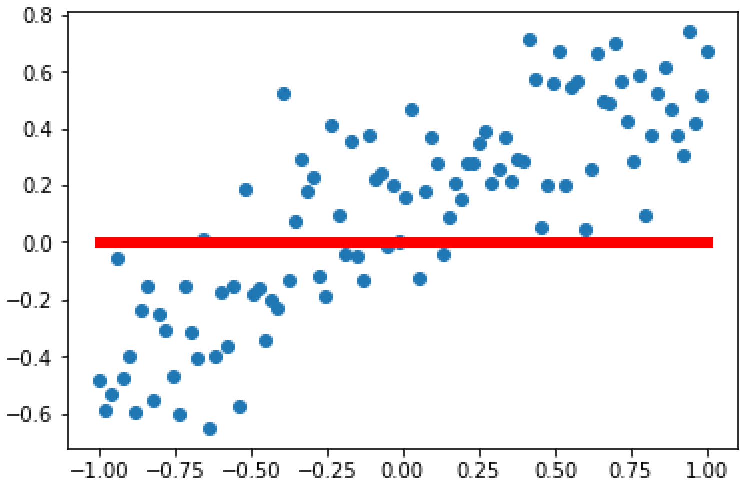
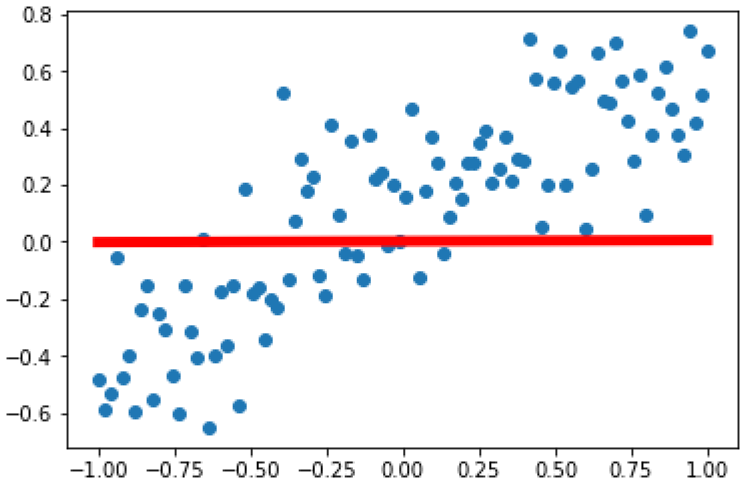
In [1]:

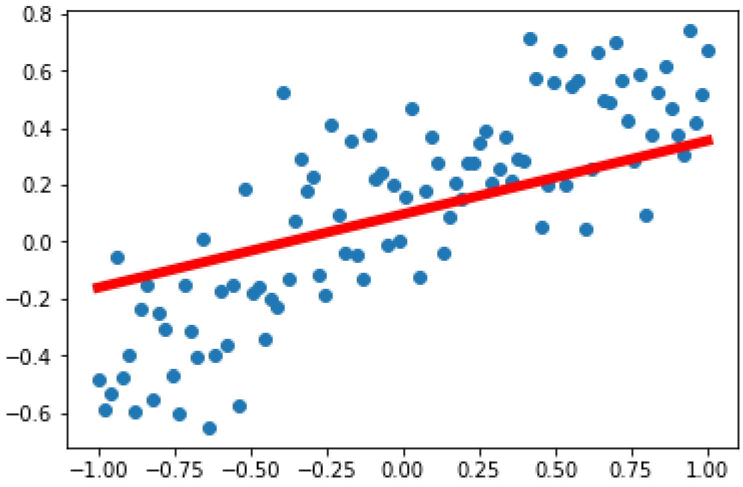
```
%matplotlib inline
import numpy as np
import matplotlib.pyplot as plt

# y = wx + b

def compute_error_for_line_given_points(b, w, points):
    totalError = 0
    for i in range(0, len(points)):
        x = points[i, 0]
        y = points[i, 1]
        totalError += (y - (w * x + b)) ** 2
    plt.cla()
    plt.scatter(points[:, 0], points[:, 1])
    plt.plot(points[:, 0], w * points[:, 0] + b, 'r-', lw=5)
    plt.show()
    return totalError / float(len(points))

def step_gradient(b_current, w_current, points, learningRate):
    b_gradient = 0
    w_gradient = 0
    N = float(len(points))
    for i in range(0, len(points)):
        x = points[i, 0]
        y = points[i, 1]
        b_gradient += -(2/N) * (y - ((w_current * x) + b_current))
        w_gradient += -(2/N) * x * (y - ((w_current * x) + b_current))
    new_b = b_current - (learningRate * b_gradient)
    new_w = w_current - (learningRate * w_gradient)
    return [new_b, new_w]

def gradient_descent_runner(points, starting_b, starting_w, learning_rate, nu
    b = starting_b
    w = starting_w
    for i in range(num_iterations):
        b, w = step_gradient(b, w, np.array(points), learning_rate)
        if i % 100 == 0:
            print('iteration %d, error is %.4f' % (i, compute_error_for_line_
    return [b, w]

def run():
    # points = np.genfromtxt("data.csv", delimiter=",")
    points = np.zeros((100, 2))
    points[:,0] = np.linspace(-1, 1, 100)
    points[:,1] = 0.5*points[:,0] + 0.1 + 0.2*np.random.randn(100)

    learning_rate = 0.01
    initial_b = 0 # initial y-intercept guess
    initial_w = 0 # initial slope guess
    num_iterations = 1001
    print("Starting gradient descent at b = {0}, w = {1}, error = {2}"
          .format(initial_b, initial_w,
                  compute_error_for_line_given_points(initial_b, initial_w, po
          )
    print("Running...")
    [b, w] = gradient_descent_runner(points, initial_b, initial_w, learning_r
    print("After {0} iterations b = {1}, w = {2}, error = {3}".
          format(num_iterations, b, w,
                 compute_error_for_line_given_points(b, w, points))
          )

if __name__ == '__main__':
    run()
```



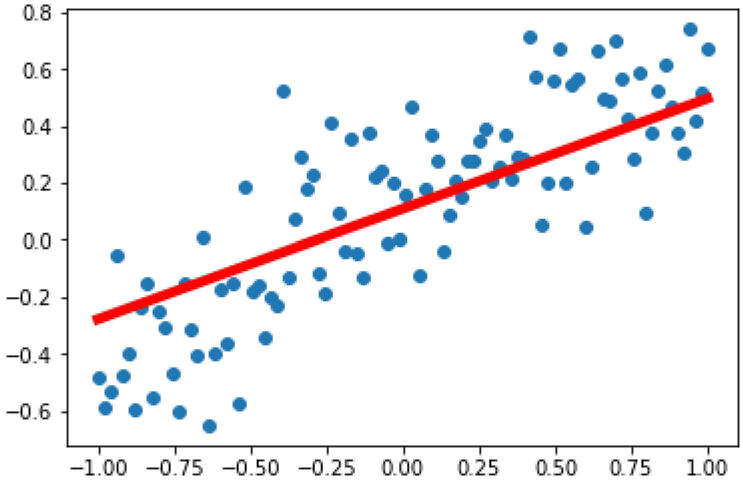
```
Starting gradient descent at b = 0, w = 0, error = 0.14440481898609517
Running...
```



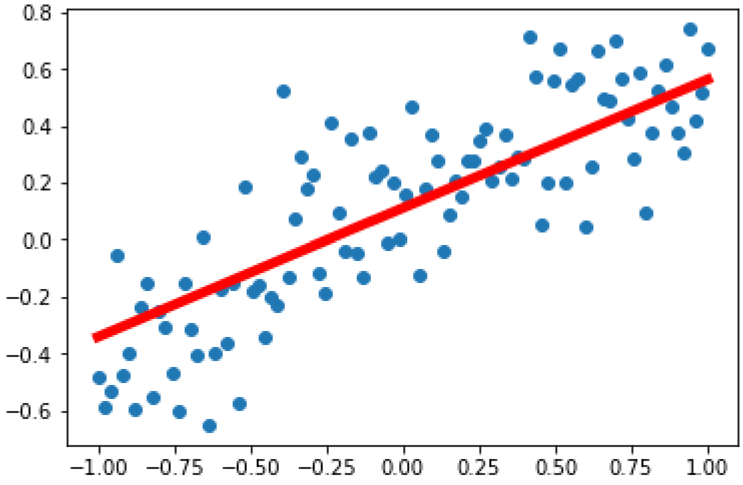
```
iteration 0, error is 0.1427
```



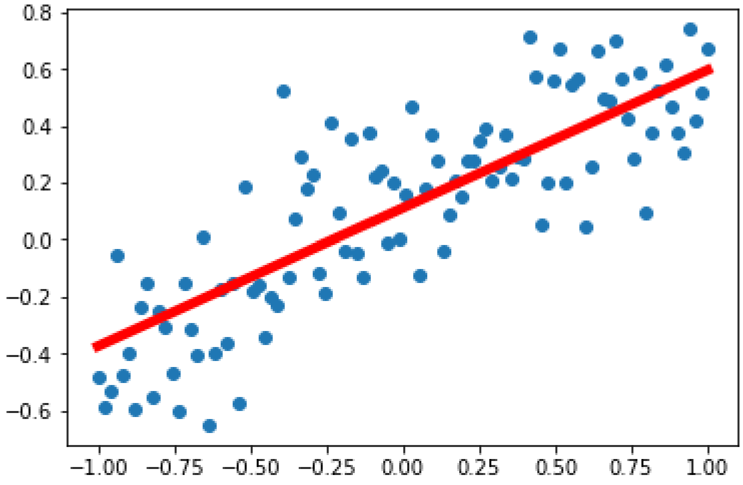
```
iteration 100, error is 0.0638
```



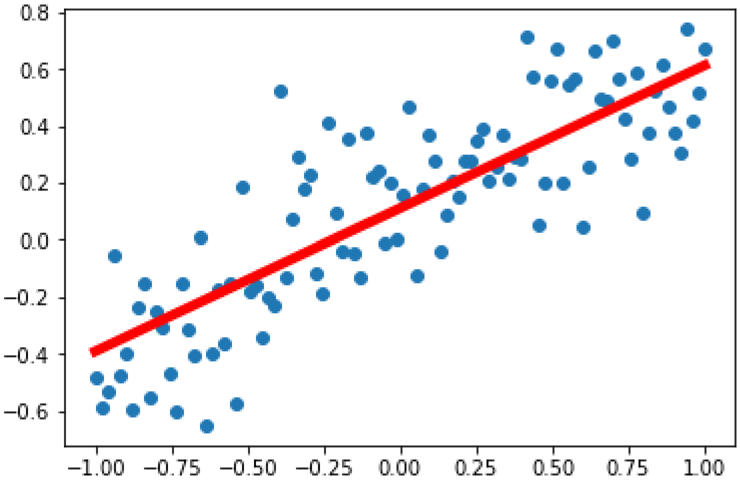
```
iteration 200, error is 0.0464
```



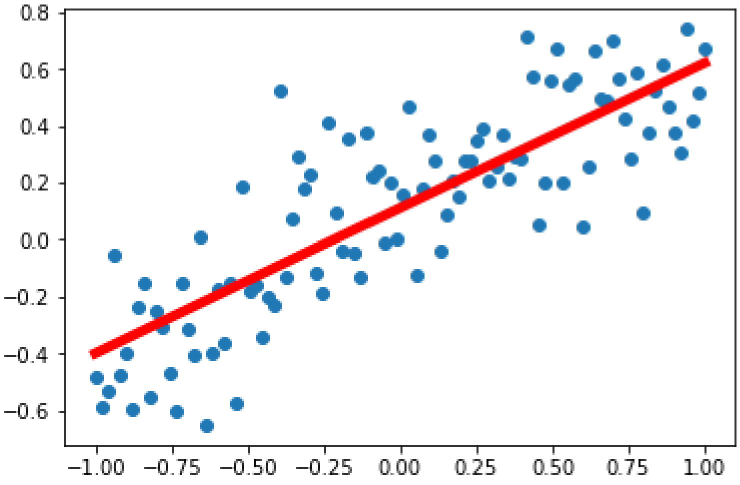
```
iteration 300, error is 0.0421
```



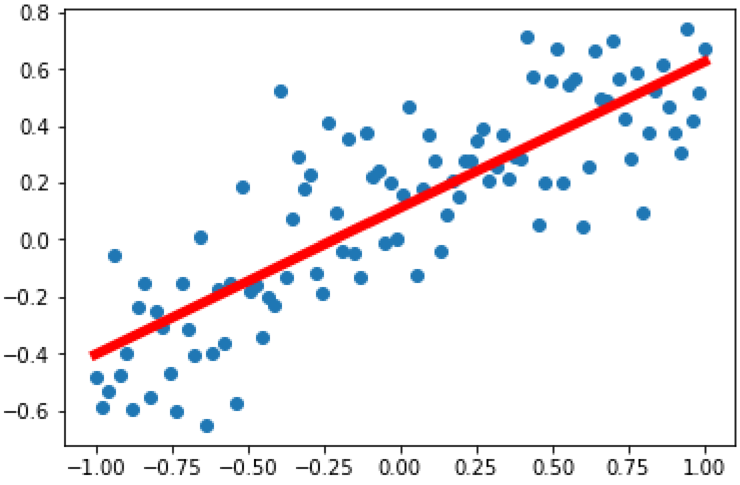
```
iteration 400, error is 0.0409
```



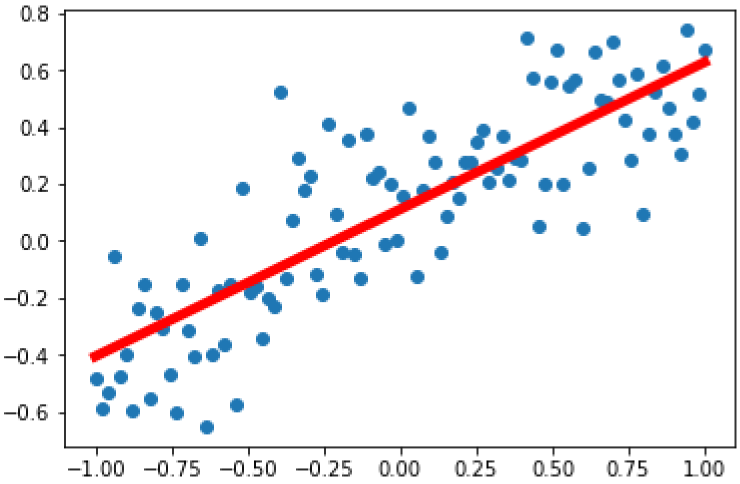
```
iteration 500, error is 0.0406
```



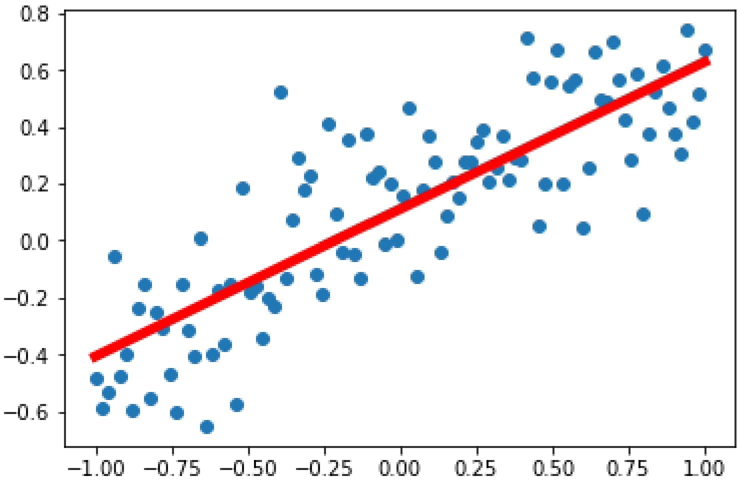
```
iteration 600, error is 0.0406
```



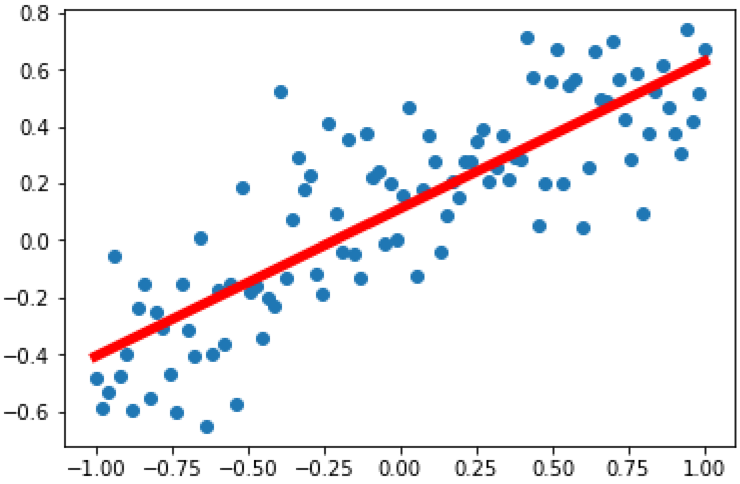
```
iteration 700, error is 0.0406
```



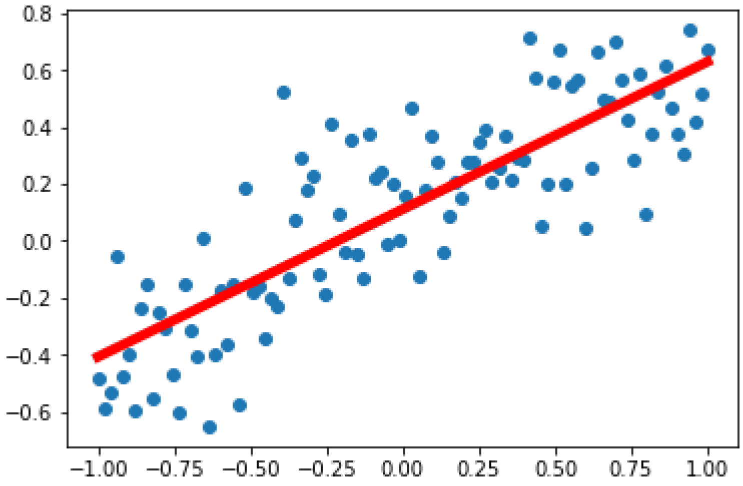
```
iteration 800, error is 0.0406
```



```
iteration 900, error is 0.0406
```



```
iteration 1000, error is 0.0406
```



```
After 1001 iterations b = 0.11079041960885337, w = 0.518378525630123, error =
0.040551189139178
```

$$y = w * x + b$$

$$loss = \frac{\sum_{i=1}^{N}(w*x_i+b-y_i)^2}{N}$$

$$\nabla w = \frac{\sum 2*x_i*(w*x_i+b-y_i)}{N}$$

$$\nabla b = \frac{\sum 2*(w*x_i+b-y_i)}{N}$$

In [2]:

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# Kan Horst - PKU - 干皓丞
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In [ ]:

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