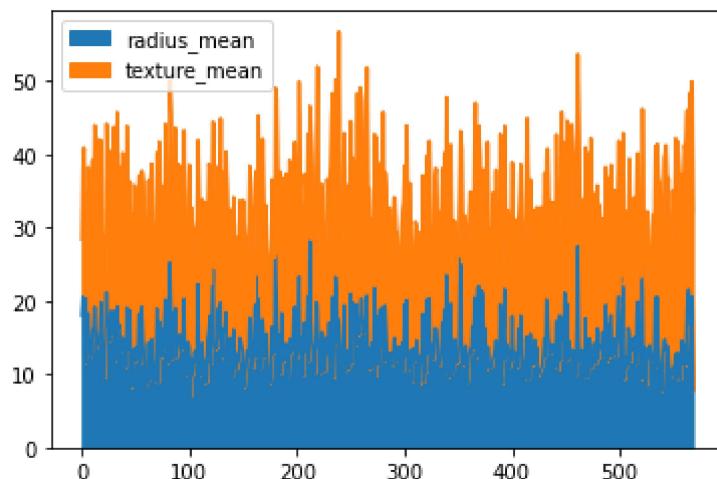
Out[27]: <AxesSubplot:ylabel='Frequency'>



Area chart

In [28]: `data.plot.area()`

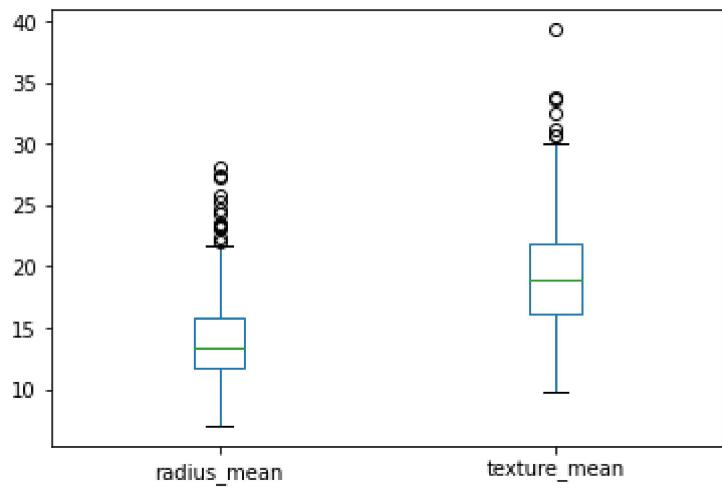
Out[28]: <AxesSubplot:>



Box chart

In [29]: `data.plot.box()`

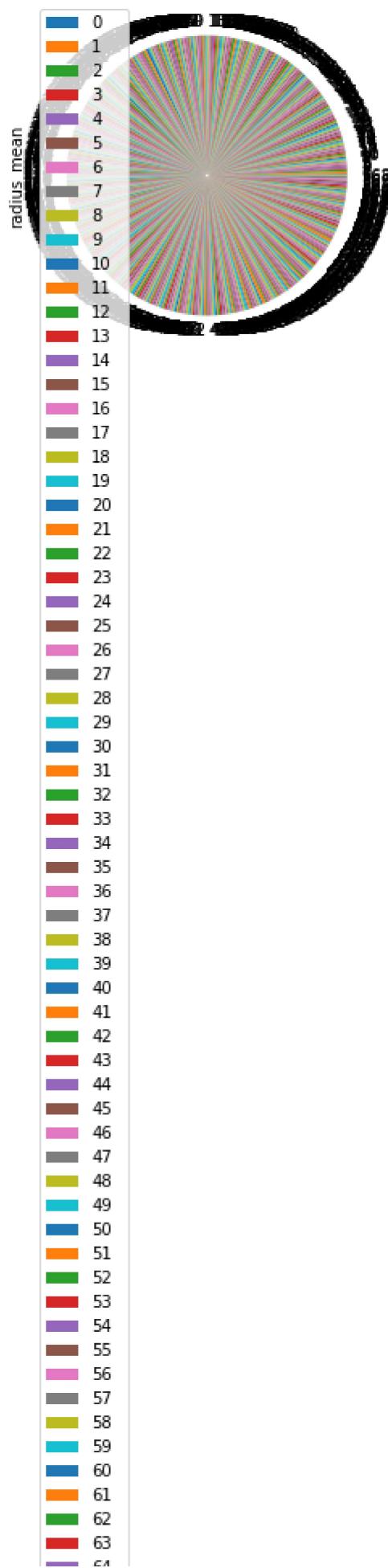
Out[29]: <AxesSubplot:>



Pie chart

```
In [30]: data.plot.pie(y='radius_mean')
```

```
Out[30]: <AxesSubplot:ylabel='radius_mean'>
```

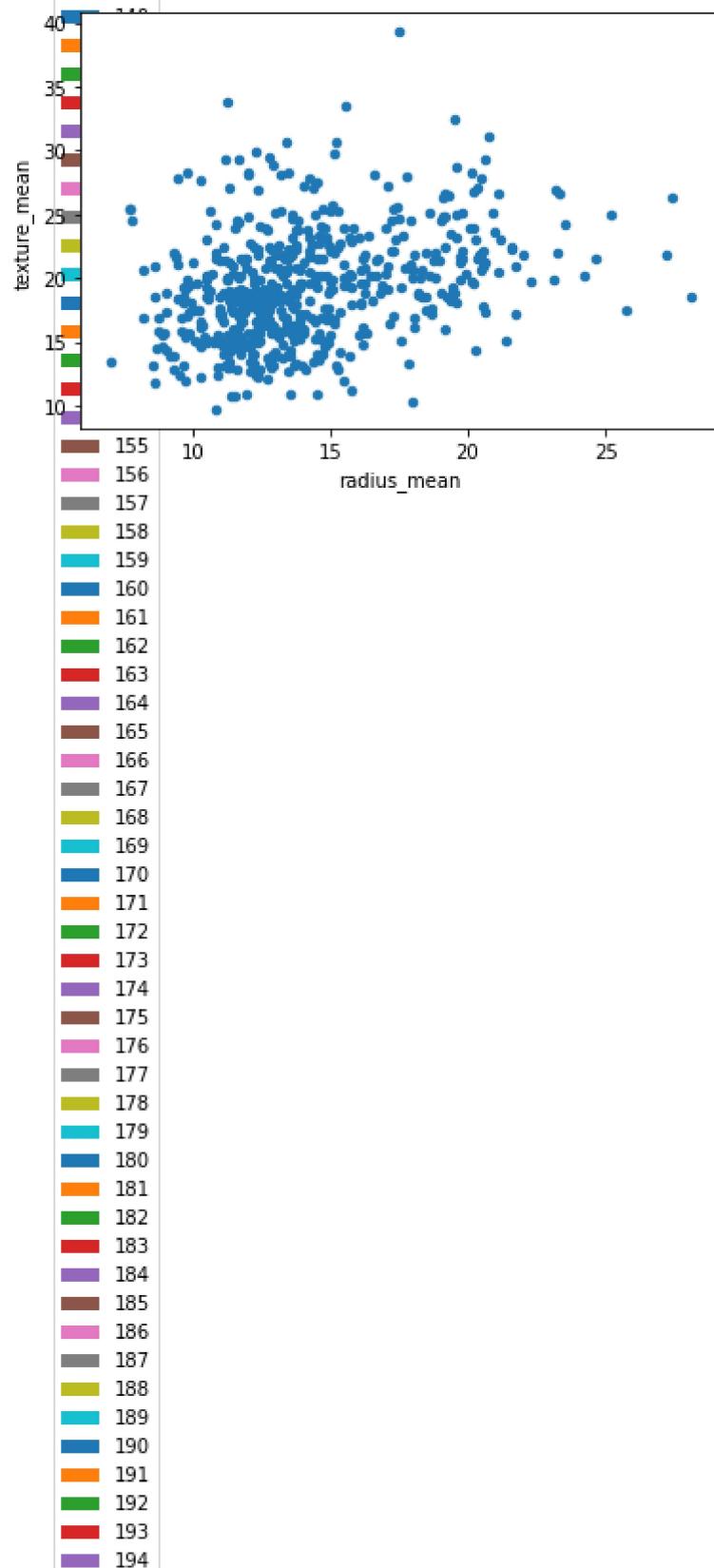


| |
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Scatter chart

```
In [31]: data.plot.scatter(x='radius_mean',y='texture_mean')
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```
Out[31]: <AxesSubplot:xlabel='radius_mean', ylabel='texture_mean'>
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