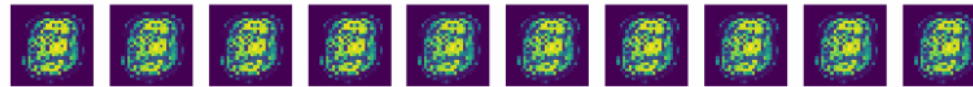




Regression

July 6, 2017

Seung-Chan Kim, Ph. D





All my great stuff, I learned outside of school

<http://www.cnbc.com/2016/04/21/steve-wozniak-school-is-not-enough-go-beyond-it.html>



**“There will be
this symbiosis
between humans
and machines,
in the same sense
that humans need
other humans.”**

*symbiosis (서로 다른 생물체 간의) 공생(共生)

Anthes, G. (2017). Artificial intelligence poised to ride a new wave. *Communications of the ACM*, 60(7), 19-21.

<http://dl.acm.org/citation.cfm?id=3088342> (교내 접속 가능)



- 1. 머신러닝 개론 및 주요 개념의 이해. Tensorflow 시스템 설치 및 환경설정 (7/4 화)
- **2. Tensorflow 에 익숙해지기 실습 및 Regression의 이해 (7/6 목)**
- 3. Neural Network 이해 및 tensorflow 를 이용한 구현 (7/11 화)
- 4. 이미지 분류 이해 및 Tensorflow를 이용한 구현 (7/13 목)



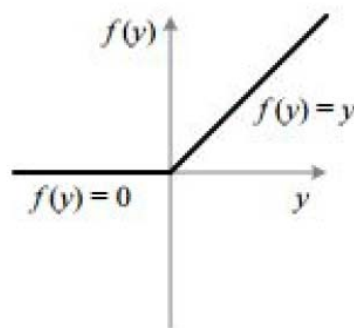
Tensor manipulation : 텐서 조작해보기 (실습)

<https://github.com/dalek7/DLWorkshop17Summer>



Rectified Linear Unit (ReLU)

$$\begin{aligned} a_1 &= \text{relu}(a_1) \\ b_1 &= \text{relu}(b_1) \\ c_1 &= \text{relu}(c_1) \end{aligned}$$



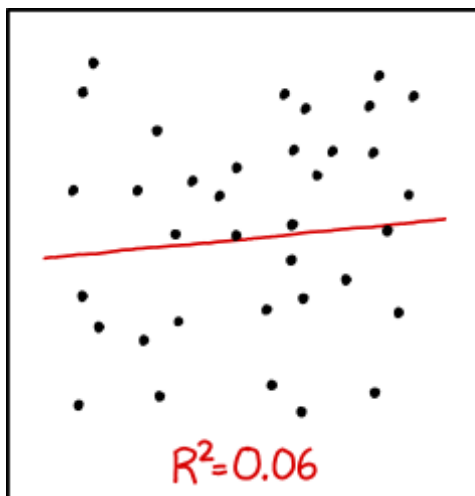
```
out = tf.nn.relu(y)
```

(-5 ,	'-->' ,)
(-4 ,	'-->' ,)
(-3 ,	'-->' ,)
(-2 ,	'-->' ,)
(-1 ,	'-->' ,)
(0 ,	'-->' ,)
(1 ,	'-->' ,)
(2 ,	'-->' ,)
(3 ,	'-->' ,)
(4 ,	'-->' ,)

00-5-relutest.py 를 열어주세요

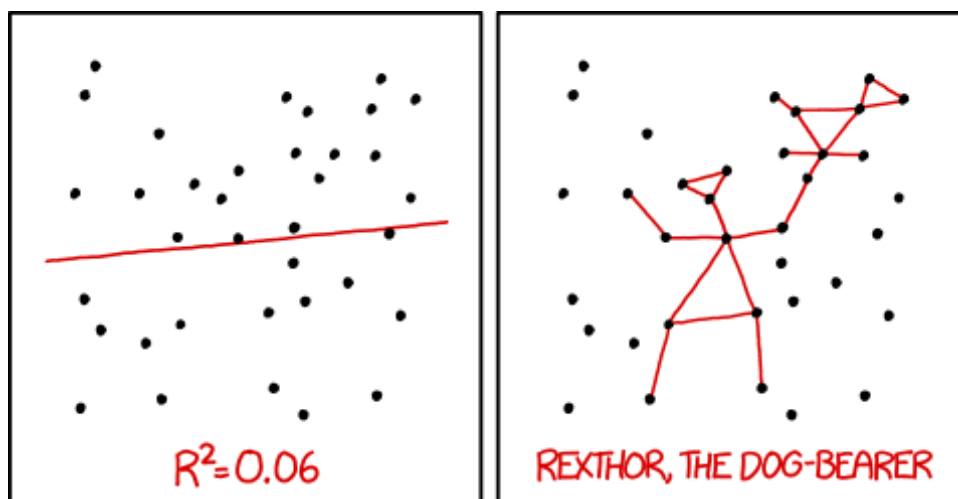


Linear Regression ??





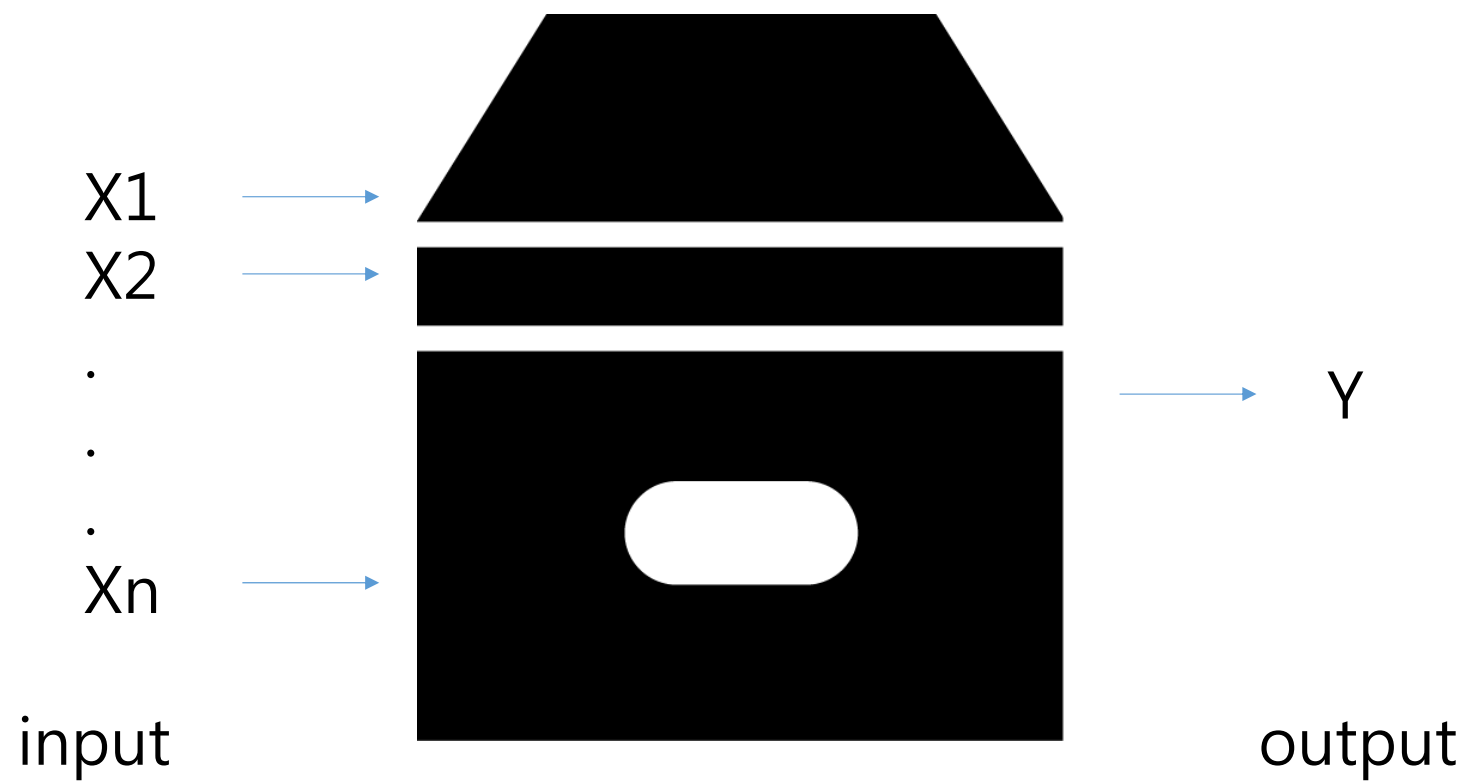
Linear Regression vs Rexthor-the-dog-bearer regression



I DON'T TRUST LINEAR REGRESSIONS WHEN IT'S HARDER
TO GUESS THE DIRECTION OF THE CORRELATION FROM THE
SCATTER PLOT THAN TO FIND NEW CONSTELLATIONS ON IT.



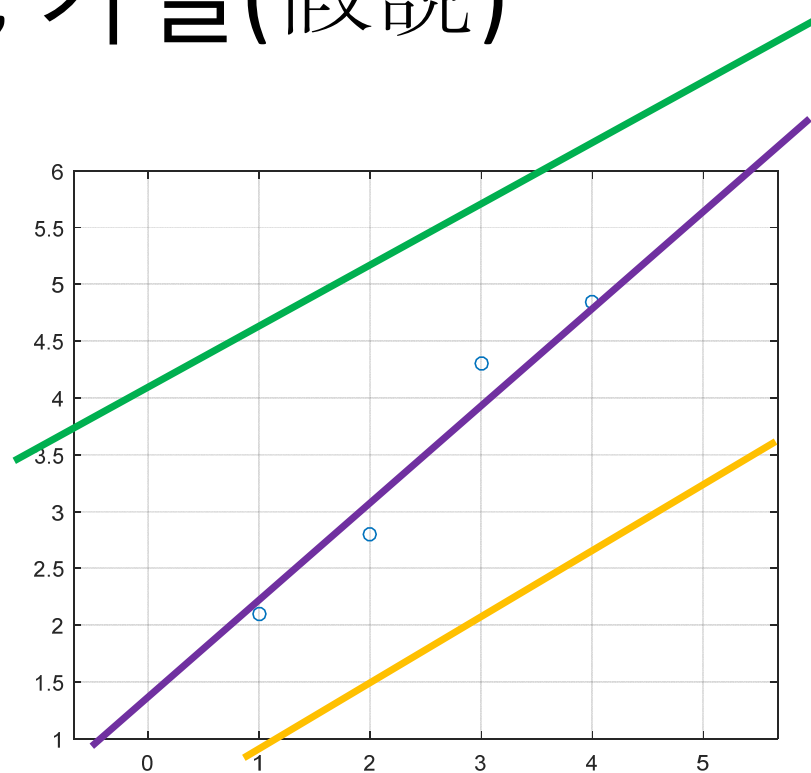
Regression





(Linear) Hypothesis, 가설(假說)

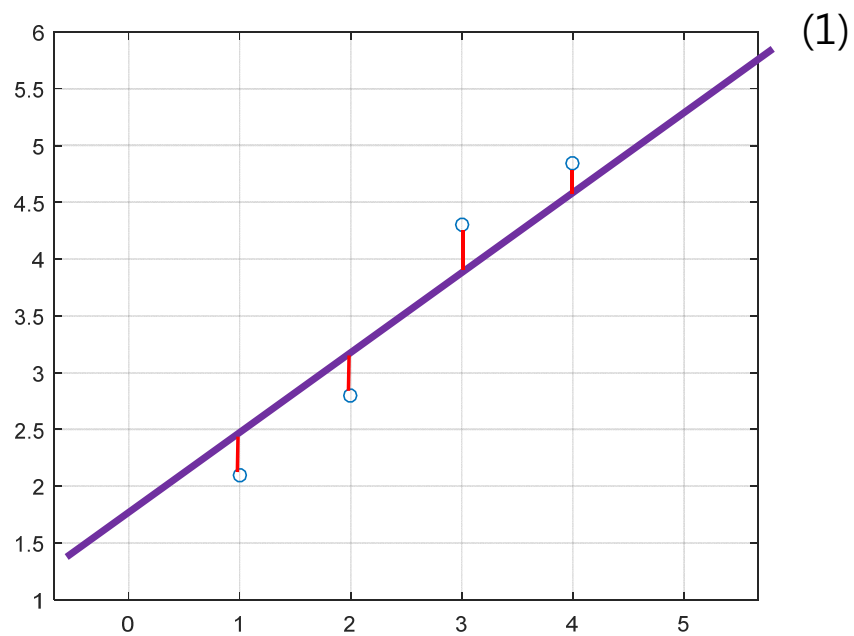
$$H(x) = Wx + b$$





Error ?

$$H(x) = Wx + b$$

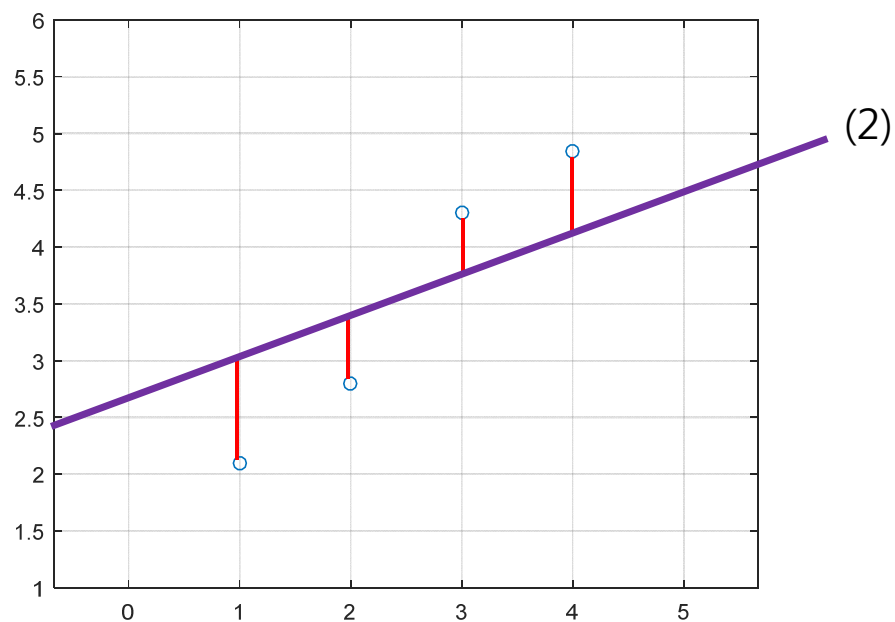




Error ?

W, b 에 따라서 에러 크기가 달라짐

$$H(x) = Wx + b$$





Linear Regression Hypothesis



$$H(x) = Wx$$

$$\text{cost}(W) = \frac{1}{m} \sum_{i=1}^m (Wx^{(i)} - y^{(i)})^2$$



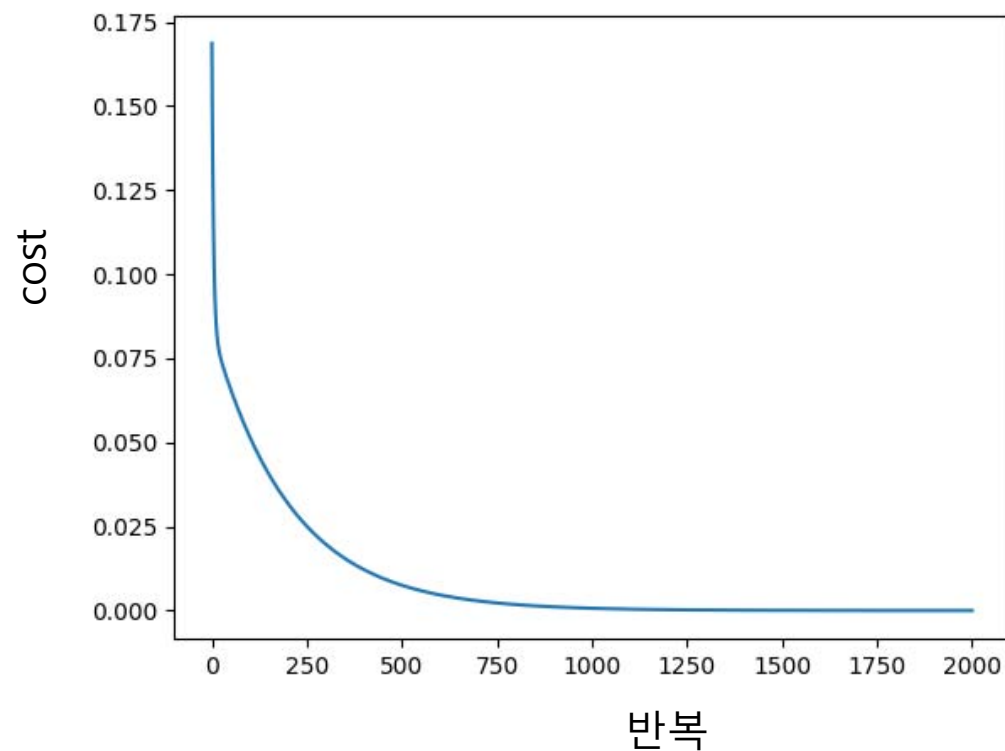
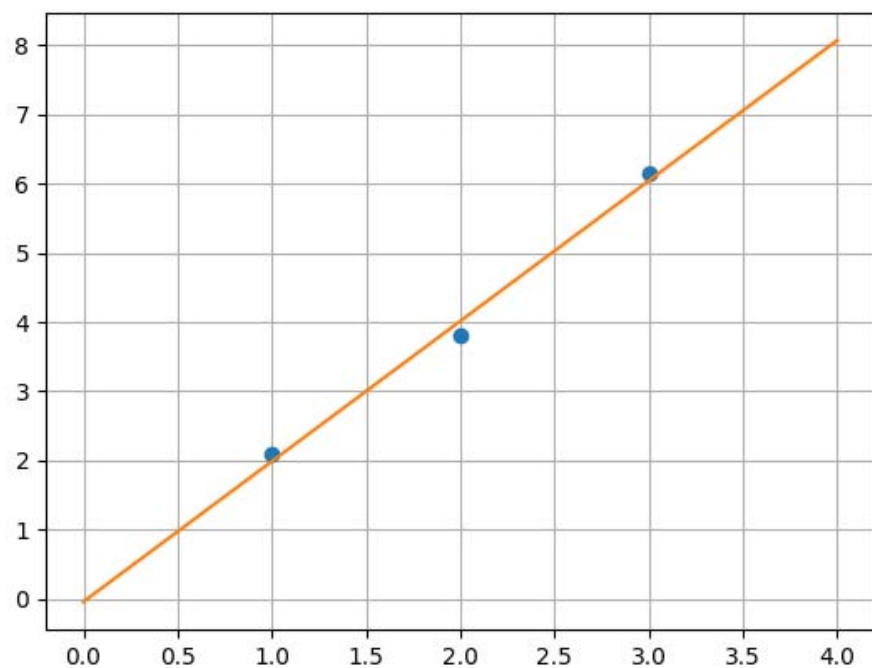
Cost function

- A function to be *minimized*
최소화 되어져야할 값

$$\underset{W, b}{\text{minimize}} \text{cost}(W, b)$$



Linear regression 실습



01-1-linear_regression.py 를 열어주세요



Can you guess ?

$$Y(x) = Wx + b$$

$y_{\text{train}} = [2, 4, 6]$

$x_{\text{train}} = [1, 2, 3]$

X and Y data

$x_{\text{train}} = [1, 2, 3]$

$y_{\text{train}} = [2, 4, 6]$



List of optimizers

- `tf.train.GradientDescentOptimizer`
- `tf.train.AdadeltaOptimizer`
- `tf.train.AdagradOptimizer`
- `tf.train.AdagradDAOptimizer`
- `tf.train.MomentumOptimizer`
- `tf.train.AdamOptimizer`
- `tf.train.FtrlOptimizer`
- `tf.train.ProximalGradientDescentOptimizer`
- `tf.train.ProximalAdagradOptimizer`
- `tf.train.RMSPropOptimizer`

the list of optimizers that TensorFlow supports, as of 1/8/2017



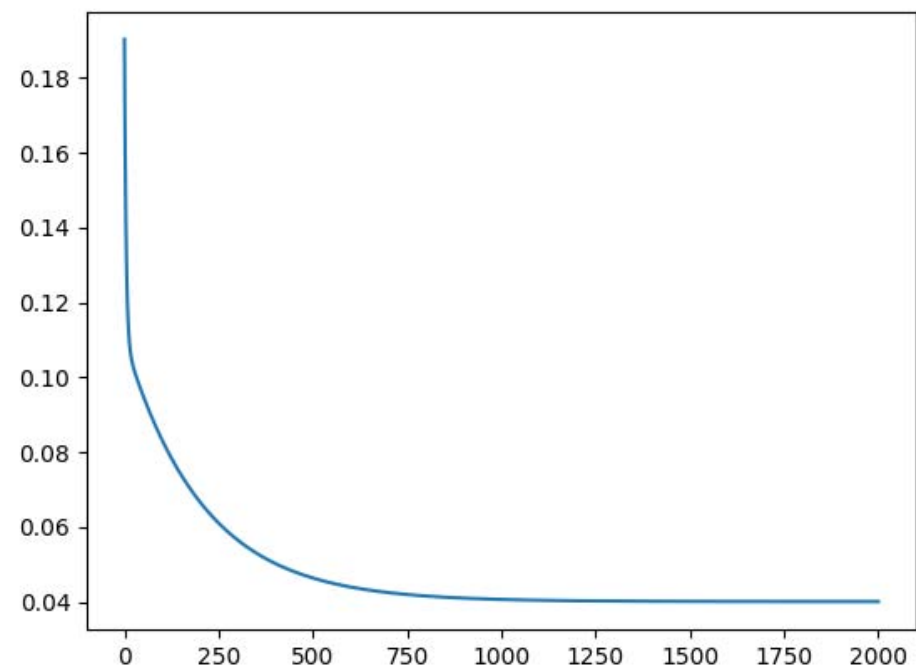
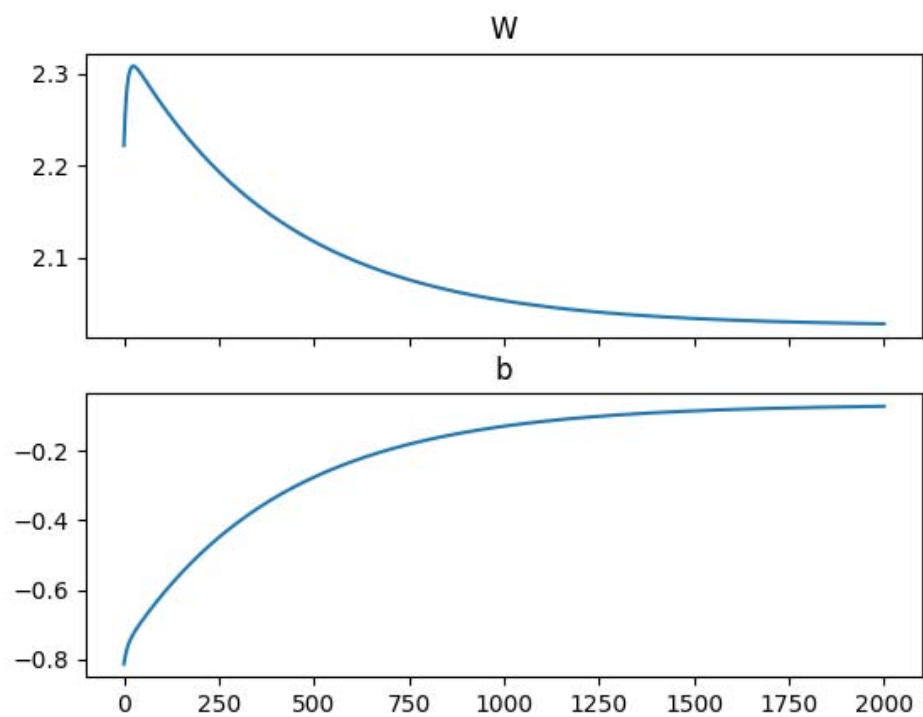
(0, 0.16853049, 2.2220104, -0.81235671)
(20, 0.076517023, 2.308851, -0.73138767)
(40, 0.068800062, 2.3035986, -0.69294065)
(60, 0.06247896, 2.2902124, -0.65998709)
(80, 0.056744356, 2.2766576, -0.62893307)
(100, 0.051536143, 2.2636638, -0.59937203)
(120, 0.04680597, 2.2512732, -0.57120341)
(140, 0.042509858, 2.2394645, -0.54435903)
(160, 0.038608193, 2.2282104, -0.5187763)

...

(1900, 8.896759e-06, 2.0034645, -0.0078751221)
(1920, 8.081005e-06, 2.0033016, -0.0075051254)
(1940, 7.3392598e-06, 2.0031466, -0.0071525616)
(1960, 6.6663715e-06, 2.0029988, -0.0068165772)
(1980, 6.0546249e-06, 2.0028582, -0.0064964173)
(2000, 5.498538e-06, 2.0027235, -0.0061912765)

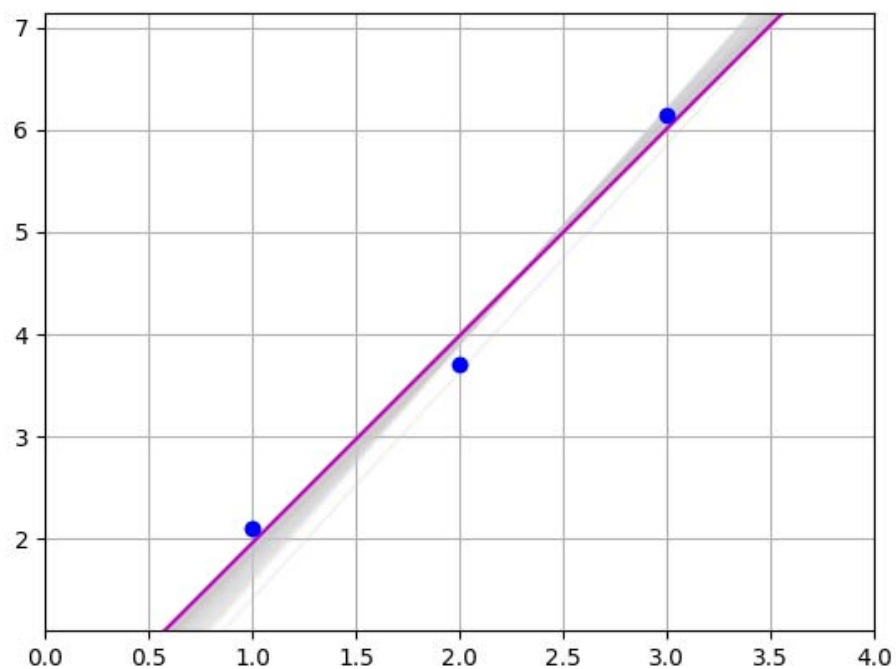


반복과정 !





반복과정 !





Testing our model !

- 학습된 가설/모델 검증해보기

01-1-linear-regression-placeholder.py
를 열어주세요

```
print("# Fit the line with new training data")
# Fit the line with new training data
for step in range(2001):
    cost_val, W_val, b_val, _ = \
        sess.run([cost, W, b, train],
                  feed_dict={X: [1, 2, 3, 4, 5],
                             Y: [2.1, 3.1, 4.1, 5.1, 6.1]})

    if step % 20 == 0:
        print(step, cost_val, W_val[0], b_val[0])
```

Testing our model

```
print(sess.run(hypothesis, feed_dict={X: [5]}))
print(sess.run(hypothesis, feed_dict={X: [2.5]}))
print(sess.run(hypothesis, feed_dict={X: [1.5, 3.5]}))
```



```
[ 6.10045338]
[ 3.59963846]
[ 2.59931231  4.59996414]
```



Bonus

- 다음 연립방정식의 해를 구하여라.

$$x + 2y = 6$$

$$x - 3y = 1$$



$$\begin{bmatrix} 1 & 2 \\ 1 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 1 \end{bmatrix}$$

$$A = \begin{bmatrix} 1.0, & 2.0 \\ 1.0, & -3.0 \end{bmatrix}$$

$$b = \begin{bmatrix} 6.0 \\ 1.0 \end{bmatrix};$$



01-2-equation.py 를 열어주세요

<http://mathbang.net/16>



기타

- Matplotlib 연습해보기

https://matplotlib.org/examples/pylab_examples/subplot_demo.html



Acknowledgement



모두를 위한 머신러닝/딥러닝 강의

Seung-han

Seung-Chan

Jeung-Chan

감사합니다.