Introduction to Machine Learning. Lec.9 Logistic Regression

Aidos Sarsembayev, IITU, 2018

- Linear Regression
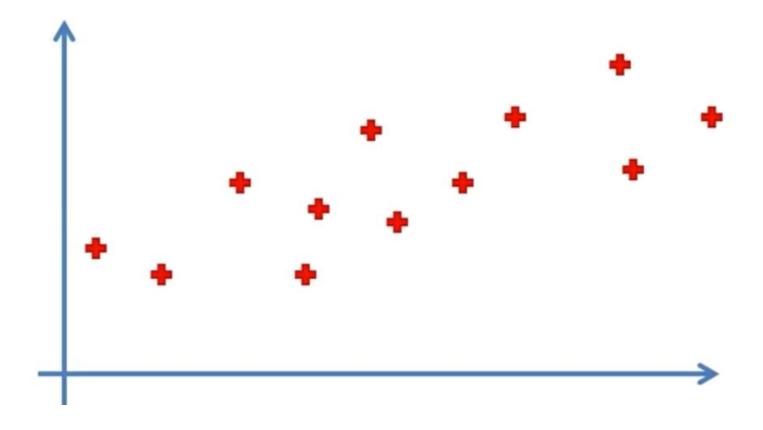
-Simple:
  $y = b_0 + b_1 * x_1$
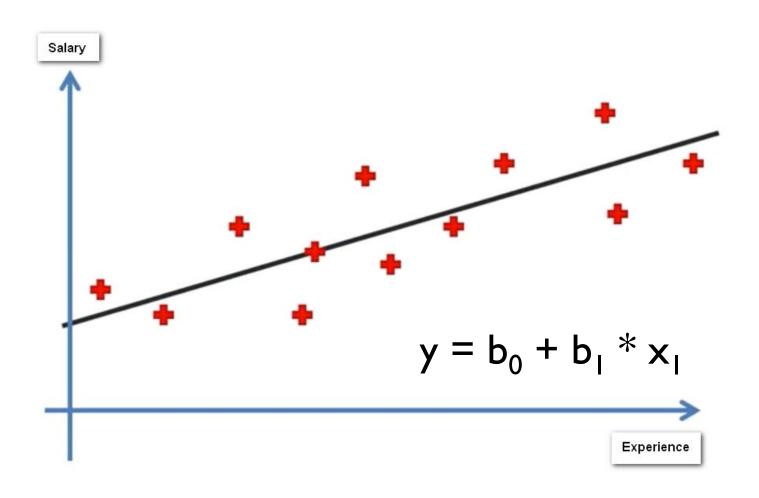
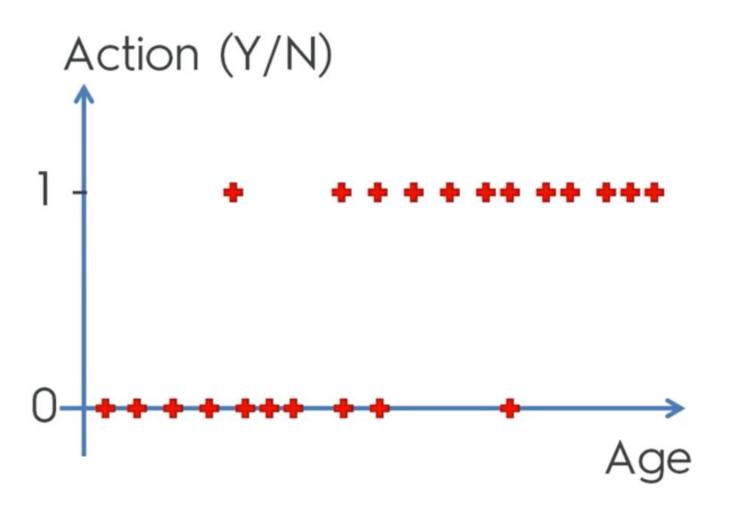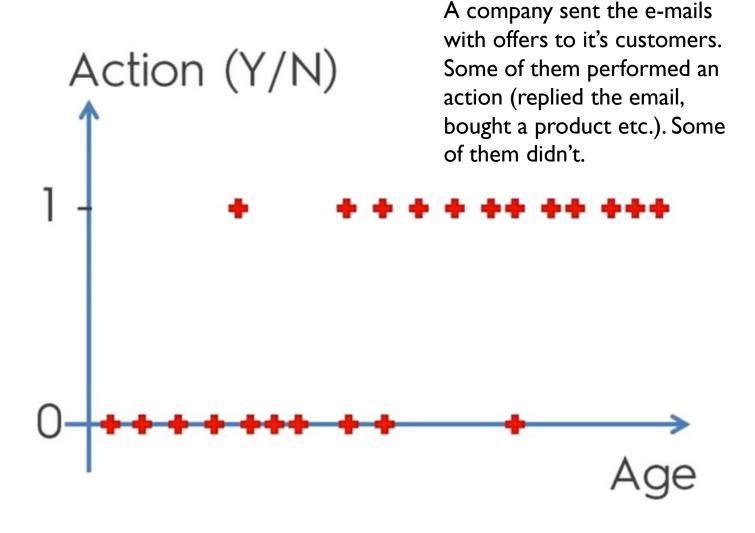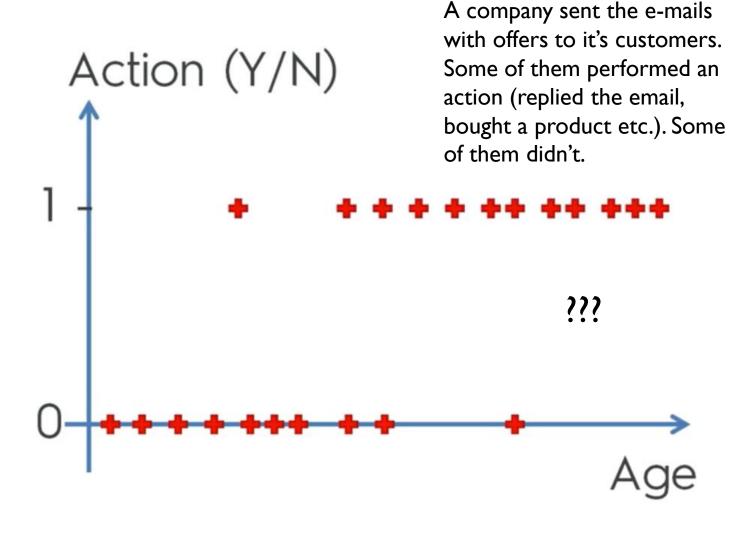-Multiple:
  $y = b_0 + b_1*x_1 + b_2*x_2 + \ldots + b_n*x_n$

We know how to solve this

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$$y = b_0 + b_1 * x_1$$

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A company sent the e-mails with offers to it's customers. Some of them performed an action (replied the email, bought a product etc.). Some of them didn't.

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Action (Y/N)

1 — + + + + + + + ++ ++ +++

Can we see the correlation here???

0 +++++++++ ++ +   +

Age

Linear regression?

Probability instead of Y/N

Action (Y/N)

What if instead of asking if a person will but a product or not, we will ask what is the probability (likelihood)of buying a product by a customer?

1

0

Age

Probability instead of Y/N

Action (Y/N)

What if instead of asking if a person will but a product or not, we will ask what is the probability (likelihood)of buying a product by a customer?

1

0

Age

Probability range between 0 and 1

Probability instead of Y/N

Action (Y/N)

What if instead of asking if a person will but a product or not, we will ask what is the probability (likelihood)of buying a product by a customer?

1

0

50 y.o.

25 y.o.

Age

Probability range between 0 and 1

Probability instead of Y/N

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Sigmoid function

$$y = b_0 + b_1 x$$

Sigmoid function

$$y = b_0 + b_1 x$$

$$p = \frac{1}{1 + e^{-y}}$$

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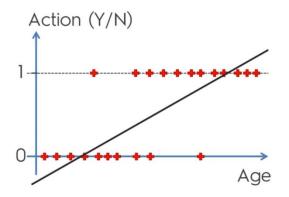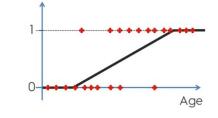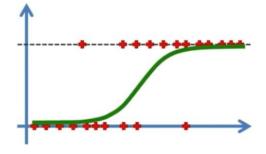
Sigmoid function

$$y = b_0 + b_1 x$$

Sigmoid function

$$p = \frac{1}{1 + e^{-y}}$$

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1 x$$

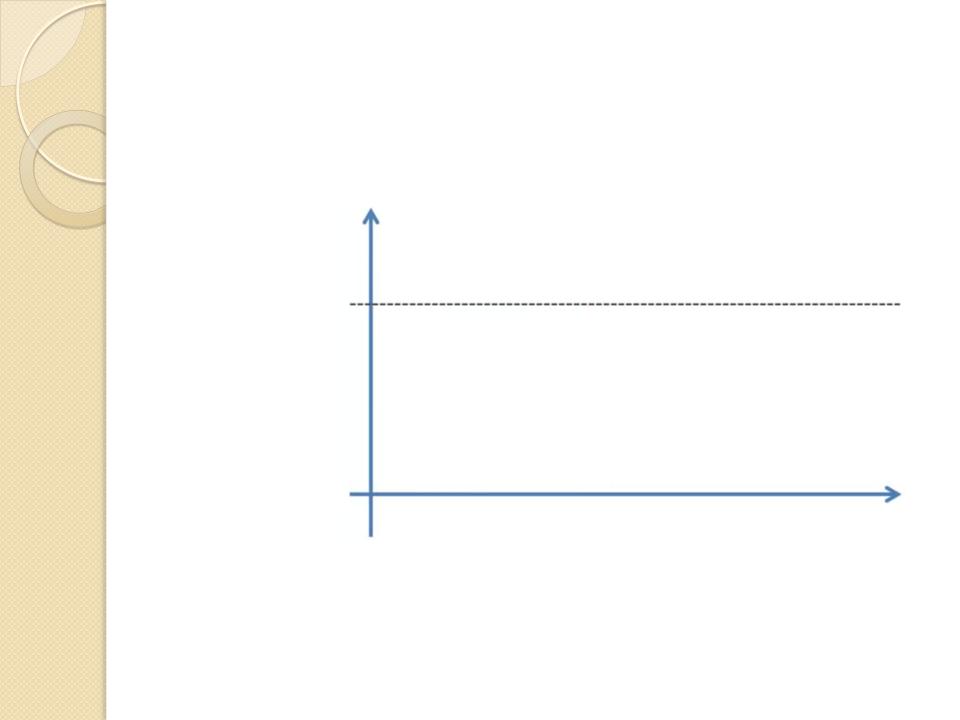# What just happened???

y (Actual DV)

x

Based on these observations + using logistic regression formula we obtain

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y (Actual DV)

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X

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y (Actual DV)

Not the most beautiful sigmoid in history

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1 x$$

X

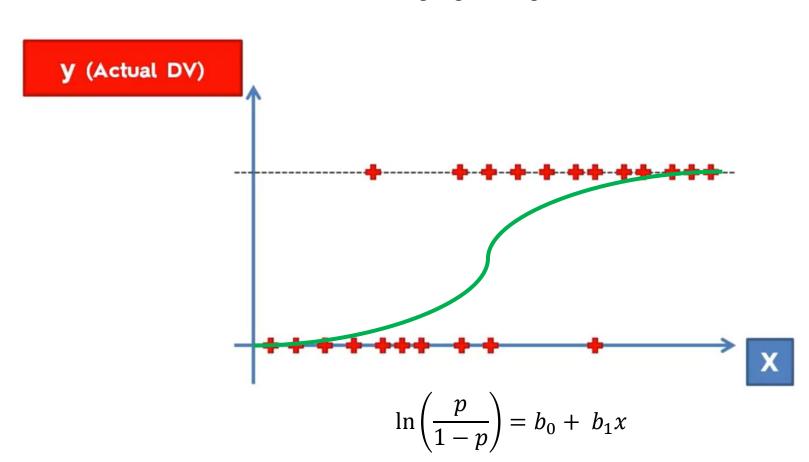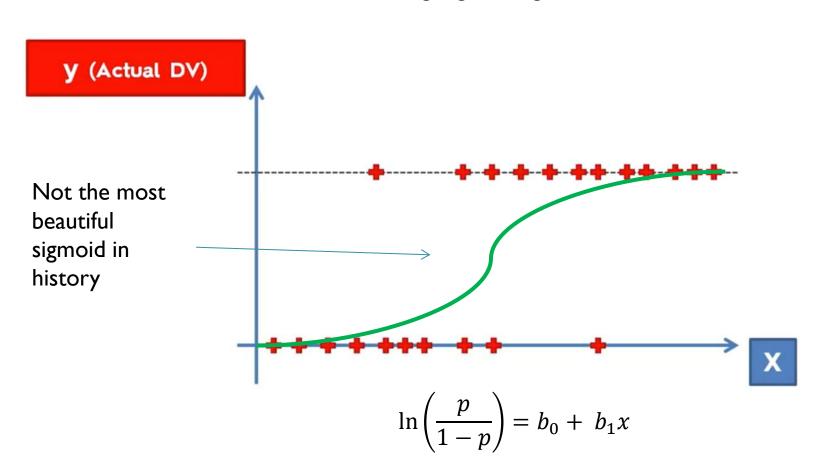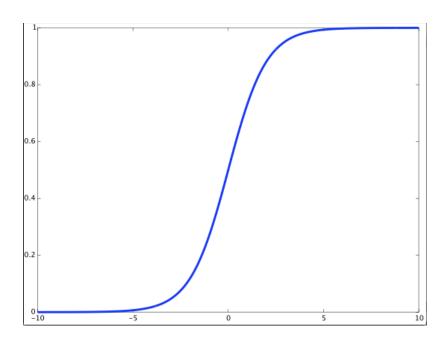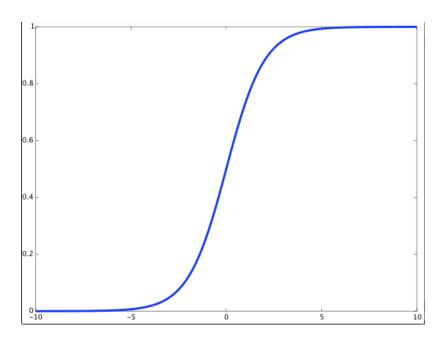Based on these observations + using logistic regression formula we obtain

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1 x$$

Actually it's the best fitting line

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1 x$$

Logistic Regression. Example

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