```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.datasets import make_classification
from sklearn.linear_model import LogisticRegression, SGDClassifier
from mlxtend.plotting import plot_decision_regions
from sklearn.utils import shuffle
```

```
!pip install --upgrade --no-cache-dir gdown
!gdown 1Won6xkyYCcJLJ7eMpVt5VA_4P0tE1nb7
```

```
Requirement already satisfied: gdown in /usr/local/lib/python3.10/dist-packages (4.7.3)
Collecting gdown
  Downloading gdown-5.0.0-py3-none-any.whl (16 kB)
Requirement already satisfied: beautifulsoup4 in /usr/local/lib/python3.10/dist-packages (from gdown) (4.11.2)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from gdown) (3.13.1)
Requirement already satisfied: requests[socks] in /usr/local/lib/python3.10/dist-packages (from gdown) (2.31.0)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (from gdown) (4.66.1)
Requirement already satisfied: soupsieve>1.2 in /usr/local/lib/python3.10/dist-packages (from beautifulsoup4->gdown) (2.5)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (3.6)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (2023.11.17)
Requirement already satisfied: PySocks!=1.5.7,>=1.5.6 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (1.7.1)
Installing collected packages: gdown
  Attempting uninstall: gdown
    Found existing installation: gdown 4.7.3
    Uninstalling gdown-4.7.3:
      Successfully uninstalled gdown-4.7.3
Successfully installed gdown-5.0.0
Downloading...
From: https://drive.google.com/uc?id=1Won6xkyYCcJLJ7eMpVt5VA_4P0tE1nb7
To: /content/data_banknote_authentication.txt
100% 46.4k/46.4k [00:00<00:00, 117MB/s]
```

```
df = pd.read_csv('/content/data_banknote_authentication.txt')
df
```

	x1	x2	x3	x4	y
0	3.62160	8.66610	-2.8073	-0.44699	0
1	4.54590	8.16740	-2.4586	-1.46210	0
2	3.86600	-2.63830	1.9242	0.10645	0
3	3.45660	9.52280	-4.0112	-3.59440	0
4	0.32924	-4.45520	4.5718	-0.98880	0
...	...	...	...	...	...
1367	0.40614	1.34920	-1.4501	-0.55949	1
1368	-1.38870	-4.87730	6.4774	0.34179	1
1369	-3.75030	-13.45860	17.5932	-2.77710	1
1370	-3.56370	-8.38270	12.3930	-1.28230	1
1371	-2.54190	-0.65804	2.6842	1.19520	1

1372 rows × 5 columns

```
shuffled_data = shuffle(df)
shuffled_data.to_csv('created_data.csv', index=False)
print(shuffled_data)
```

```
             x1         x2       x3       x4  y
69    0.12326   8.984800 -0.93510 -2.43320  0
31    1.48840   3.627400  3.30800  0.48921  0
1010 -2.99150  -6.625800  8.65210  1.81980  1
1316 -1.60290  -0.389030  1.62000  1.91030  1
35    2.43910   6.441700 -0.80743 -0.69139  0
...       ...        ...      ...      ... ..
343   0.66018  10.387800 -1.40290 -3.91510  0
1106 -0.12690  -1.150500 -0.95138  0.57843  1
```

```
1341 -2.26250  -0.099335  2.81270  0.48662  1
303  -1.91770  11.689400  2.54540 -3.27630  0
1147 -1.69880  -7.116300  5.79020  0.16723  1

[1372 rows x 5 columns]
```

```
df2 = pd.read_csv('/content/created_data.csv')
df2
```

	x1	x2	x3	x4	y
0	0.12326	8.984800	-0.93510	-2.43320	0
1	1.48840	3.627400	3.30800	0.48921	0
2	-2.99150	-6.625800	8.65210	1.81980	1
3	-1.60290	-0.389030	1.62000	1.91030	1
4	2.43910	6.441700	-0.80743	-0.69139	0
...	...	...	...	...	...
1367	0.66018	10.387800	-1.40290	-3.91510	0
1368	-0.12690	-1.150500	-0.95138	0.57843	1
1369	-2.26250	-0.099335	2.81270	0.48662	1
1370	-1.91770	11.689400	2.54540	-3.27630	0
1371	-1.69880	-7.116300	5.79020	0.16723	1

1372 rows × 5 columns

```
class_counts = df2['y'].value_counts()

# نمایش تعداد نمونه‌ها برای هر کلاس
print(class_counts)
```

```
0    762
1    610
Name: y, dtype: int64
```

```
X = df2[['x1','x2','x3','x4']].values
y = df2[['y']].values
X, y
```

```
(array([[ 0.12326 ,  8.9848  , -0.9351  , -2.4332  ],
        [ 1.4884  ,  3.6274  ,  3.308   ,  0.48921 ],
        [-2.9915  , -6.6258  ,  8.6521  ,  1.8198  ],
        ...,
        [-2.2625  , -0.099335,  2.8127  ,  0.48662 ],
        [-1.9177  , 11.6894  ,  2.5454  , -3.2763  ],
        [-1.6988  , -7.1163  ,  5.7902  ,  0.16723 ]]),
 array([[0],
        [0],
        [1],
        ...,
        [1],
        [0],
        [1]]))
```

```
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2,random_state=42)
model = LogisticRegression(solver='sag',class_weight='balanced', max_iter=60000, random_state=42)
history=model.fit(x_train, y_train)
print(x_train.shape), print(y_train.shape), print(x_test.shape), print(y_test.shape)
y_pred=model.predict(x_test)
y_pred, y_test
```

```
model.score(x_train, y_train)
```

```
0.995
```

```
model.score(x_test, y_test)
```

```
0.995
```