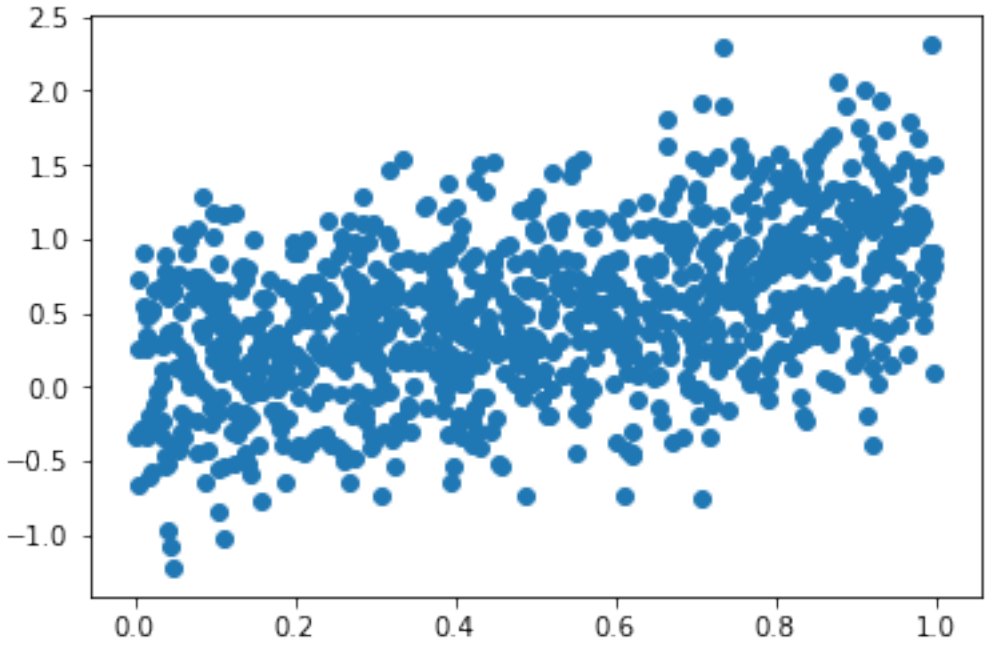
hw1

September 3, 2018

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:
```
n = 1000
x = np.random.uniform(0, 1, n)
e = np.random.randn(n)*0.5
y = x + e
```

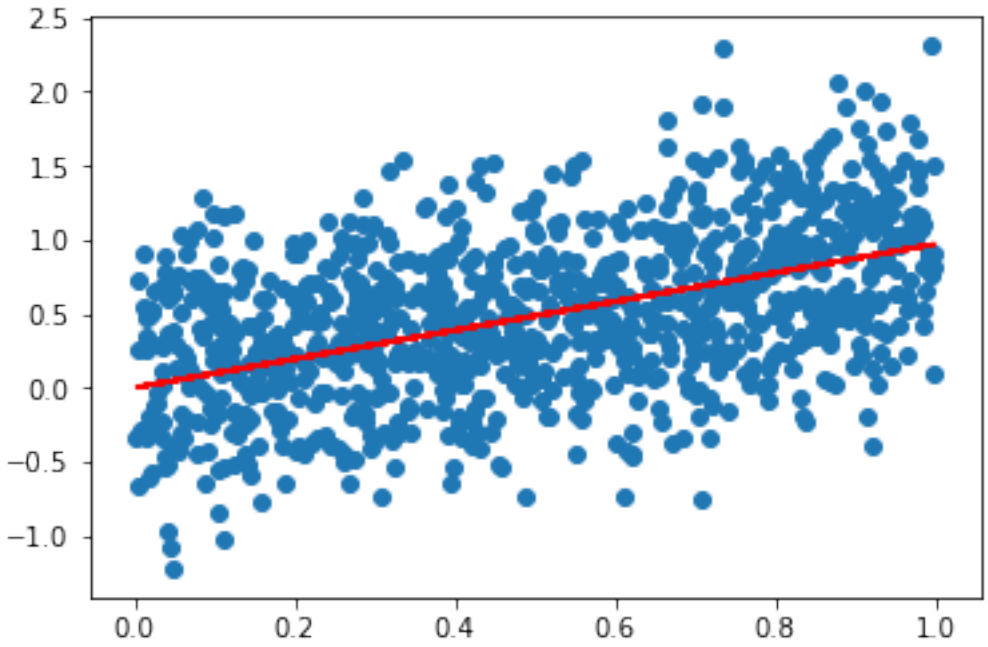
In [3]:
```
# Problem 4.1
plt.scatter(x,y)
plt.show()
```



In [4]:
```
# Problem 4.2
a = np.linspace(0, 2, 10000)
m = np.zeros(len(a))
for i in range(0,len(a)):
```

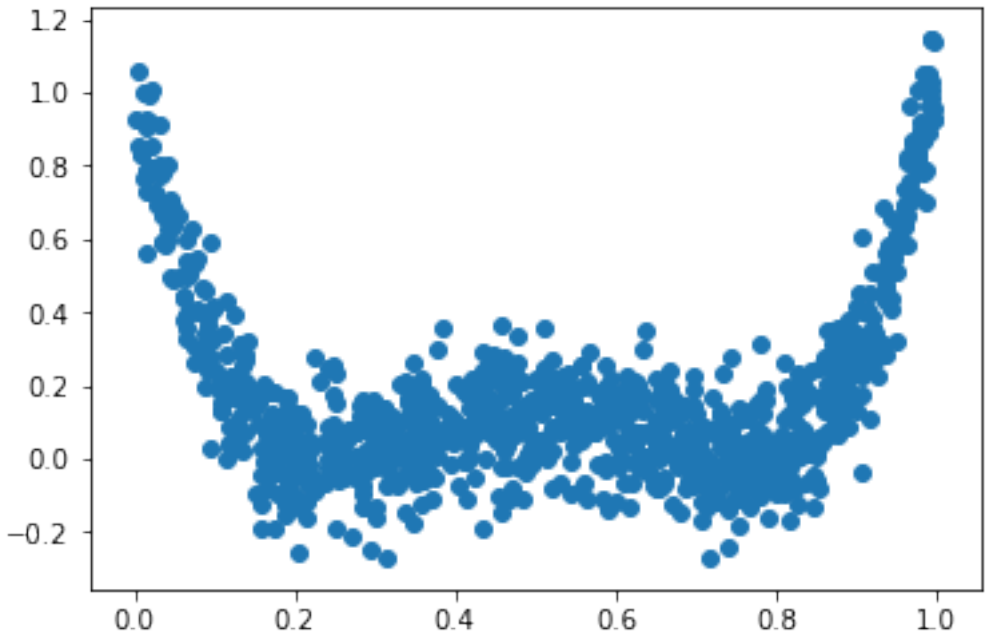
```
        m[i] = np.linalg.norm(x*a[i] - y)**2
    a_min = a[np.where(m==min(m))]
    f = np.linalg.norm(x*a_min - y)**2
    print(f)
    y1 = a_min*x
    print(a_min)
    plt.scatter(x,y)
    plt.plot(x,y1, color='red')
    plt.show()
```

```
229.905534832
[ 0.97069707]
```



In [5]:
```
x = np.random.uniform(0, 1, n)
e = np.random.randn(n)*0.1
y = 30*((x-0.25)**2)*((x-0.75)**2) + e
```

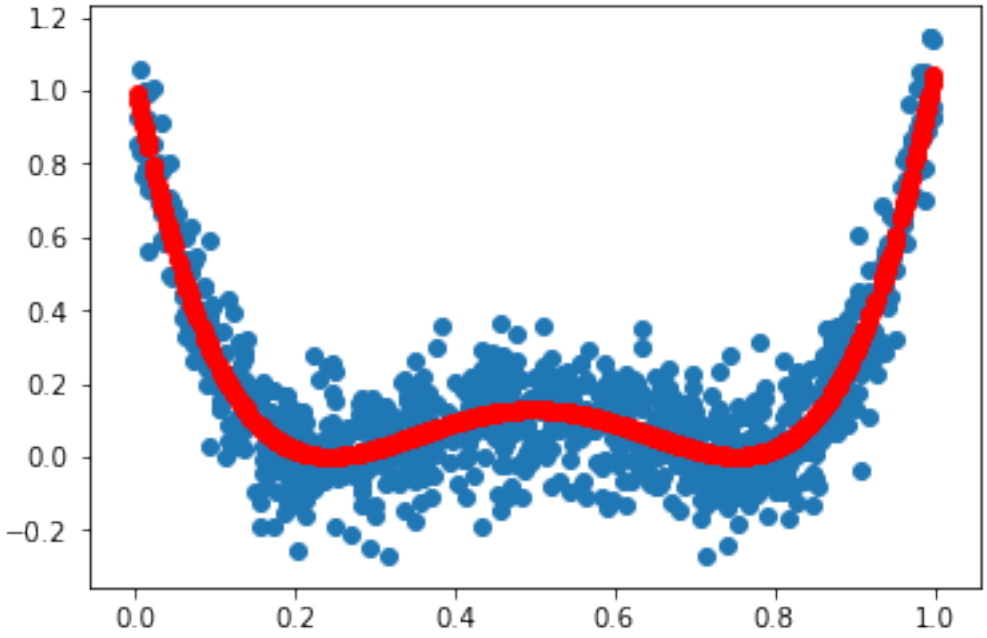
In [6]:
```
# Problem 4.4-1
plt.scatter(x,y)
plt.show()
```




```
In [9]: d = 4
        X = np.zeros((n,d+1))
        for i in range(d+1):
            X[:,i] = x**i
        Xt = np.transpose(X)
        a = np.linalg.inv(Xt @ X) @ Xt @ y
        print(a)
```

```
[  1.02141806 -11.07833275  41.19769197 -60.36780505  30.28808685]
```

```
In [10]: # Problem 4.4-2
         y1 = X @ a
         plt.scatter(x,y)
         plt.scatter(x,y1, color='red')
         plt.show()
```


1.2
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
0.0
0.2
0.4
0.6
0.8
1.0