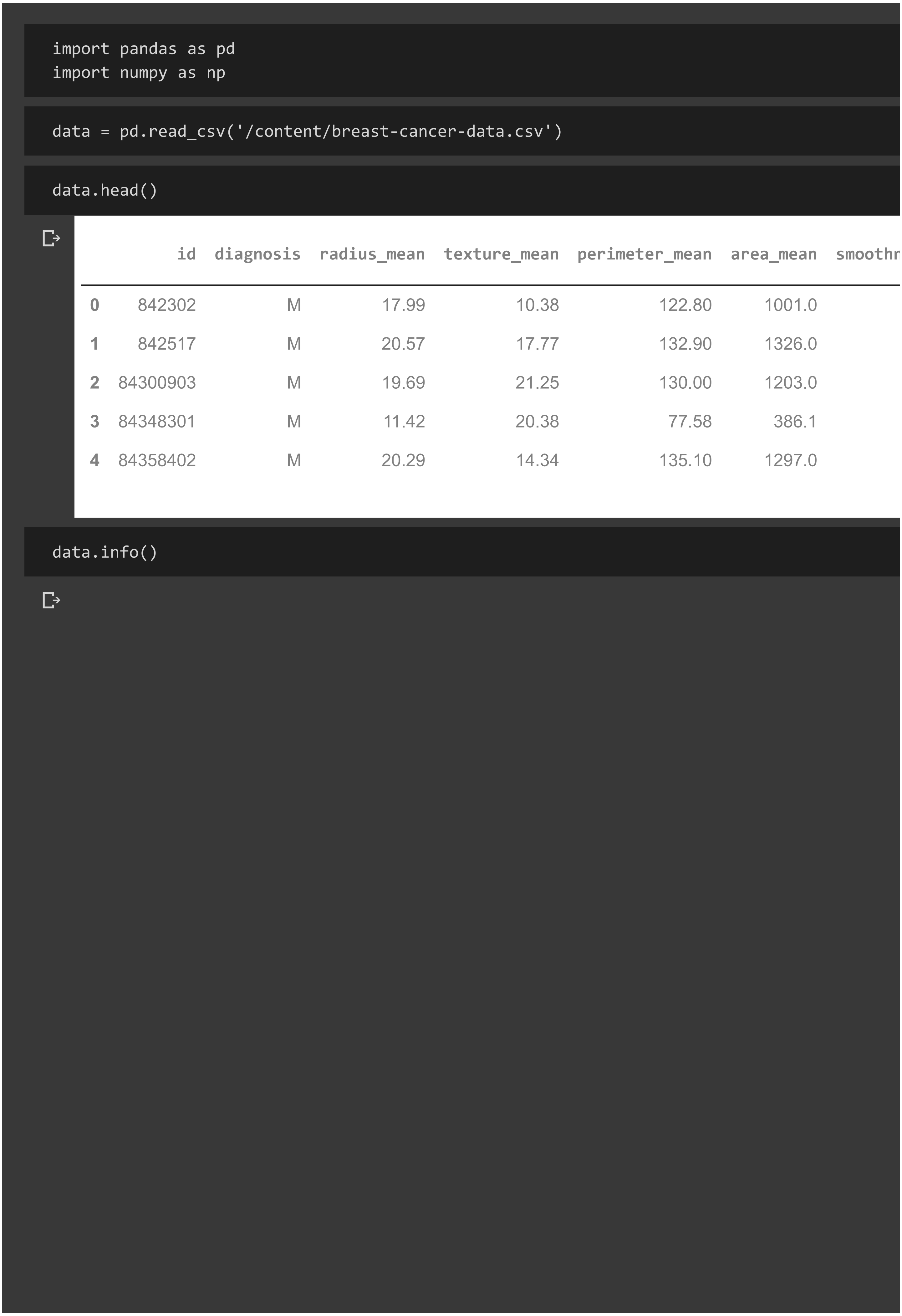


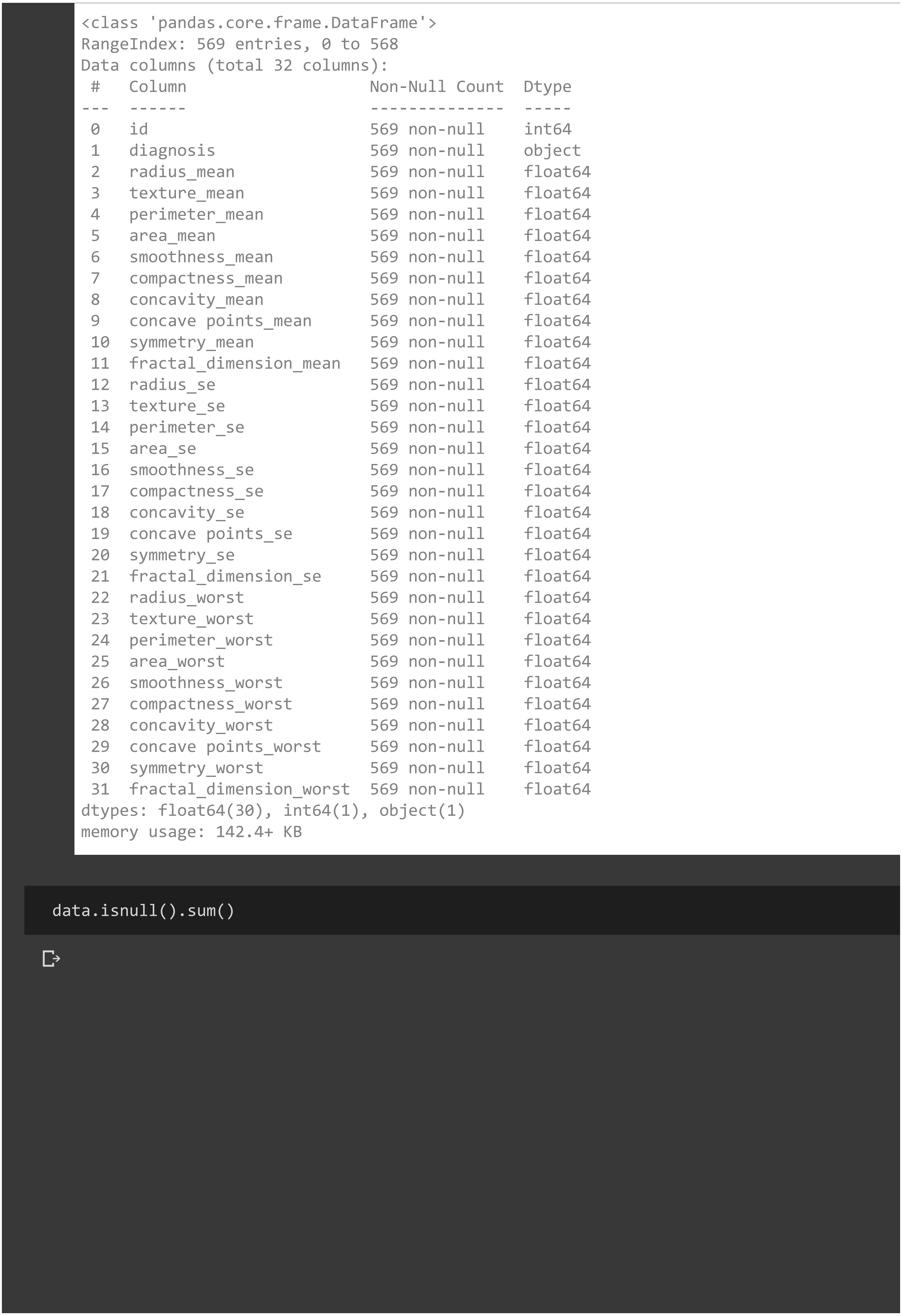
```
import pandas as pd
import numpy as np
```

```
data = pd.read_csv('/content/breast-cancer-data.csv')
```

```
data.head()
```

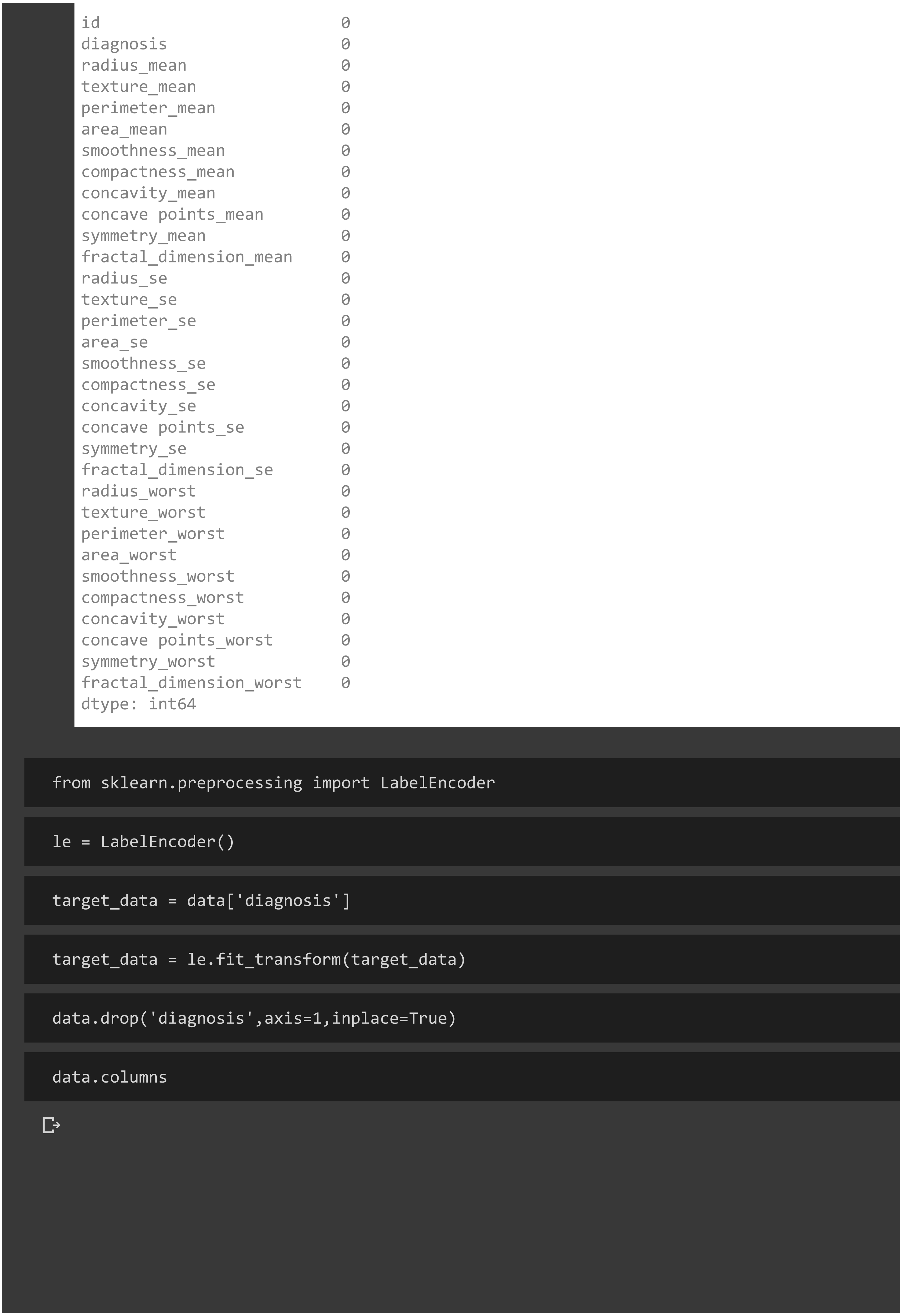
	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothn
0	842302	M	17.99	10.38	122.80	1001.0	
1	842517	M	20.57	17.77	132.90	1326.0	
2	84300903	M	19.69	21.25	130.00	1203.0	
3	84348301	M	11.42	20.38	77.58	386.1	
4	84358402	M	20.29	14.34	135.10	1297.0	

```
data.info()
```



```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 32 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   id                       569 non-null    int64  
 1   diagnosis                569 non-null    object 
 2   radius_mean              569 non-null    float64
 3   texture_mean             569 non-null    float64
 4   perimeter_mean           569 non-null    float64
 5   area_mean                569 non-null    float64
 6   smoothness_mean          569 non-null    float64
 7   compactness_mean         569 non-null    float64
 8   concavity_mean           569 non-null    float64
 9   concave points_mean      569 non-null    float64
 10  symmetry_mean            569 non-null    float64
 11  fractal_dimension_mean   569 non-null    float64
 12  radius_se                569 non-null    float64
 13  texture_se               569 non-null    float64
 14  perimeter_se             569 non-null    float64
 15  area_se                  569 non-null    float64
 16  smoothness_se            569 non-null    float64
 17  compactness_se           569 non-null    float64
 18  concavity_se             569 non-null    float64
 19  concave points_se        569 non-null    float64
 20  symmetry_se              569 non-null    float64
 21  fractal_dimension_se     569 non-null    float64
 22  radius_worst             569 non-null    float64
 23  texture_worst            569 non-null    float64
 24  perimeter_worst          569 non-null    float64
 25  area_worst               569 non-null    float64
 26  smoothness_worst         569 non-null    float64
 27  compactness_worst        569 non-null    float64
 28  concavity_worst          569 non-null    float64
 29  concave points_worst     569 non-null    float64
 30  symmetry_worst           569 non-null    float64
 31  fractal_dimension_worst  569 non-null    float64
dtypes: float64(30), int64(1), object(1)
memory usage: 142.4+ KB
```

```
data.isnull().sum()
```



```
id                         0
diagnosis                  0
radius_mean                0
texture_mean               0
perimeter_mean             0
area_mean                  0
smoothness_mean            0
compactness_mean           0
concavity_mean             0
concave points_mean        0
symmetry_mean              0
fractal_dimension_mean     0
radius_se                  0
texture_se                 0
perimeter_se               0
area_se                    0
smoothness_se              0
compactness_se             0
concavity_se               0
concave points_se          0
symmetry_se                0
fractal_dimension_se       0
radius_worst               0
texture_worst              0
perimeter_worst            0
area_worst                 0
smoothness_worst           0
compactness_worst          0
concavity_worst            0
concave points_worst       0
symmetry_worst             0
fractal_dimension_worst    0
dtype: int64
```

```
from sklearn.preprocessing import LabelEncoder
```

```
le = LabelEncoder()
```

```
target_data = data['diagnosis']
```

```
target_data = le.fit_transform(target_data)
```

```
data.drop('diagnosis',axis=1,inplace=True)
```

```
data.columns
```

```
Index(['id', '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'],
      dtype='object')
```

```
from sklearn.preprocessing import StandardScaler
```

```
scaler = StandardScaler()
```

```
scaler.fit(data)
```

```
StandardScaler(copy=True, with_mean=True, with_std=True)
```

```
scaled_data = scaler.transform(data)
```

```
scaled_data
```

```
array([[-0.23640517,  1.09706398, -2.07333501, ...,  2.29607613,
         2.75062224,  1.93701461],
       [-0.23640344,  1.82982061, -0.35363241, ...,  1.0870843 ,
        -0.24388967,  0.28118999],
       [ 0.43174109,  1.57988811,  0.45618695, ...,  1.95500035,
         1.152255  ,  0.20139121],
       ...,
       [-0.23572747,  0.70228425,  2.0455738 , ...,  0.41406869,
        -1.10454895, -0.31840916],
       [-0.23572517,  1.83834103,  2.33645719, ...,  2.28998549,
         1.91908301,  2.21963528],
       [-0.24240586, -1.80840125,  1.22179204, ..., -1.74506282,
        -0.04813821, -0.75120669]])
```

```
from sklearn.decomposition import PCA
```

```
pca = PCA(n_components=2)
```

```
pca.fit(scaled_data)
```

```
PCA(copy=True, iterated_power='auto', n_components=2, random_state=None,
    svd_solver='auto', tol=0.0, whiten=False)
```

```
x_pca = pca.transform(scaled_data)
```

```
scaled_data.shape
```

```
(569, 31)
```

```
x_pca.shape
```

```
(569, 2)
```

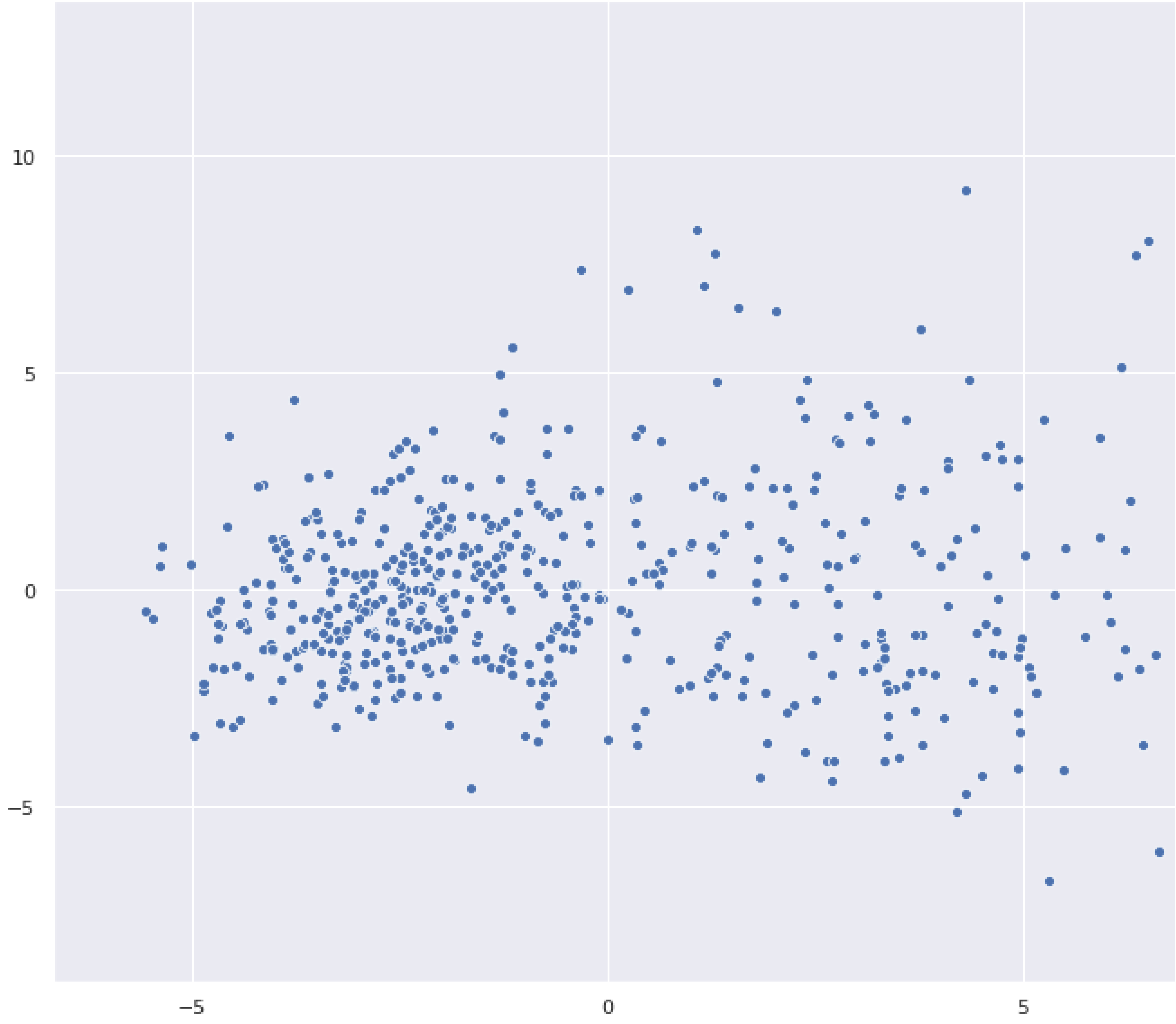
```
x_pca
```

```
array([[ 9.18319983,  1.97127137],
       [ 2.38329766, -3.75345877],
       [ 5.74247239, -1.08035048],
       ...,
       [ 1.2518901 , -1.89397674],
       [10.36503528,  1.69639755],
       [-5.47826365, -0.67278804]])
```

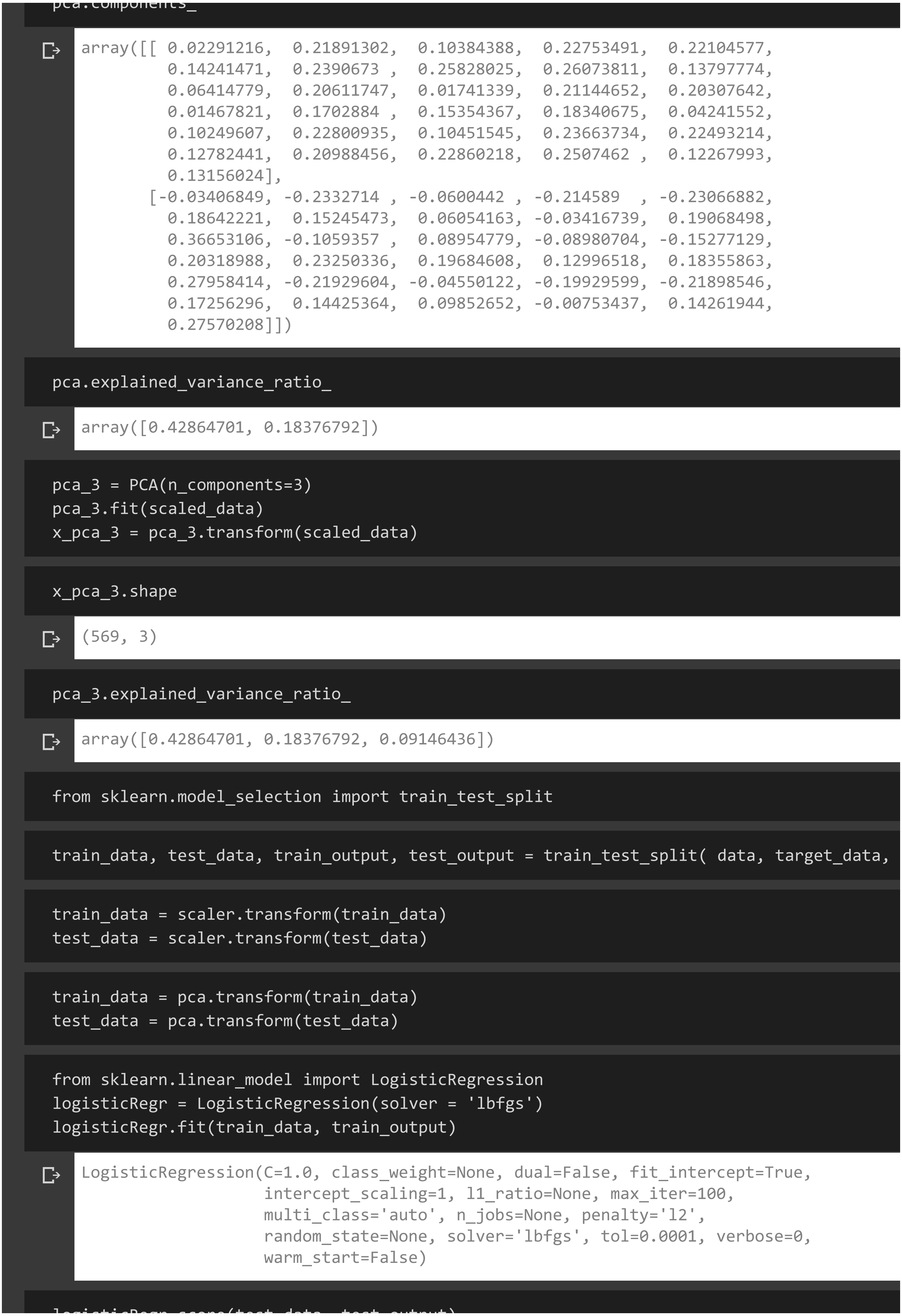
```
import matplotlib.pyplot as plt
import seaborn as sns
sns.set()
```

```
plt.figure(figsize=(20,10))
sns.scatterplot(x_pca[:,0],x_pca[:,1],cmap='viridis')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7feabdb7d978>
```



```
pca.components_
```



```
pca.components_
```

```
array([[ 0.02291216,  0.21891302,  0.10384388,  0.22753491,  0.22104577,
         0.14241471,  0.2390673 ,  0.25828025,  0.26073811,  0.13797774,
         0.06414779,  0.20611747,  0.01741339,  0.21144652,  0.20307642,
         0.01467821,  0.1702884 ,  0.15354367,  0.18340675,  0.04241552,
         0.10249607,  0.22800935,  0.10451545,  0.23663734,  0.22493214,
         0.12782441,  0.20988456,  0.22860218,  0.2507462 ,  0.12267993,
         0.13156024],
       [-0.03406849, -0.2332714 , -0.0600442 , -0.214589  , -0.23066882,
         0.18642221,  0.15245473,  0.06054163, -0.03416739,  0.19068498,
         0.36653106, -0.1059357 ,  0.08954779, -0.08980704, -0.15277129,
         0.20318988,  0.23250336,  0.19684608,  0.12996518,  0.18355863,
         0.27958414, -0.21929604, -0.04550122, -0.19929599, -0.21898546,
         0.17256296,  0.14425364,  0.09852652, -0.00753437,  0.14261944,
         0.27570208]])
```

```
pca.explained_variance_ratio_
```

```
array([0.42864701, 0.18376792])
```

```
pca_3 = PCA(n_components=3)
pca_3.fit(scaled_data)
x_pca_3 = pca_3.transform(scaled_data)
```

```
x_pca_3.shape
```

```
(569, 3)
```

```
pca_3.explained_variance_ratio_
```

```
array([0.42864701, 0.18376792, 0.09146436])
```

```
from sklearn.model_selection import train_test_split
```

```
train_data, test_data, train_output, test_output = train_test_split( data, target_data,
```

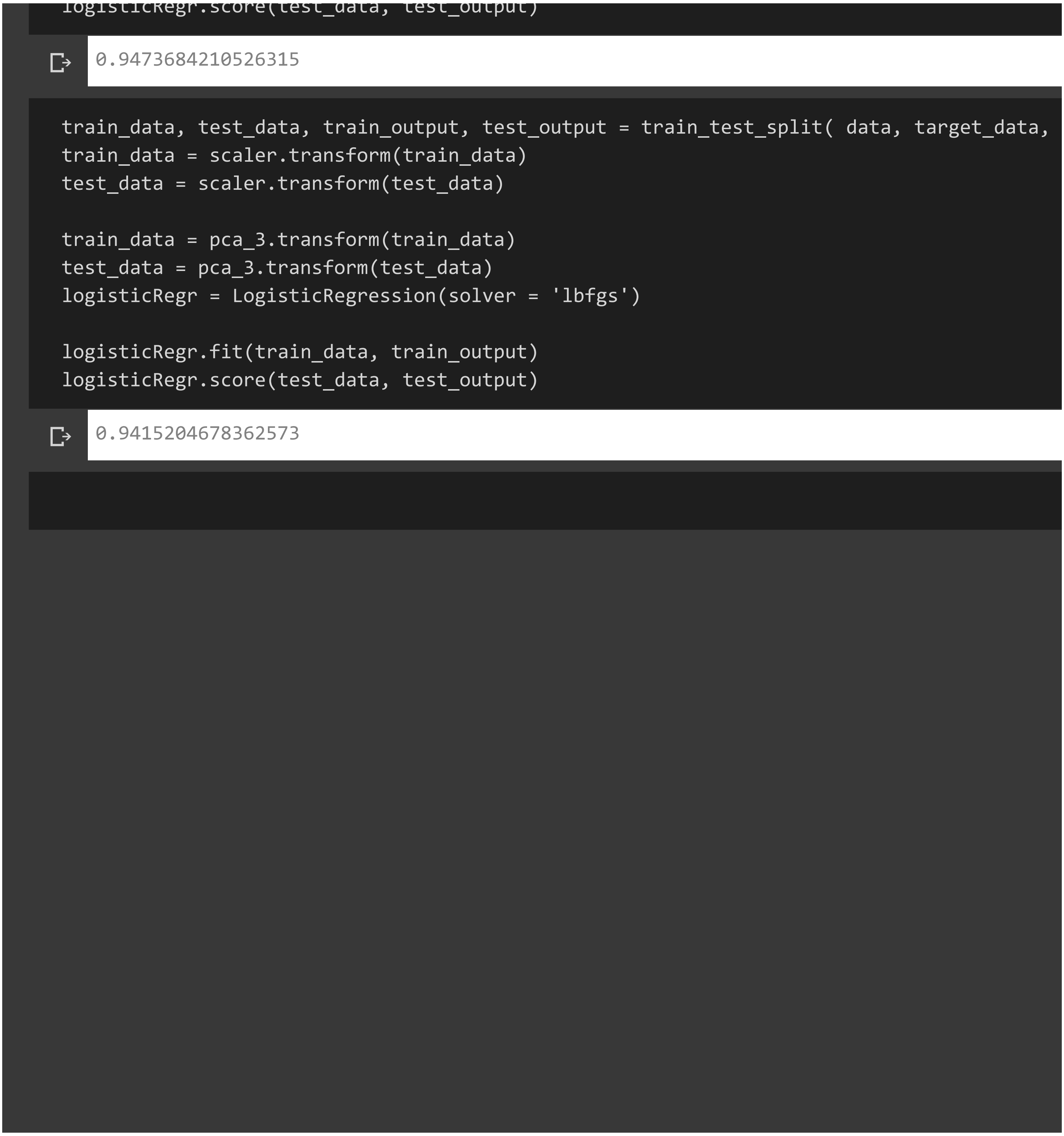
```
train_data = scaler.transform(train_data)
test_data = scaler.transform(test_data)
```

```
train_data = pca.transform(train_data)
test_data = pca.transform(test_data)
```

```
from sklearn.linear_model import LogisticRegression
logisticRegr = LogisticRegression(solver = 'lbfgs')
logisticRegr.fit(train_data, train_output)
```

```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, l1_ratio=None, max_iter=100,
                   multi_class='auto', n_jobs=None, penalty='l2',
                   random_state=None, solver='lbfgs', tol=0.0001, verbose=0,
                   warm_start=False)
```

```
logisticRegr.score(test_data, test_output)
```



```
logisticRegr.score(test_data, test_output)
```

```
0.9473684210526315
```

```
train_data, test_data, train_output, test_output = train_test_split( data, target_data,
train_data = scaler.transform(train_data)
test_data = scaler.transform(test_data)

train_data = pca_3.transform(train_data)
test_data = pca_3.transform(test_data)
logisticRegr = LogisticRegression(solver = 'lbfgs')

logisticRegr.fit(train_data, train_output)
logisticRegr.score(test_data, test_output)
```

```
0.9415204678362573
```