In [97]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

In [98]:
```
df = pd.read_csv('ushape.csv')
```

In [99]:
```
df.head()
```

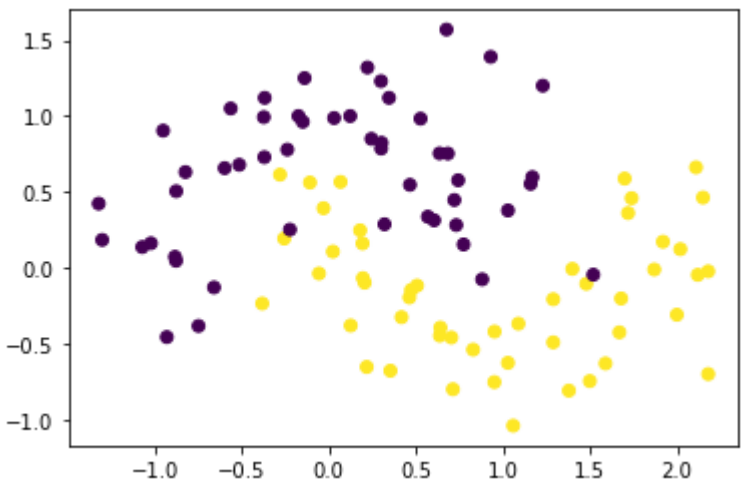
Out[99]:

	X	Y	class
0	0.0316	0.9870	0.0
1	2.1200	-0.0462	1.0
2	0.8820	-0.0758	0.0
3	-0.0551	-0.0373	1.0
4	0.8300	-0.5390	1.0

In [100…
```
X = df.iloc[:,0:2].values
y = df.iloc[:,-1].values
```

In [101…
```
plt.scatter(X[:,0],X[:,1],c=y)
```

Out[101…



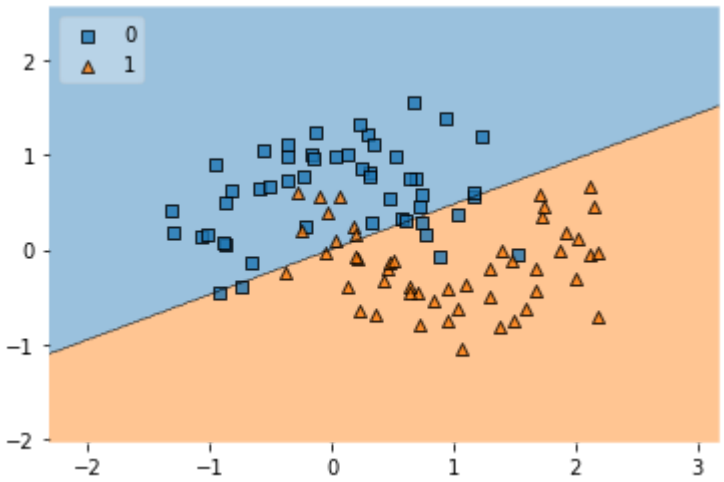
In [102…
```
from sklearn.linear_model import LogisticRegression
clf = LogisticRegression()
```

In [103…
```
clf.fit(X,y)
```

Out[103… LogisticRegression()

In [104…
```
from mlxtend.plotting import plot_decision_regions

plot_decision_regions(X, y.astype('int'), clf, legend=2)
```

Out[104…



In [105…
```
from sklearn.model_selection import cross_val_score
np.mean(cross_val_score(clf,X,y,scoring='accuracy',cv=10))
```

Out[105… 0.8300000000000001

In [106…
```
from sklearn.preprocessing import PolynomialFeatures
poly = PolynomialFeatures(degree=3,include_bias=False)
X_trf = poly.fit_transform(X)
```

In [107…
```
clf1 = LogisticRegression()
np.mean(cross_val_score(clf1,X_trf,y,scoring='accuracy',cv=10))
```

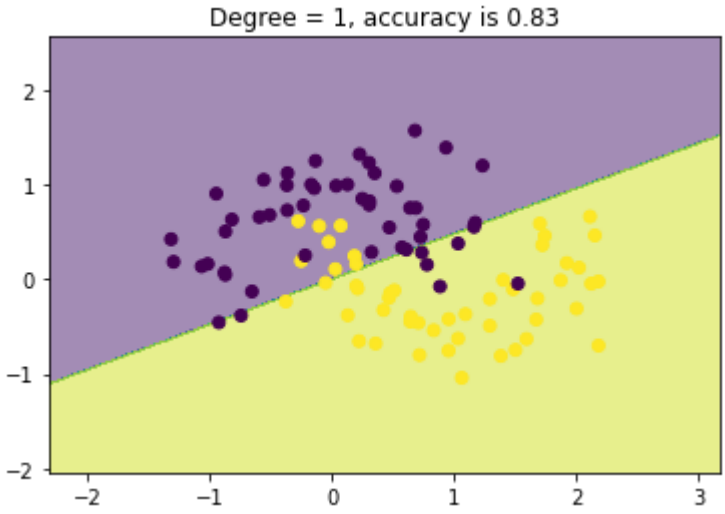
Out[107… 0.9

In [108…
```
def plot_decision_boundary(X,y,degree=1):

    poly = PolynomialFeatures(degree=degree)
    X_trf = poly.fit_transform(X)

    clf = LogisticRegression()
    clf.fit(X_trf,y)

    accuracy = np.mean(cross_val_score(clf,X_trf,y,scoring='accuracy',cv=10)

    a=np.arange(start=X[:,0].min()-1, stop=X[:,0].max()+1, step=0.01)
    b=np.arange(start=X[:,1].min()-1, stop=X[:,1].max()+1, step=0.01)


    XX,YY=np.meshgrid(a,b)

    input_array=np.array([XX.ravel(),YY.ravel()]).T

    labels=clf.predict(poly.transform(input_array))
```

```
    plt.contourf(XX,YY,labels.reshape(XX.shape),alpha=0.5)
    plt.scatter(X[:,0],X[:,1], c=y)
    plt.title('Degree = {}, accuracy is {}'.format(degree,np.round(accuracy,
```

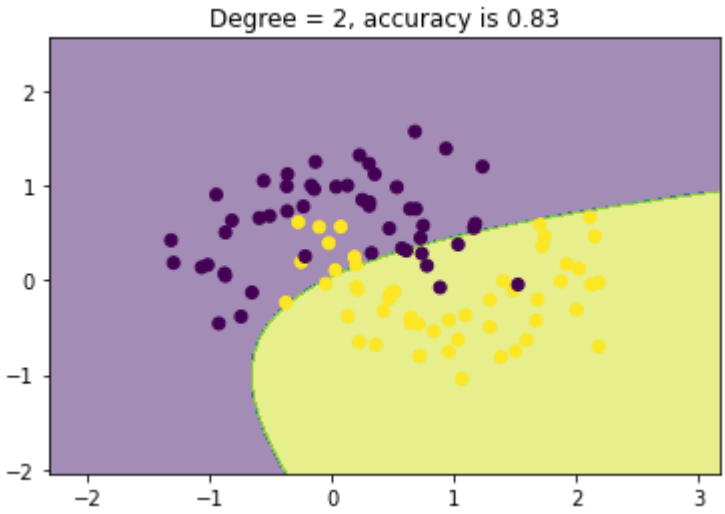
In [109…

```
plot_decision_boundary(X,y)
```



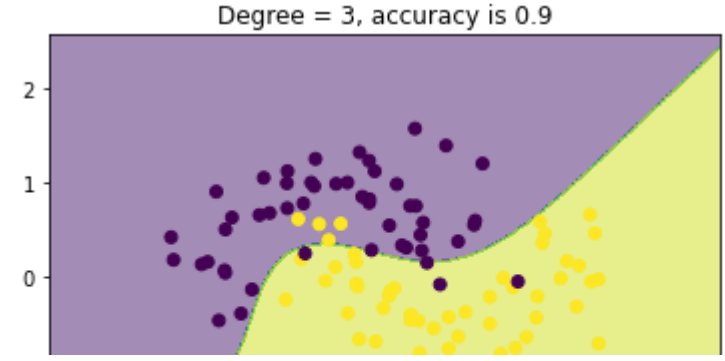
In [110…

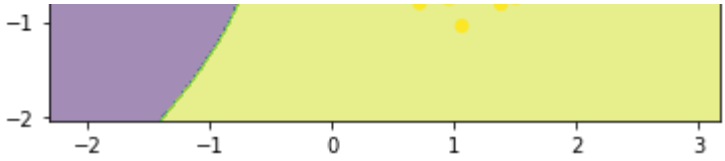
```
plot_decision_boundary(X,y,degree=2)
```



In [111…

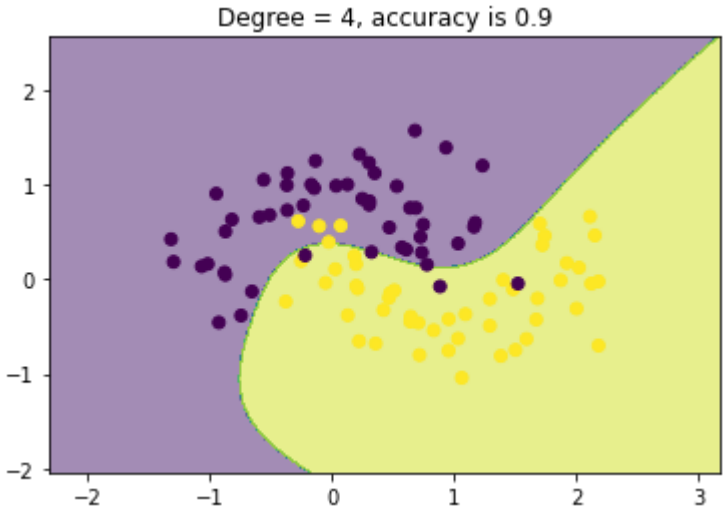
```
plot_decision_boundary(X,y,degree=3)
```





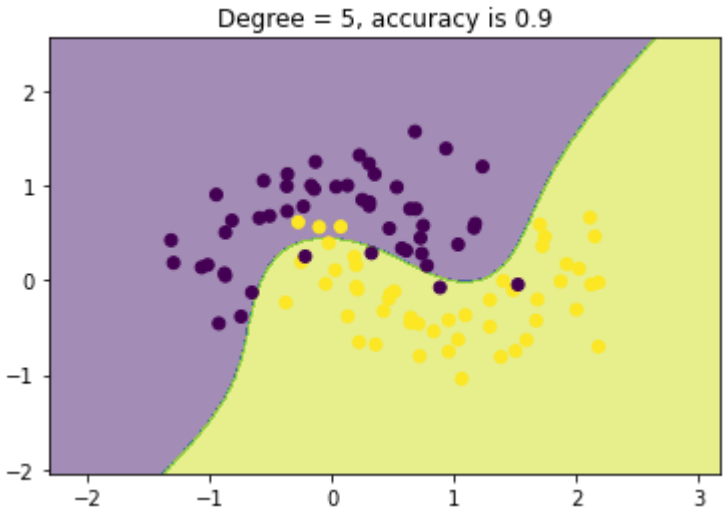
In [112…

```
plot_decision_boundary(X,y,degree=4)
```



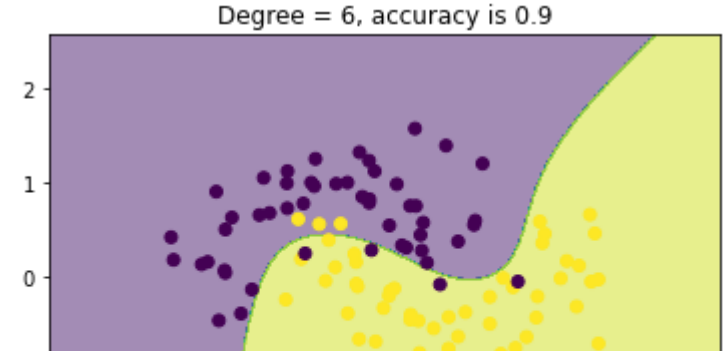
In [113…

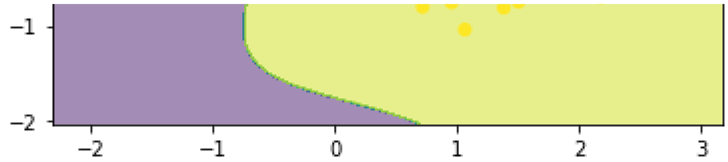
```
plot_decision_boundary(X,y,degree=5)
```



In [114…

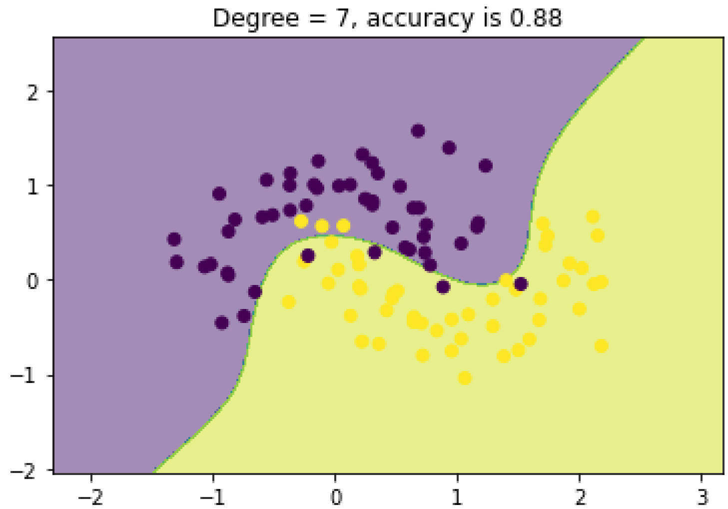
```
plot_decision_boundary(X,y,degree=6)
```





In [115…

```
plot_decision_boundary(X,y,degree=7)
```



In [116…

```
plot_decision_boundary(X,y,degree=25)
```

```
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
763: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
763: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
763: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
```

```
763: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
763: ConvergenceWarning: lbfgs failed to converge (status=2):
ABNORMAL_TERMINATION_IN_LNSRCH.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
763: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
763: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
763: ConvergenceWarning: lbfgs failed to converge (status=1):
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C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
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Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
C:\Users\91842\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:
```

```
763: ConvergenceWarning: lbfgs failed to converge (status=1):
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    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion
  n_iter_i = _check_optimize_result(
```

Degree = 25, accuracy is 0.8