# overffitting

July 21, 2022

[ ]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import PolynomialFeatures as PF
from sklearn.linear_model import LinearRegression as reg
from sklearn.metrics import mean_squared_error
```

[ ]:

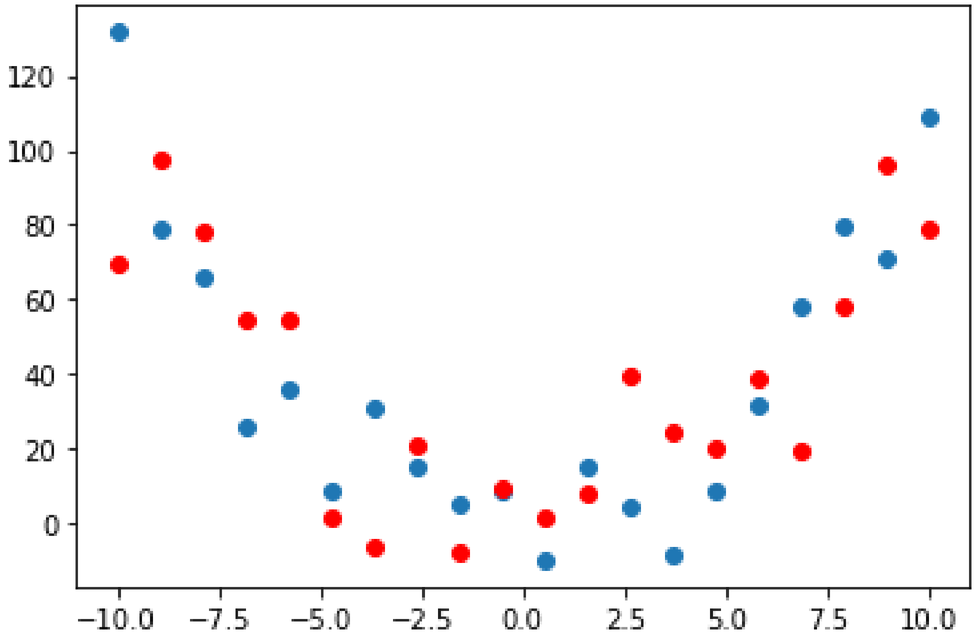
```
def f(x):
  return x**2


def generate_X_for_predict(num = 1000):
  return np.linspace(-10, 10, num).reshape(-1, 1)


def generate_data(num = 20):
  X = np.linspace(-10, 10, num)
  noise = np.random.normal(loc=0, scale=15, size=num)
  Y =  X**2 + noise
  return X.reshape(-1, 1), Y
```

[ ]:

```
train_X, train_Y = generate_data()
test_X, test_Y = generate_data()
```

[ ]:

```
plt.scatter(train_X, train_Y)
plt.scatter(test_X, test_Y, color='red')
plt.show()
```



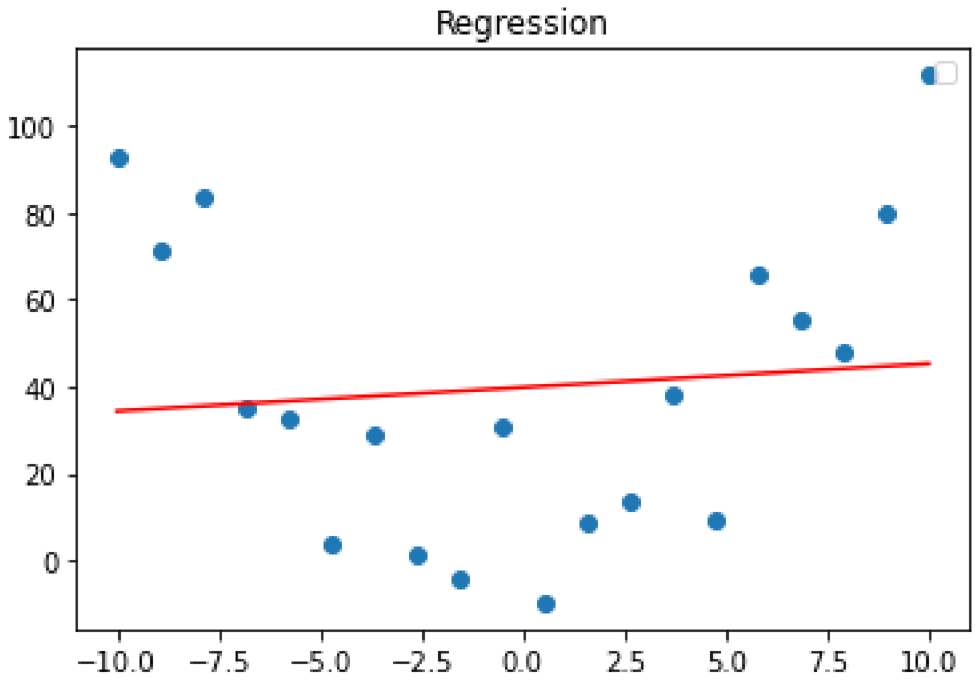
[ ]:

```
def exec_and_plot(DegreeSet, show_graph=False):
    errors = []
    test_errors = []
    for dg in DegreeSet:
        pf = PF(degree = dg)
        x_poly = pf.fit_transform(train_X)
        poly_reg = reg()
        poly_reg.fit(x_poly, train_Y)
        polypred = poly_reg.predict(x_poly)

        test_pred = poly_reg.predict(pf.fit_transform(test_X))

        error = mean_squared_error(train_Y, polypred)
        test_error = mean_squared_error(test_Y, test_pred)
        # print(" {0}: =>    {1}".format(dg, error))
        errors.append(error)
        test_errors.append(test_error)

        if show_graph:
            plt.scatter(train_X, train_Y)
            plt.plot(train_X, polypred, color="red")
            plt.legend()
            plt.title("Regression")
            plt.show()
    return errors, test_errors
```

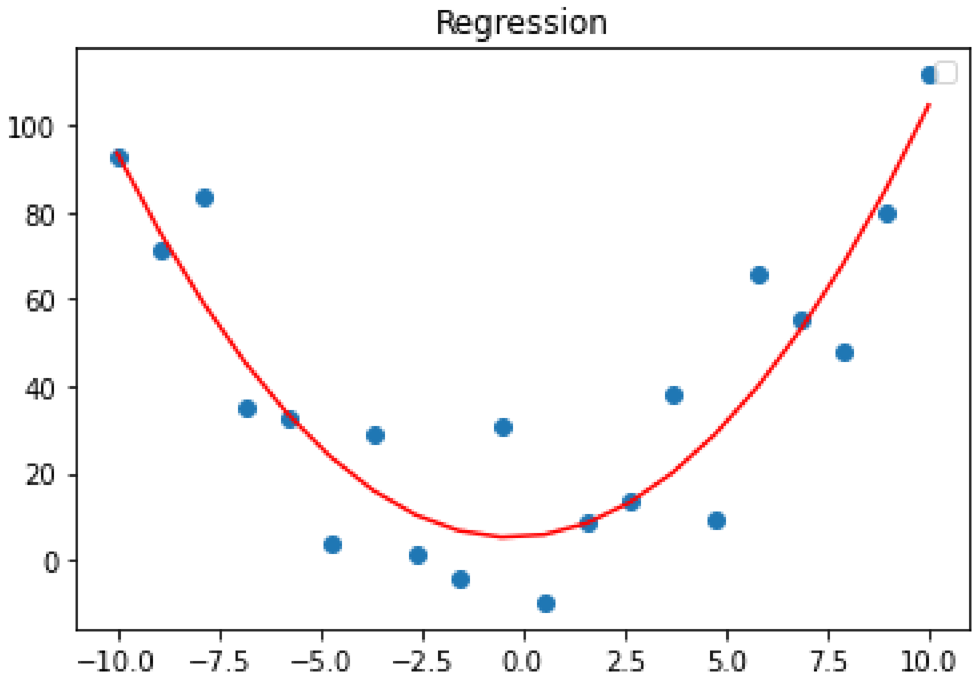
```
[ ]: degree_set = range(30)
     errors, test_errors = exec_and_plot(degree_set)
```

```
[ ]: degree_set_2 = [1, 2, 20]
     errors, test_errors = exec_and_plot(degree_set_2, True)
```

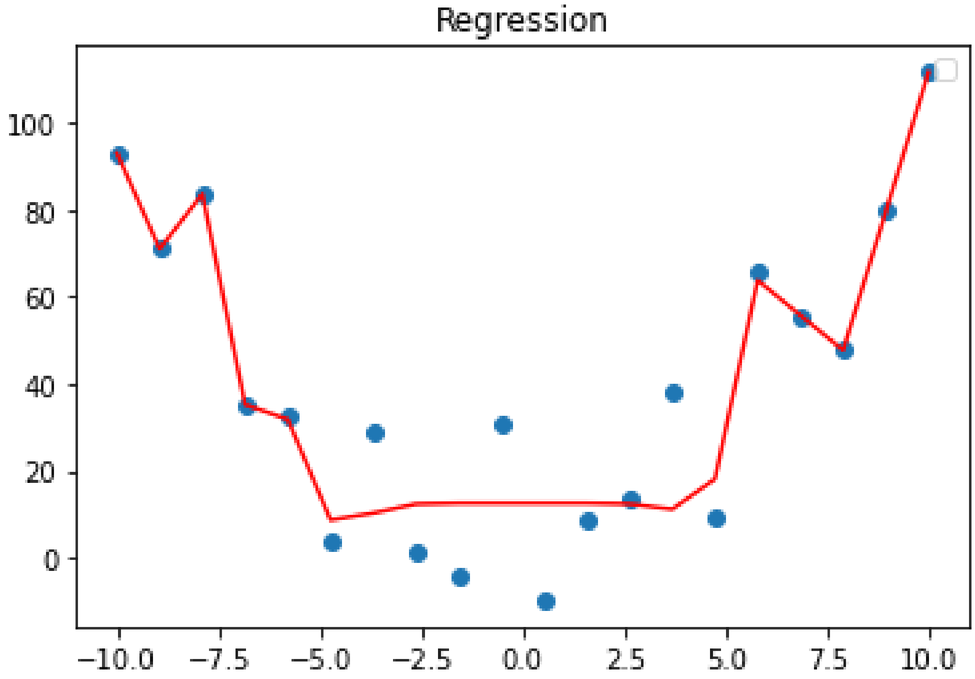
```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```

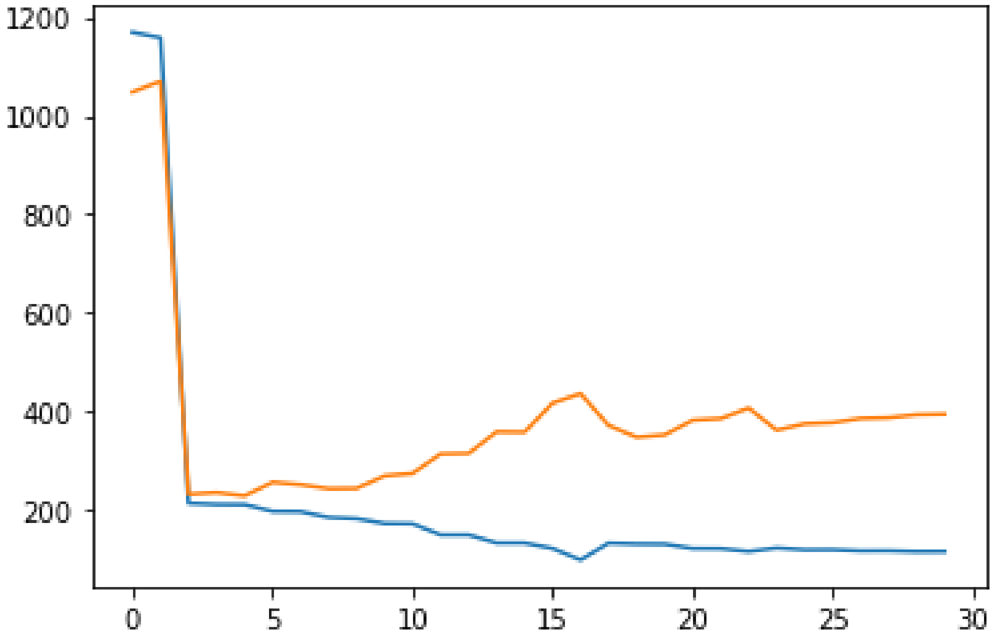


[ ]:

```
plt.plot(degree_set, errors)
plt.plot(degree_set, test_errors)
```

[ ]:

```
[<matplotlib.lines.Line2D at 0x7fb528871630>]
```


1200
1000
800
600
400
200
0
5
10
15
20
25
30