

```
dict_keys(['data', 'target', 'frame', 'target_names', 'DESCR', 'feature_names', 'filename', 'data_module'])
```

```
.. _breast_cancer_dataset:
```

```
Breast cancer wisconsin (diagnostic) dataset
```

```
-----
```

```
**Data Set Characteristics:**
```

```
:Number of Instances: 569
```

```
:Number of Attributes: 30 numeric, predictive attributes and the  
class
```

```
:Attribute Information:
```

```
  - radius (mean of distances from center to points on the  
perimeter)  
  - texture (standard deviation of gray-scale values)  
  - perimeter  
  - area  
  - smoothness (local variation in radius lengths)  
  - compactness (perimeter^2 / area - 1.0)  
  - concavity (severity of concave portions of the contour)  
  - concave points (number of concave portions of the contour)  
  - symmetry  
  - fractal dimension ("coastline approximation" - 1)
```

```
  The mean, standard error, and "worst" or largest (mean of the  
three  
worst/largest values) of these features were computed for each  
image,  
resulting in 30 features. For instance, field 0 is Mean  
Radius, field  
10 is Radius SE, field 20 is Worst Radius.
```

```
  - class:  
    - WDBC-Malignant  
    - WDBC-Benign
```

```
:Summary Statistics:
```

```
=====  =====  =====  
                                     Min    Max  
=====  =====  =====  
radius (mean):                      6.981  28.11  
texture (mean):                     9.71   39.28  
perimeter (mean):                   43.79  188.5  
area (mean):                        143.5  2501.0  
smoothness (mean):                  0.053  0.163  
compactness (mean):                 0.019  0.345  
concavity (mean):                   0.0    0.427  
concave points (mean):              0.0    0.201  
symmetry (mean):                    0.106  0.304  
fractal dimension (mean):           0.05   0.097  
radius (standard error):            0.112  2.873  
texture (standard error):           0.36   4.885  
perimeter (standard error):         0.757  21.98  
area (standard error):              6.802  542.2
```

smoothness (standard error):	0.002	0.031
compactness (standard error):	0.002	0.135
concavity (standard error):	0.0	0.396
concave points (standard error):	0.0	0.053
symmetry (standard error):	0.008	0.079
fractal dimension (standard error):	0.001	0.03
radius (worst):	7.93	36.04
texture (worst):	12.02	49.54
perimeter (worst):	50.41	251.2
area (worst):	185.2	4254.0
smoothness (worst):	0.071	0.223
compactness (worst):	0.027	1.058
concavity (worst):	0.0	1.252
concave points (worst):	0.0	0.291
symmetry (worst):	0.156	0.664
fractal dimension (worst):	0.055	0.208
=====	=====	=====

:Missing Attribute Values: None

:Class Distribution: 212 - Malignant, 357 - Benign

:Creator: Dr. William H. Wolberg, W. Nick Street, Olvi L. Mangasarian

:Donor: Nick Street

:Date: November, 1995

This is a copy of UCI ML Breast Cancer Wisconsin (Diagnostic) datasets.  
<https://goo.gl/U2Uwz2>

Features are computed from a digitized image of a fine needle aspirate (FNA) of a breast mass. They describe characteristics of the cell nuclei present in the image.

Separating plane described above was obtained using Multisurface Method-Tree (MSM-T) [K. P. Bennett, "Decision Tree Construction Via Linear Programming." Proceedings of the 4th Midwest Artificial Intelligence and Cognitive Science Society, pp. 97-101, 1992], a classification method which uses linear programming to construct a decision tree. Relevant features were selected using an exhaustive search in the space of 1-4 features and 1-3 separating planes.

The actual linear program used to obtain the separating plane in the 3-dimensional space is that described in: [K. P. Bennett and O. L. Mangasarian: "Robust Linear Programming Discrimination of Two Linearly Inseparable Sets", Optimization Methods and Software 1, 1992, 23-34].

This database is also available through the UW CS ftp server:

```
ftp ftp.cs.wisc.edu
cd math-prog/cpo-dataset/machine-learn/WDBC/
```

.. topic:: References

- W.N. Street, W.H. Wolberg and O.L. Mangasarian. Nuclear feature extraction for breast tumor diagnosis. IS&T/SPIE 1993 International Symposium on Electronic Imaging: Science and Technology, volume 1905, pages 861-870, San Jose, CA, 1993.
- O.L. Mangasarian, W.N. Street and W.H. Wolberg. Breast cancer diagnosis and prognosis via linear programming. Operations Research, 43(4), pages 570-577, July-August 1995.
- W.H. Wolberg, W.N. Street, and O.L. Mangasarian. Machine learning techniques to diagnose breast cancer from fine-needle aspirates. Cancer Letters 77 (1994) 163-171.

..\_breast\_cancer\_dataset:

Breast cancer wisconsin (diagnostic) dataset

**\*\*Data Set Characteristics:\*\***

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```
=====
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- W.H. Wolberg, W.N. Street, and O.L. Mangasarian. Machine learning techniques to diagnose breast cancer from fine-needle aspirates. Cancer Letters 77 (1994) 163-171.

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output

```
['mean radius' 'mean texture' 'mean perimeter' 'mean area'  
'mean smoothness' 'mean compactness' 'mean concavity'  
'mean concave points' 'mean symmetry' 'mean fractal dimension'  
'radius error' 'texture error' 'perimeter error' 'area error'  
'smoothness error' 'compactness error' 'concavity error'  
'concave points error' 'symmetry error' 'fractal dimension error'  
'worst radius' 'worst texture' 'worst perimeter' 'worst area'  
'worst smoothness' 'worst compactness' 'worst concavity'  
'worst concave points' 'worst symmetry' 'worst fractal dimension']
```

---

```
array([[ 1.09706398, -2.07333501,  1.26993369, ...,  2.29607613,  
        2.75062224,  1.93701461],  
       [ 1.82982061, -0.35363241,  1.68595471, ...,  1.0870843 ,  
        -0.24388967,  0.28118999],  
       [ 1.57988811,  0.45618695,  1.56650313, ...,  1.95500035,  
        1.152255 ,  0.20139121],  
       ...,  
       [ 0.70228425,  2.0455738 ,  0.67267578, ...,  0.41406869,  
        -1.10454895, -0.31840916],  
       [ 1.83834103,  2.33645719,  1.98252415, ...,  2.28998549,  
        1.91908301,  2.21963528],  
       [-1.80840125,  1.22179204, -1.81438851, ..., -1.74506282,  
        -0.04813821, -0.75120669]])
```

(569, 30)

(569, 30)

(569, 2)

```
array([[ 9.19283683,  1.94858307],  
       [ 2.3878018 , -3.76817174],  
       [ 5.73389628, -1.0751738 ],  
       ...,  
       [ 1.25617928, -1.90229671],  
       [10.37479406,  1.67201011],  
       [-5.4752433 , -0.67063679]])
```

	mean radius	mean texture	mean perimeter	mean area	mean smoothness	mean compactness	mean concavity	mean concave points	mean symmetry	mean fractal dimension	...	worst radius	worst texture	worst perimeter	worst area	worst smoothness	worst compactness	worst concavity	worst concave points
0	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	0.14710	0.2419	0.07871	...	25.38	17.33	184.60	2019.0	0.1622	0.6656	0.7119	0.26
1	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	0.07017	0.1812	0.05667	...	24.99	23.41	158.80	1956.0	0.1238	0.1866	0.2416	0.18
2	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	0.12790	0.2069	0.05999	...	23.57	25.53	152.50	1709.0	0.1444	0.4245	0.4504	0.24
3	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	0.10520	0.2597	0.09744	...	14.91	26.50	98.87	567.7	0.2098	0.8663	0.6869	0.25
4	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	0.10430	0.1809	0.05883	...	22.54	16.67	152.20	1575.0	0.1374	0.2050	0.4000	0.16

5 rows × 30 columns

