AI Seminar

Week 2

Overview

Linear Regression

Hands-on Exercise

Supervised Learning --> Regression

Slides Credit:

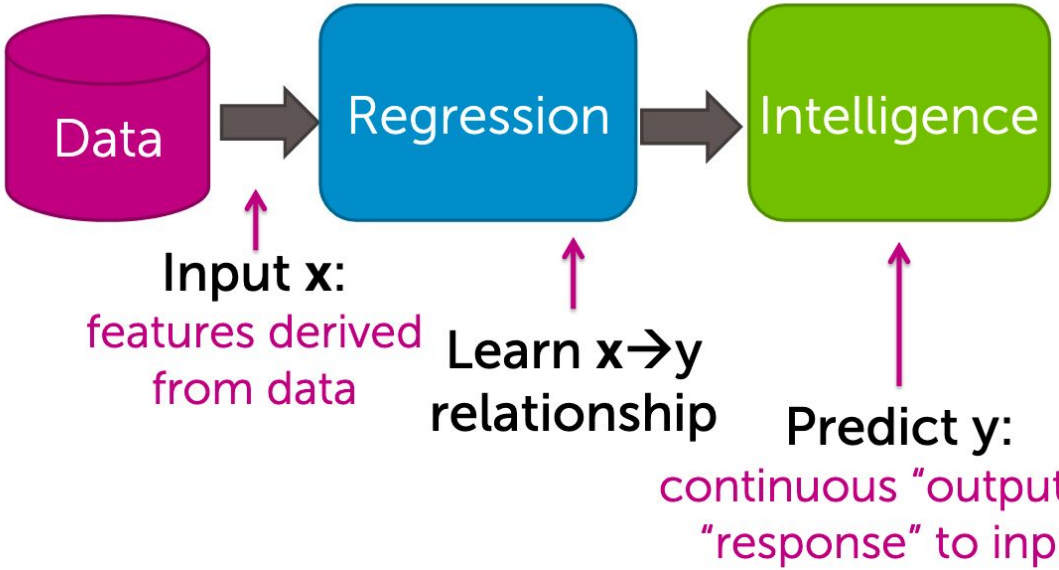
Emily Fox , University of Washington

CSE 446 Machine Learning

Website: https://courses.cs.washington.edu/courses/cse446/17wi/

What is regression?

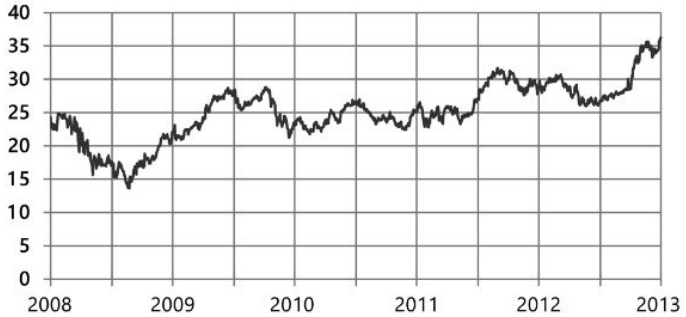
From features to predictions



Credit:https://courses.cs.washington.edu/courses/cse446/17wi/slides/intro.pdf

Stock prediction

- Predict the price of a stock (y)
- Depends on **x** =
  - Recent history of stock price
  - News events
  - Related commodities



Credit:https://courses.cs.washington.edu/courses/cse446/17wi/slides/intro.pdf

Tweet popularity

- How many people will retweet your tweet? (y)
- Depends on **x** = # followers,
  # of followers of followers,
  features of text tweeted,
  popularity of hashtag,
  # of past retweets,...

Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/intro.pdf

Quiz: Which of the following is a Regression Problem?

1) Predict if a project is going to be a SUCCESS or FAILURE?

2) Predict if an image is a CAT or DOG?

3) Predict the NUMBER of CARS at 9:00am on interstate I-40?

Quiz - Which of the following is a Regression Problem?

1) Predict if project is going to be a SUCCESS or FAILURE?

2) Predict if the the image is of CAT or DOG?

CLASSIFICATION

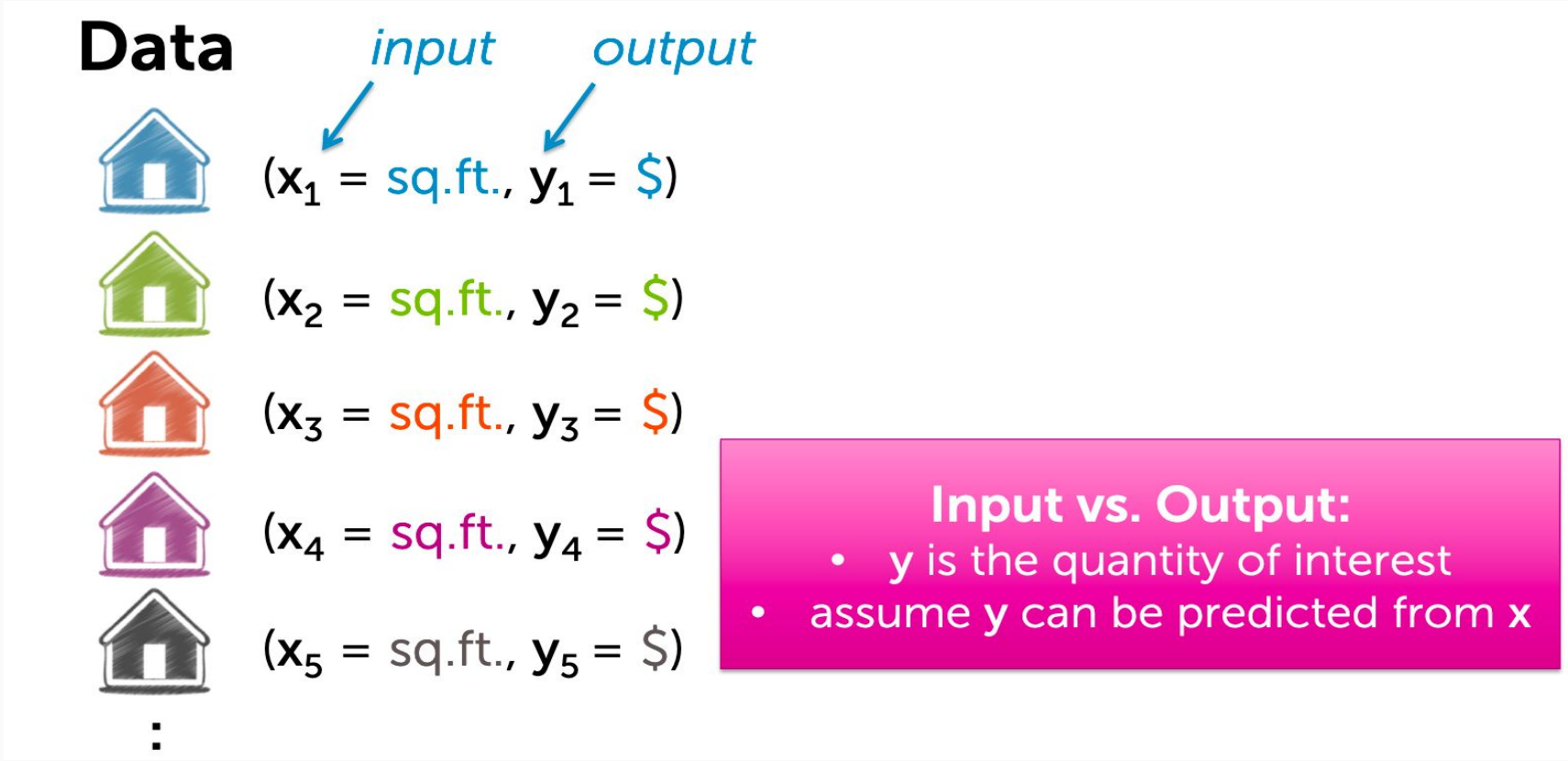
3) Predict the NUM of CAR at 9:00am on I-40?

Regression

Predict House price

Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

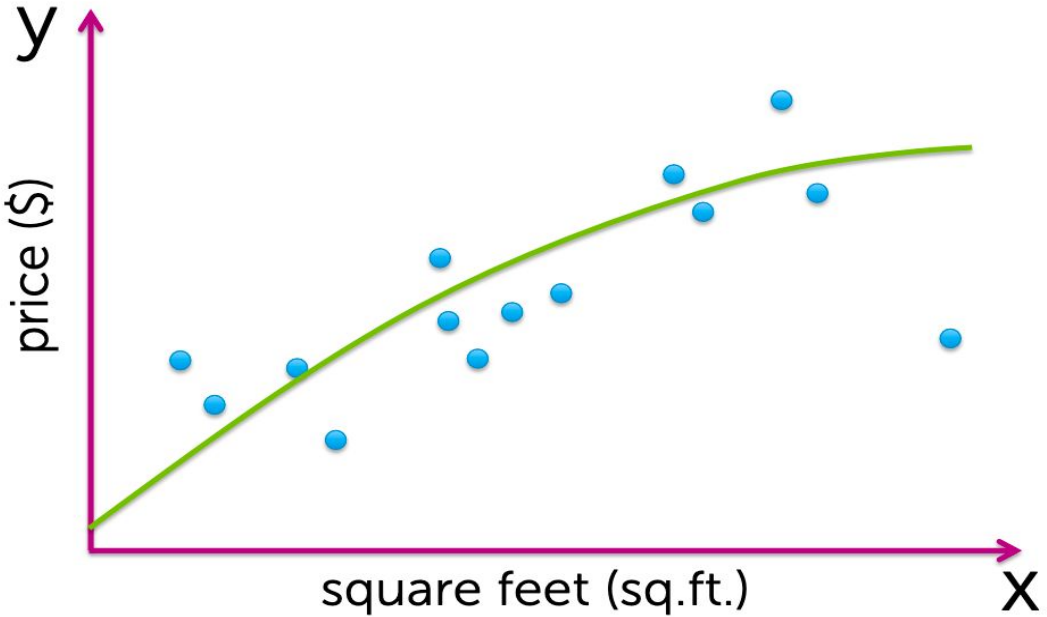
Predict House price



Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Predict House price

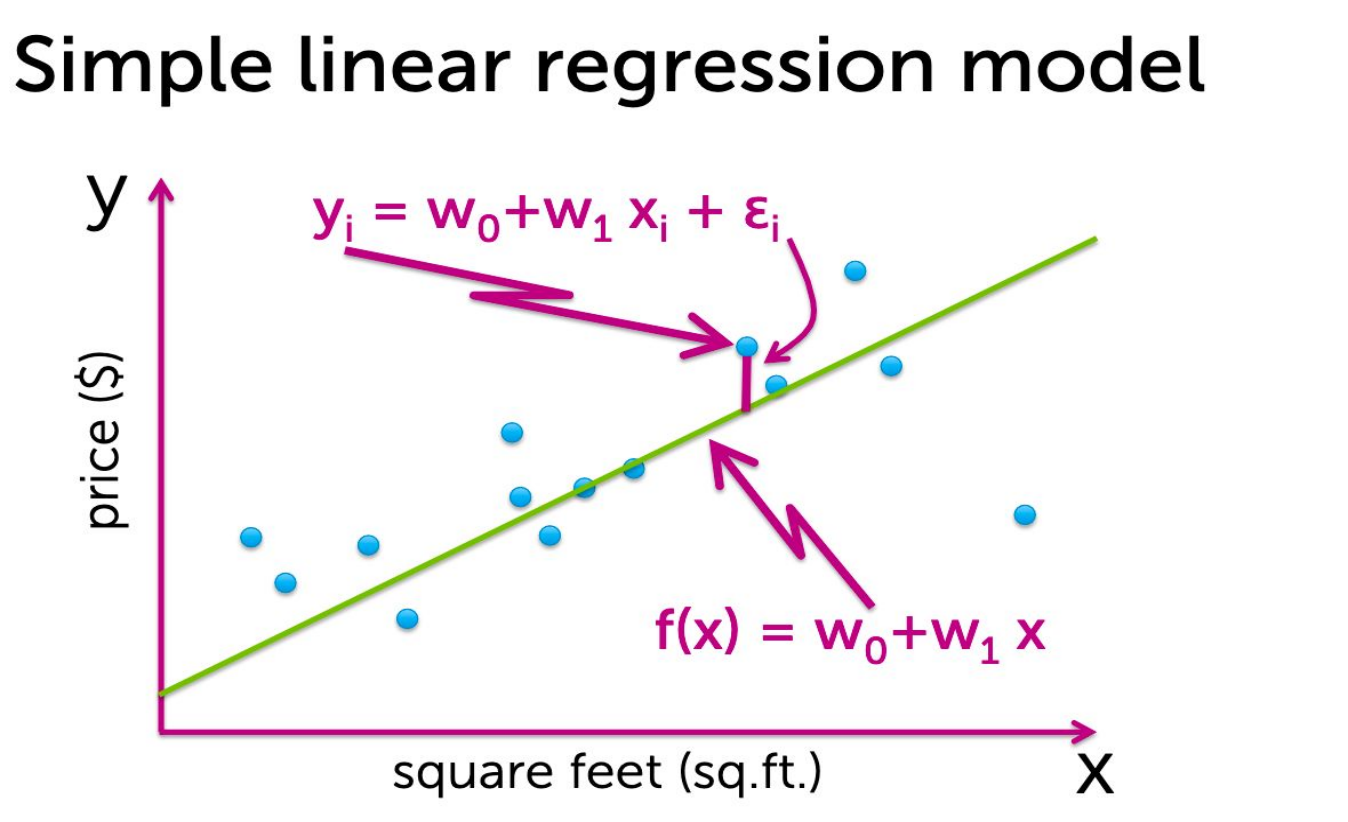
Model –
How we *assume* the world works



Regression model:

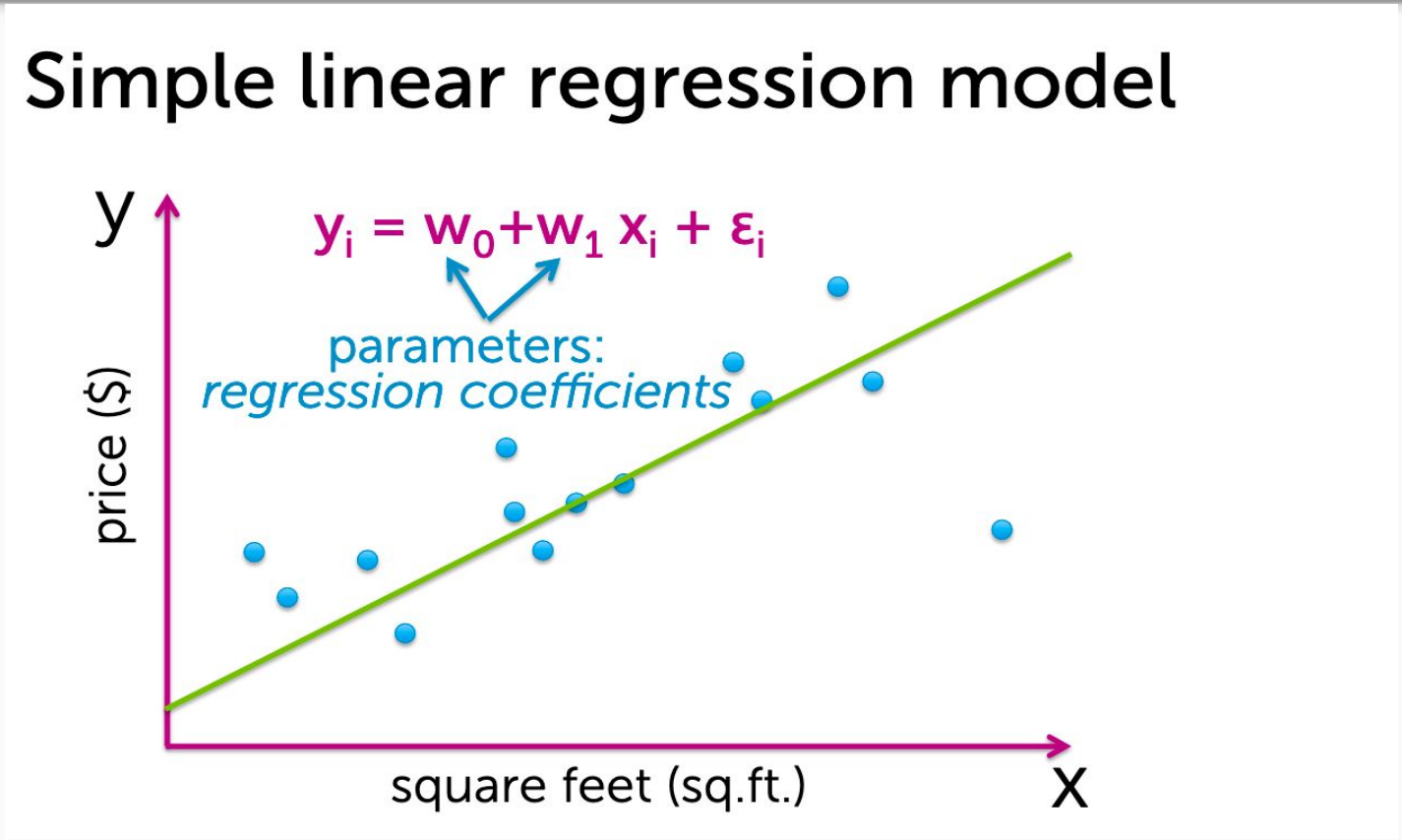
Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Predict House price : Linear Regression



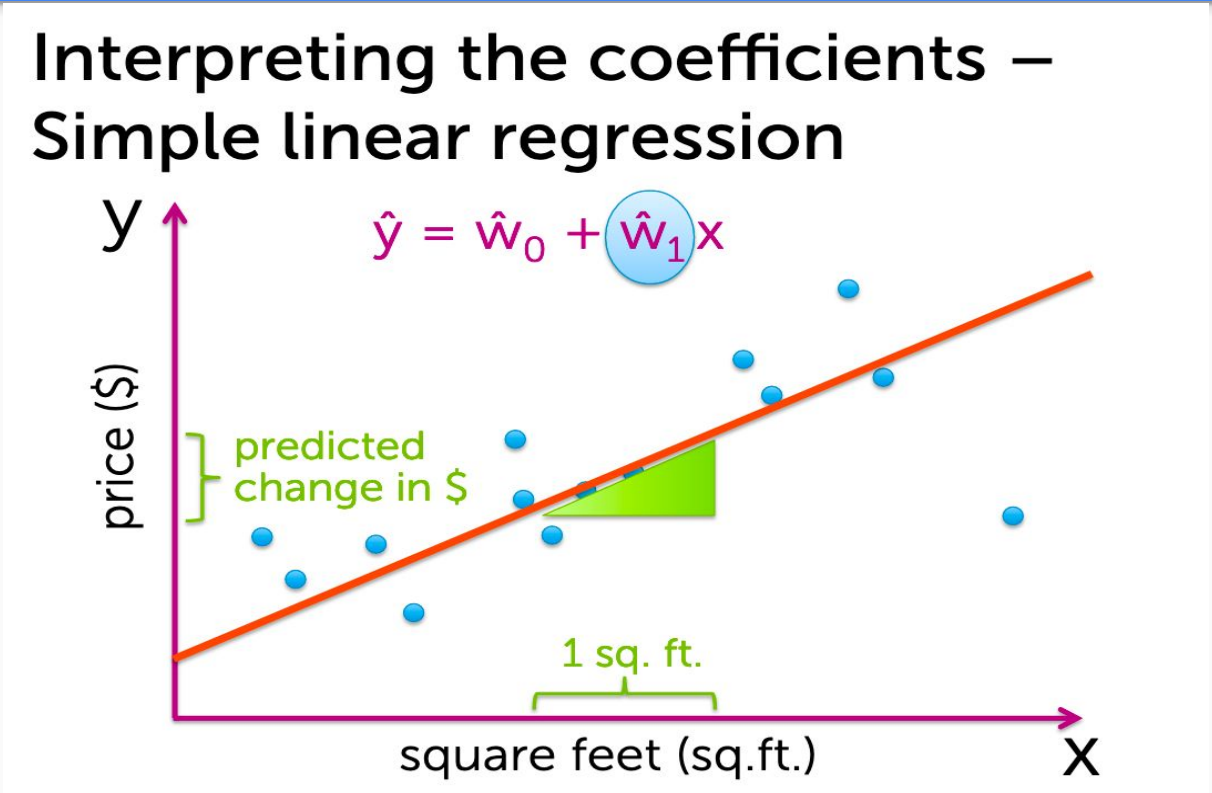
Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Predict House price: Linear Regression



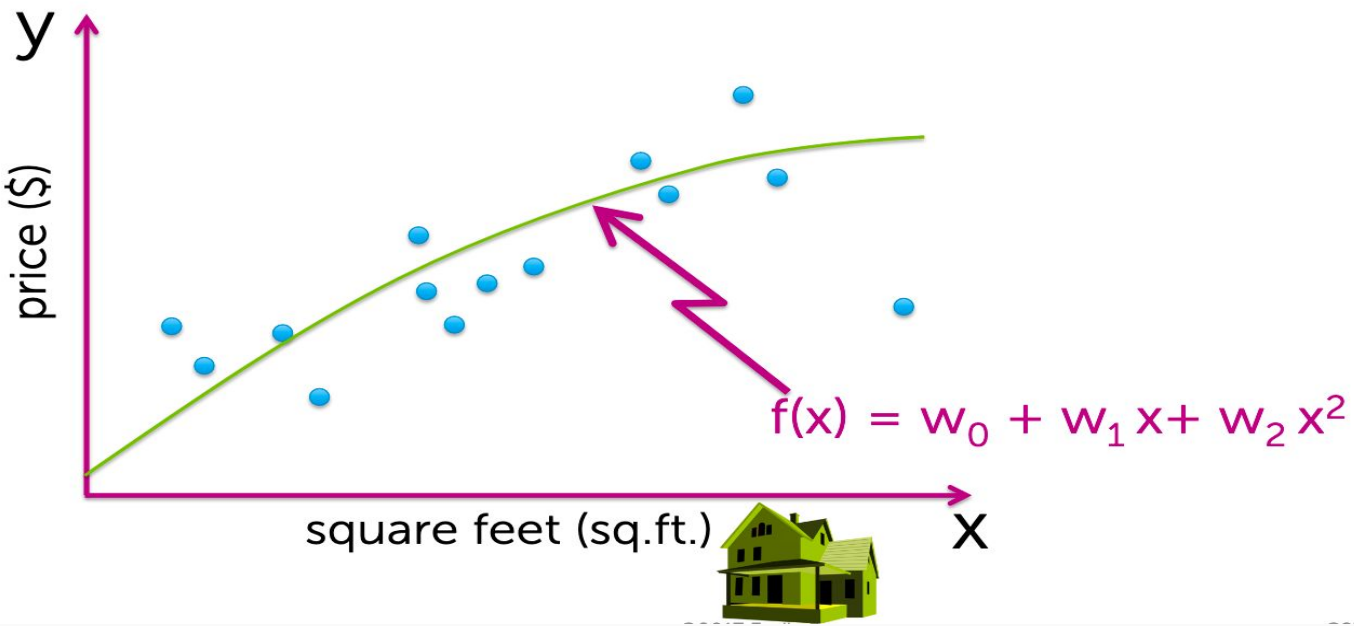
Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Predict House price: Linear Regression



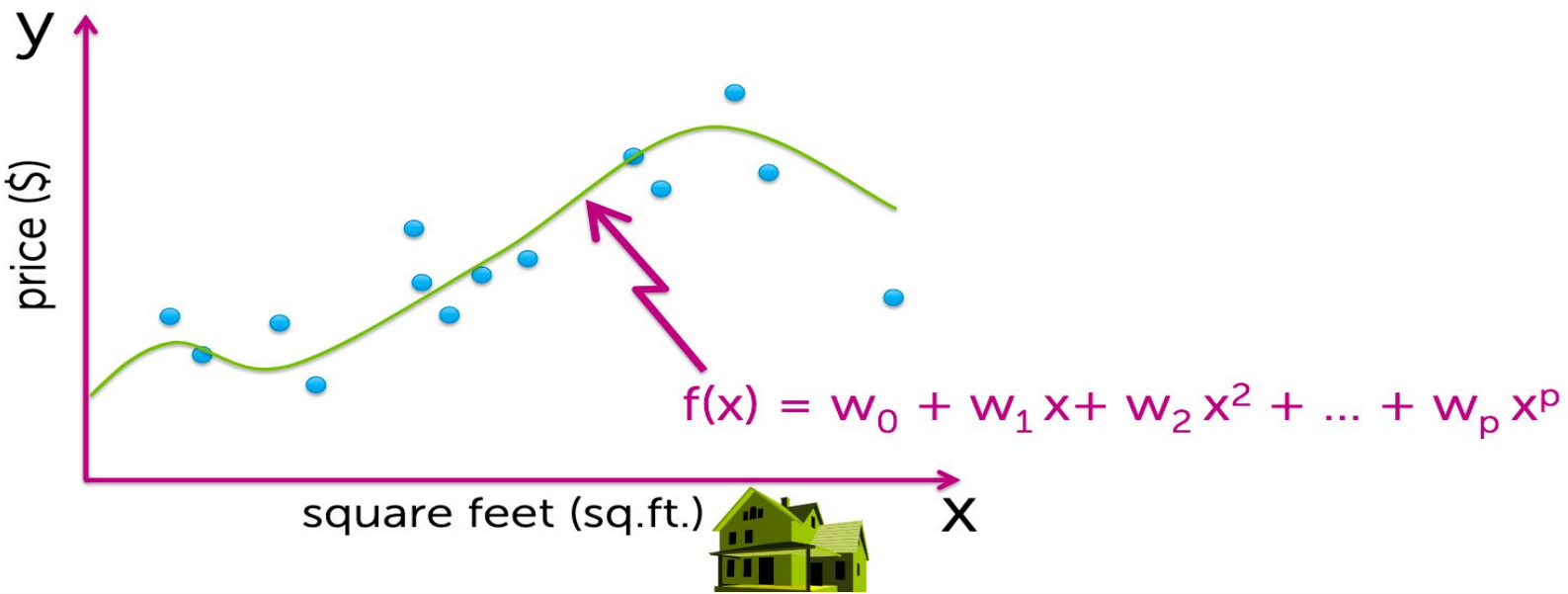
Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

What about a quadratic function?



Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Even higher order polynomial



Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Polynomial Regression

Polynomial regression

Model:

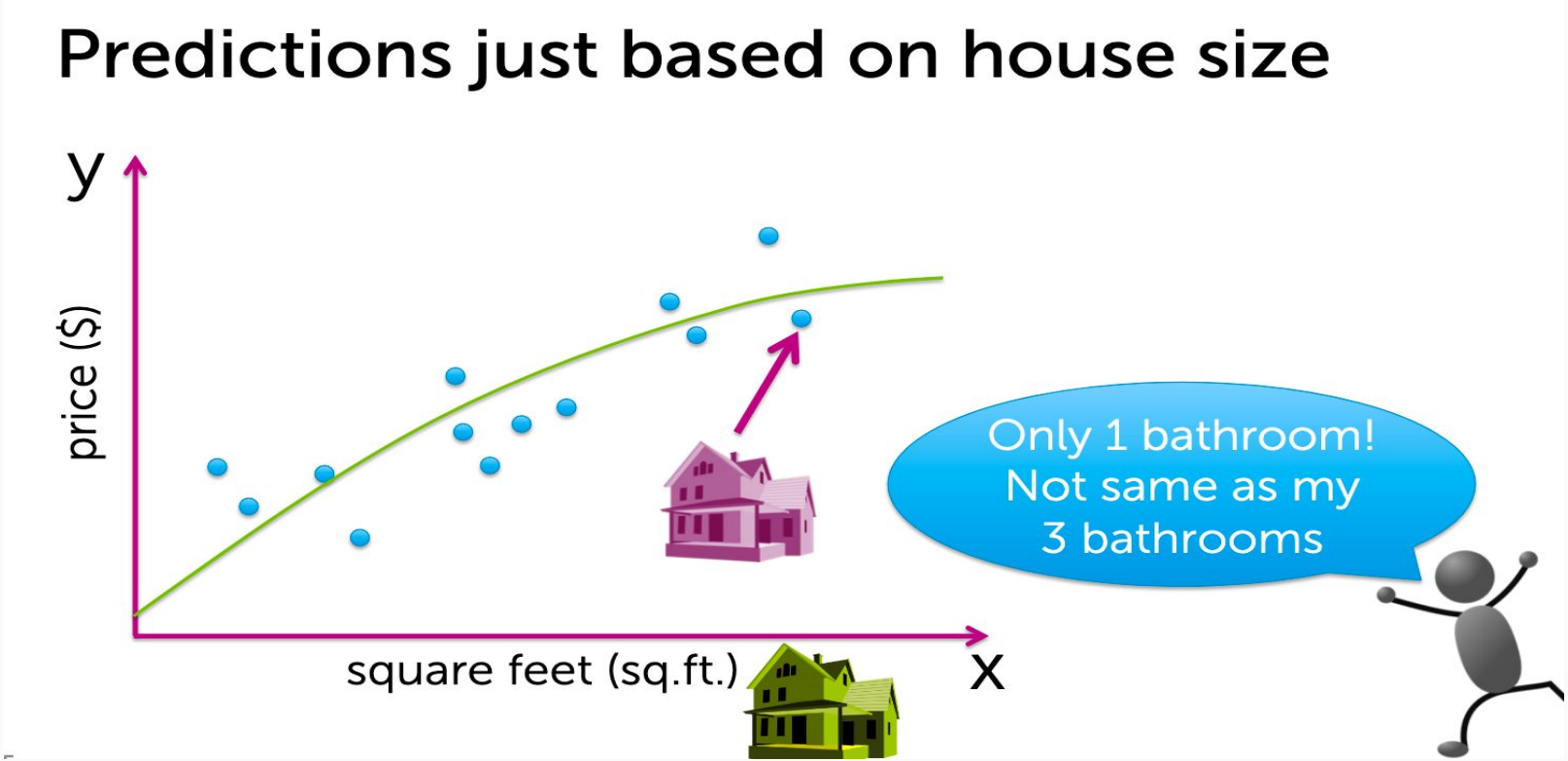
$$y_i = w_0 + w_1 x_i + w_2 x_i^2 + \ldots + w_p x_i^p + \varepsilon_i$$

treat as different **features**

feature 1 = 1 (constant)	*parameter* 1 = w_0
feature 2 = x	*parameter* 2 = w_1
feature 3 = x^2	*parameter* 3 = w_2
...	...
feature p+1 = x^p	*parameter* p+1 = w_p

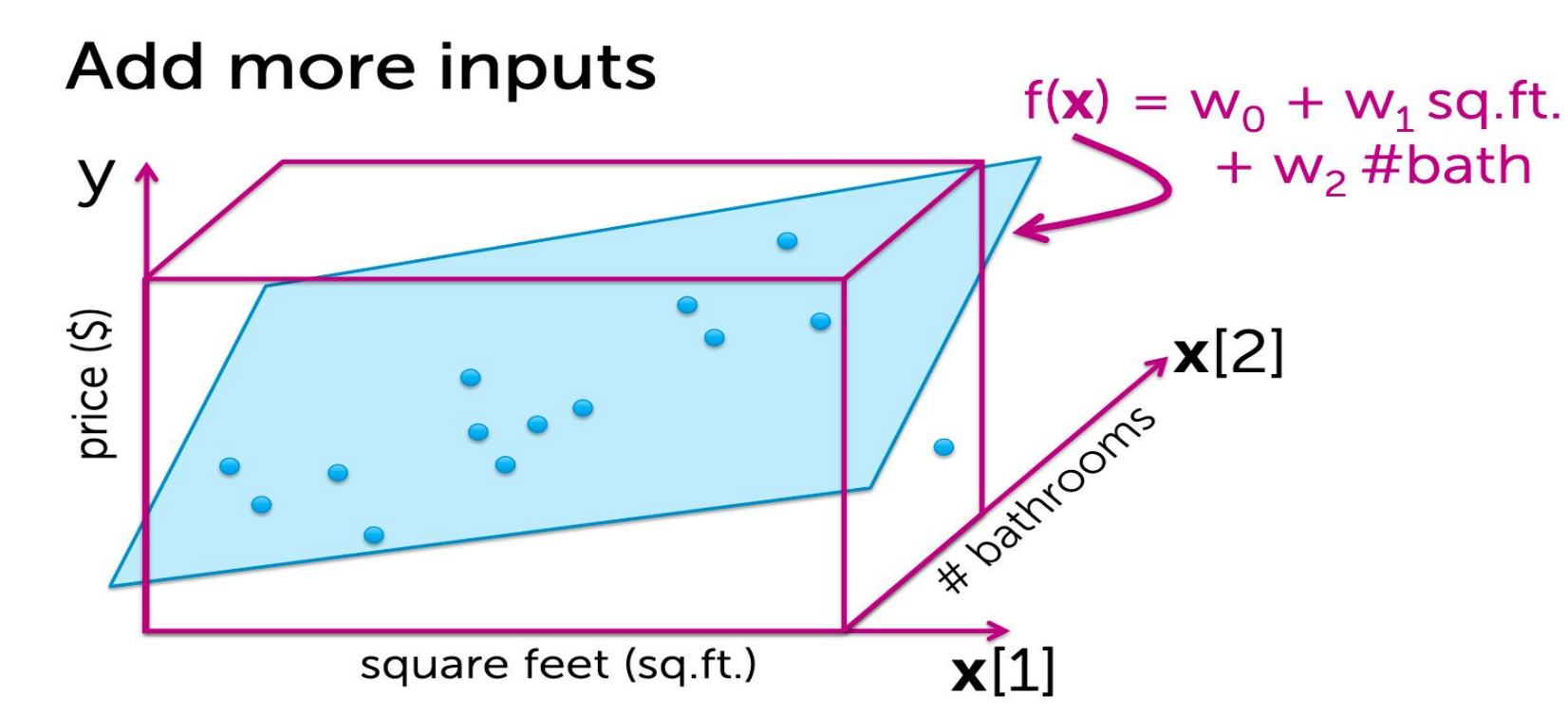
Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Adding more input features data



Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Adding more input features data

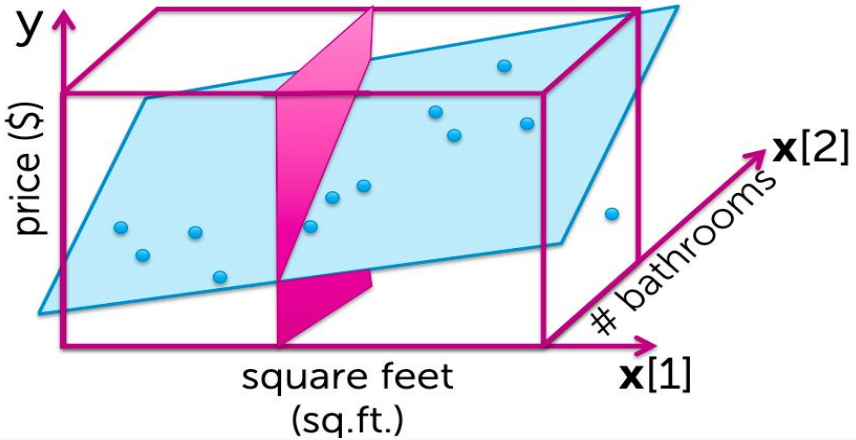


Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Interpreting the coefficients – Two linear features

$$\hat{y} = \hat{w}_0 + \hat{w}_1 \mathbf{x}[1] + \hat{w}_2 \mathbf{x}[2]$$

fix

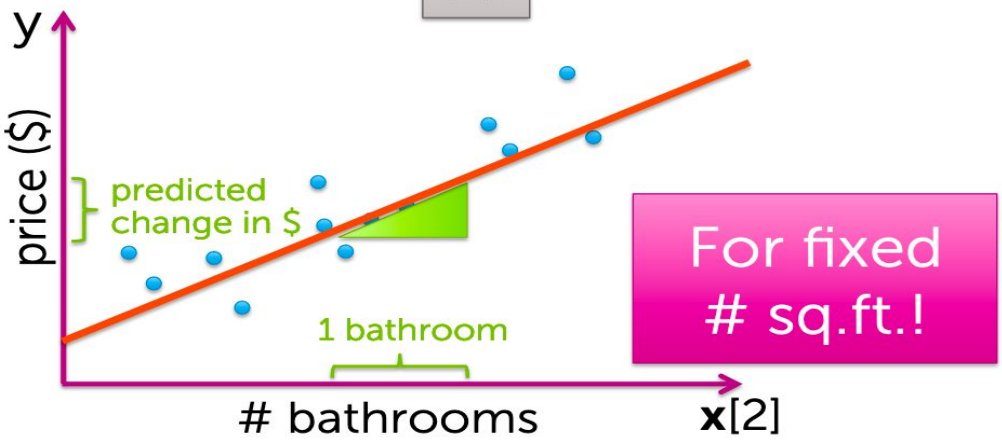


Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Interpreting the coefficients – Two linear features

$$\hat{y} = \hat{w}_0 + \hat{w}_1 \mathbf{x}[1] + \hat{w}_2 \mathbf{x}[2]$$

fix



Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

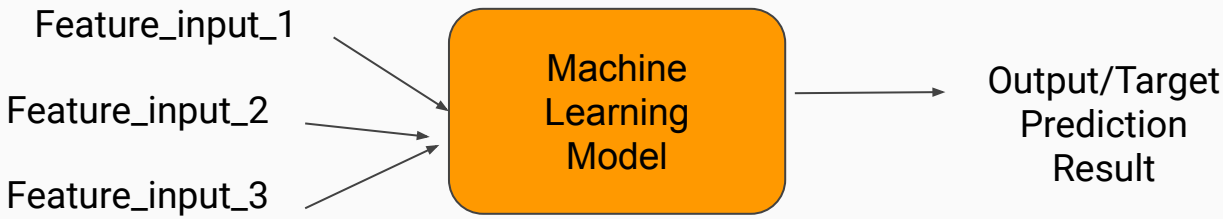
Many possible inputs

- Square feet
- # bathrooms
- # bedrooms
- Lot size
- Year built
- ...

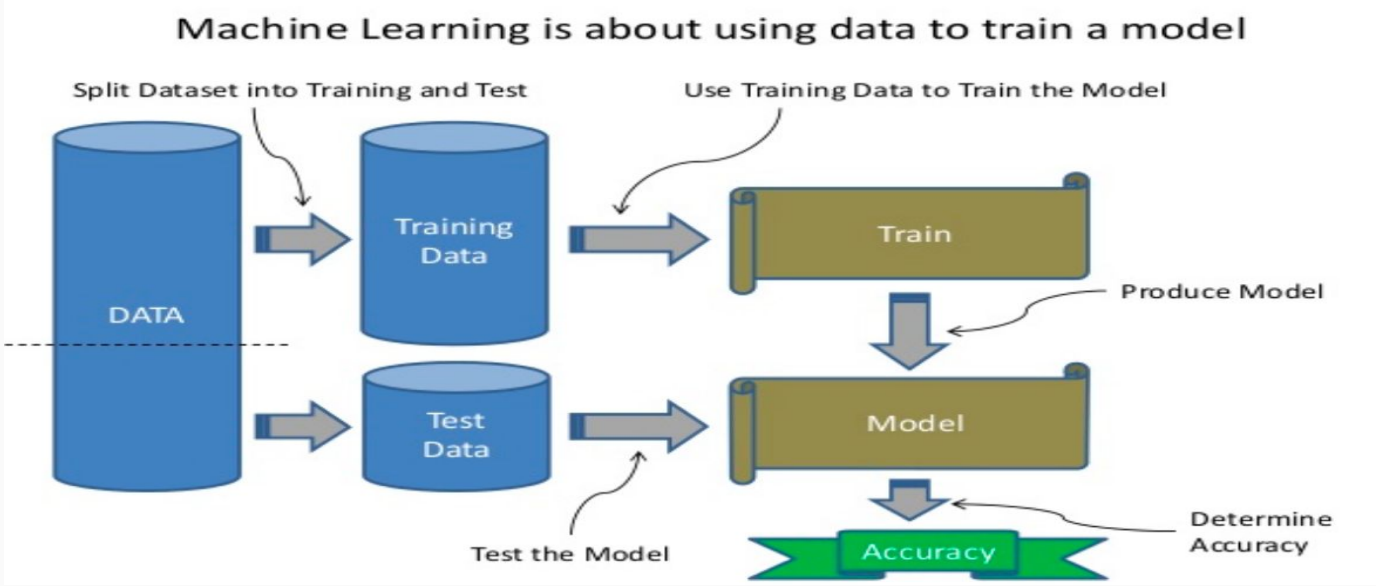
Credit: https://courses.cs.washington.edu/courses/cse446/17wi/slides/regression-LS-graddesc.pdf

Training Regression Model

Feature_input_1	Feature_input_2	Feature_input_...N	Output/Target
x_1_1	x_2_1	x_N_1	y1
x_1_2	x_2_2	x_N_2	y2
x_1_3	x_2_3	x_N_3	yn



Data Preparation



- Simplest method of splitting data is to split it serially.
  - Take first 80% rows and put into training set.
  - Take remaining 20% rows and put into test set.

Credit: https://www.slideshare.net/AndrewFerlitsch/machine-learning-splitting-datasets

Hands-On

Week 2 Jupyter NoteBook:

https://github.com/balasub/ai-seminar/blob/master/week-2/ai_seminar_week2.ipynb