Deep Learning for NLP

Sorokin Semen

Grading system

Three labs (each 0.17) 50% of cumulative assessment
Three / five (not decided yet) test 50% of cumulative assessment

If cumulative assessment >= 6:
    free to go or increase your score on the exam
else:
    pass the exam (a result of the exam >= cumulative assessment)

Exam - two topics from different lectures or
(Mb, if you are lucky) questions like "What is the name of the lecturer?" or
"Classify (manually) this image"

Syllabus

- Linear / Logistic regression
- Word embeddings
- Tricks in DL
- Convolution NN
- Recurrent NN
- Language modeling
- Sequence tagging

Framework

Deep Learning

Classic Machine Learning

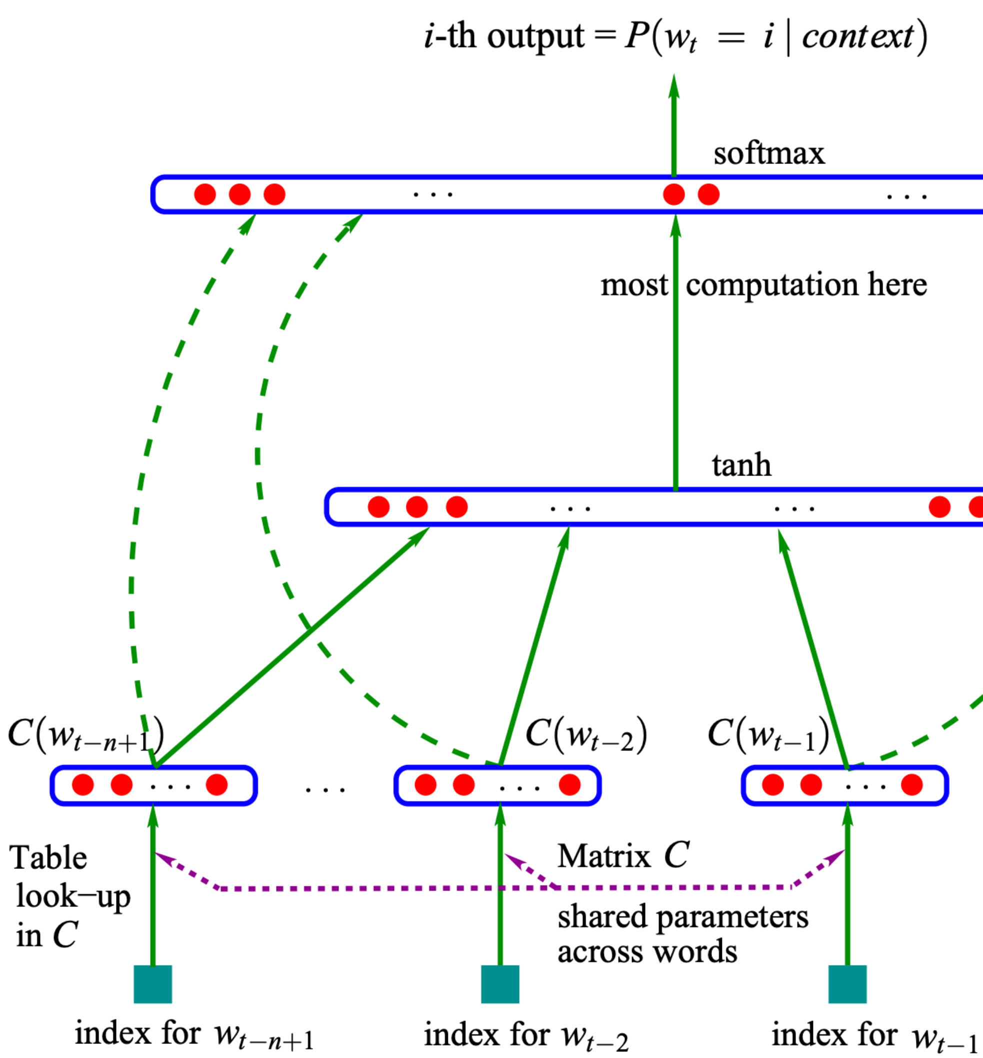
Deep Learning

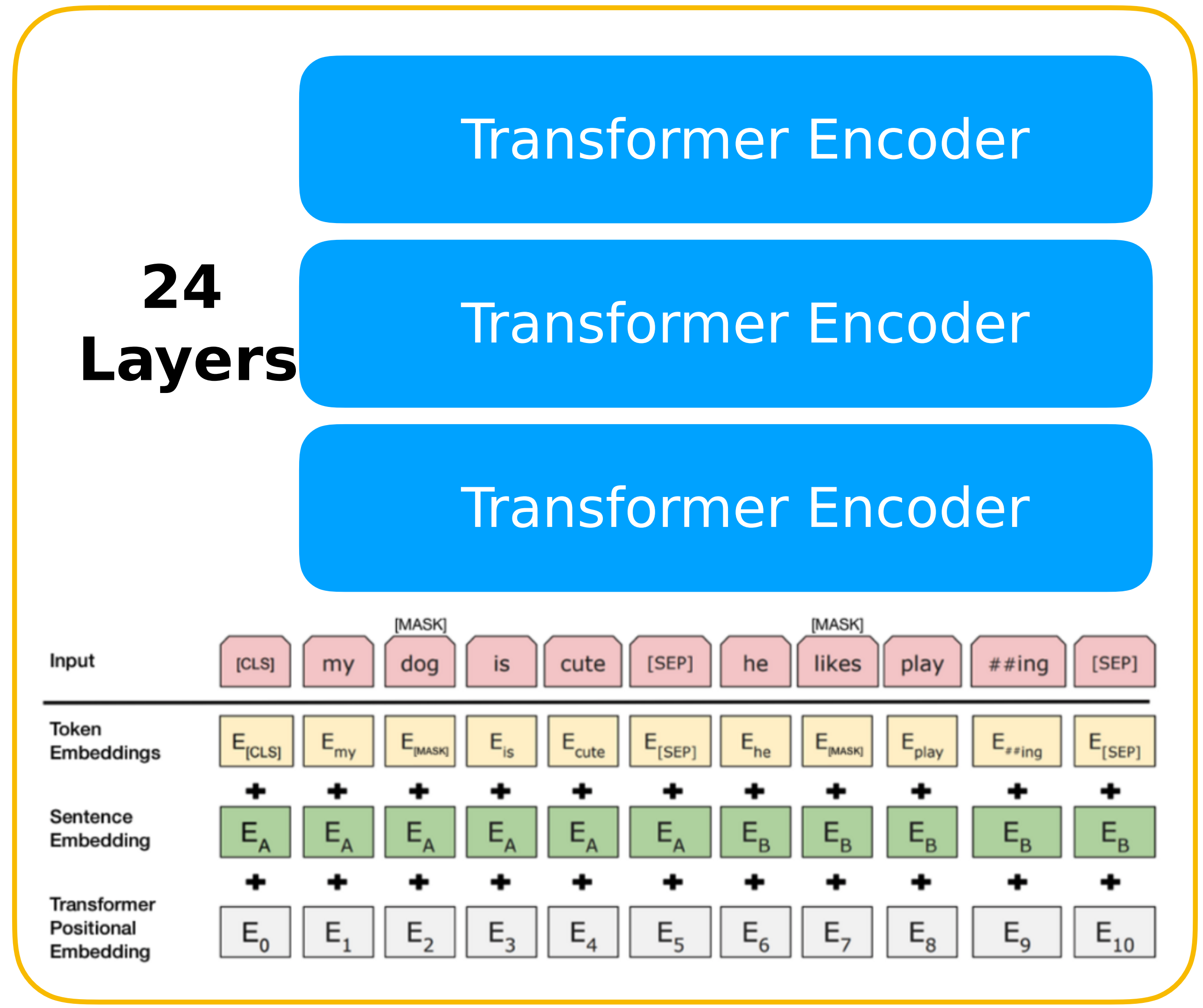
Deep Learning

Neural Probabilistic Language Model

BERT

2003 → **Q42018**



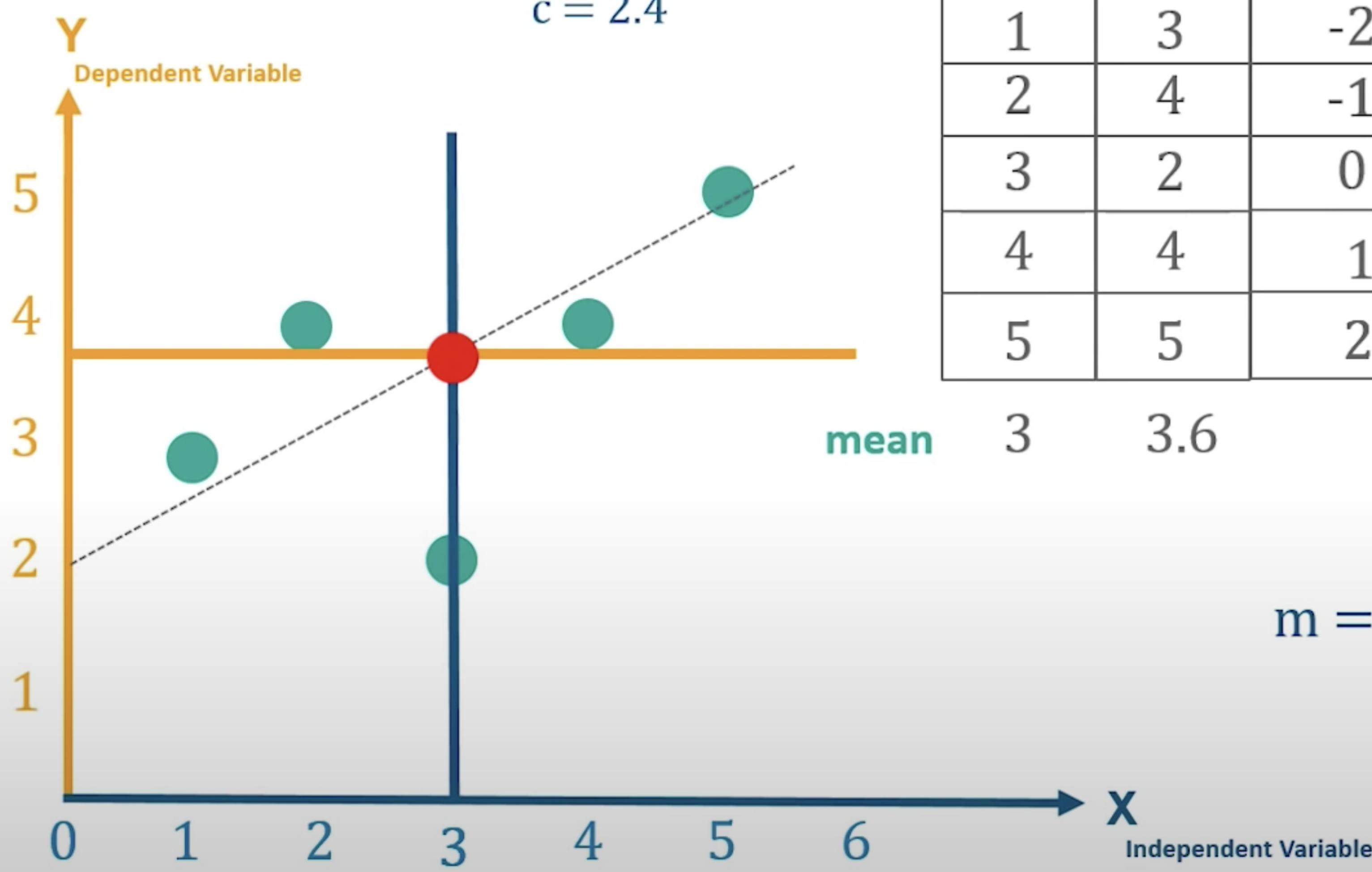


ML Recap

Understanding Linear Regression Algorithm

$y = mx + c$

$c = 2.4$



x	y	$x - \bar{x}$	$y - \bar{y}$	$(x - \bar{x})^2$	$(x - \bar{x})(y - \bar{y})$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean: 3	3.6			$\Sigma = 10$	$\Sigma = 4$

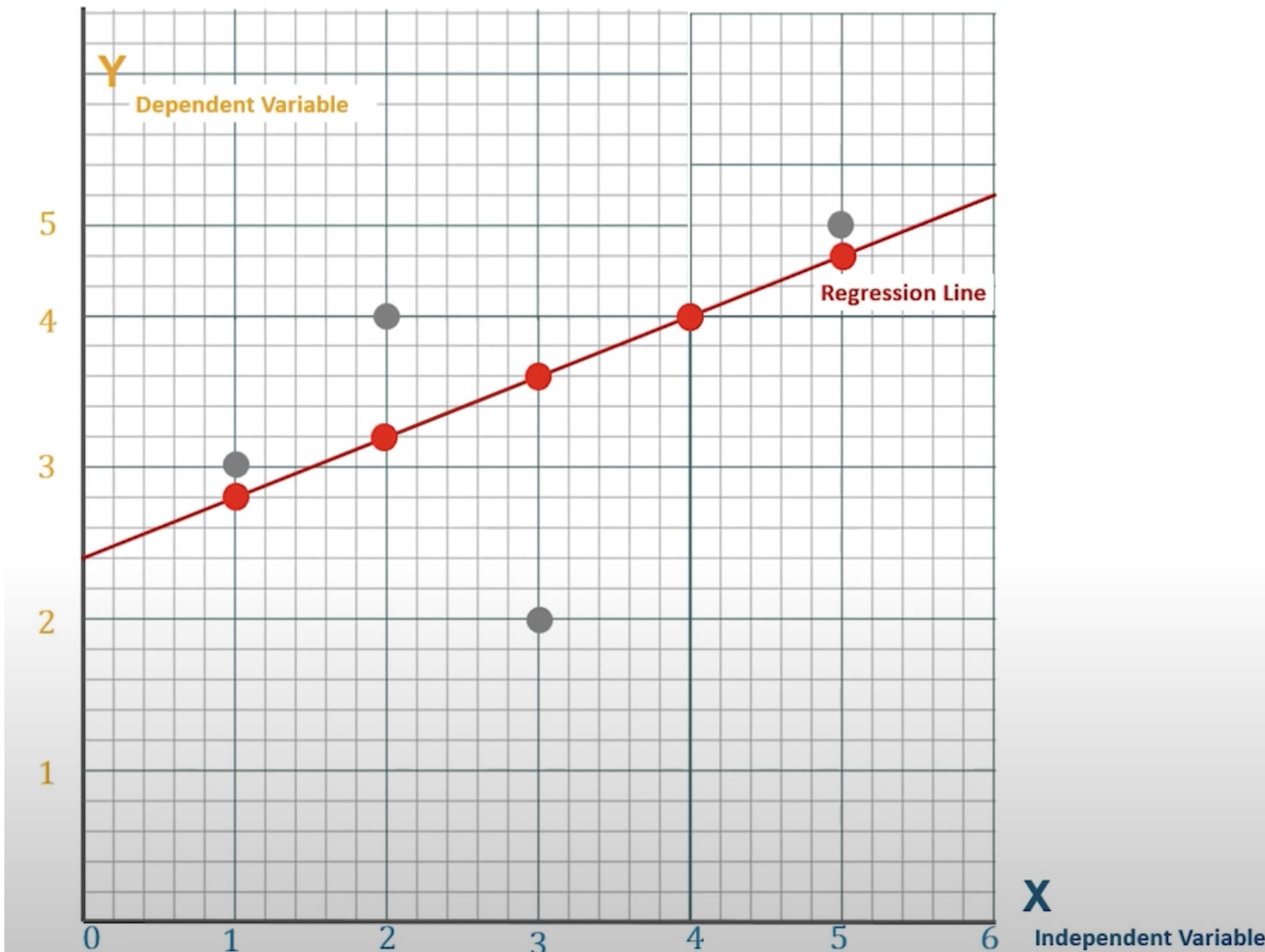
$$m = \sum \frac{(x - \bar{x})(y - \bar{y})}{(x - \bar{x})^2} = \frac{4}{10}$$

$m = 0.4$

$c = 2.4$

$y = 0.4x + 2.4$

Mean Square Error



$m = 0.4$

$c = 2.4$

$y = 0.4x + 2.4$

For given $m = 0.4$ & $c = 2.4$, lets predict values for y for $x = \{1,2,3,4,5\}$

$y = 0.4 \times 1 + 2.4 = 2.8$

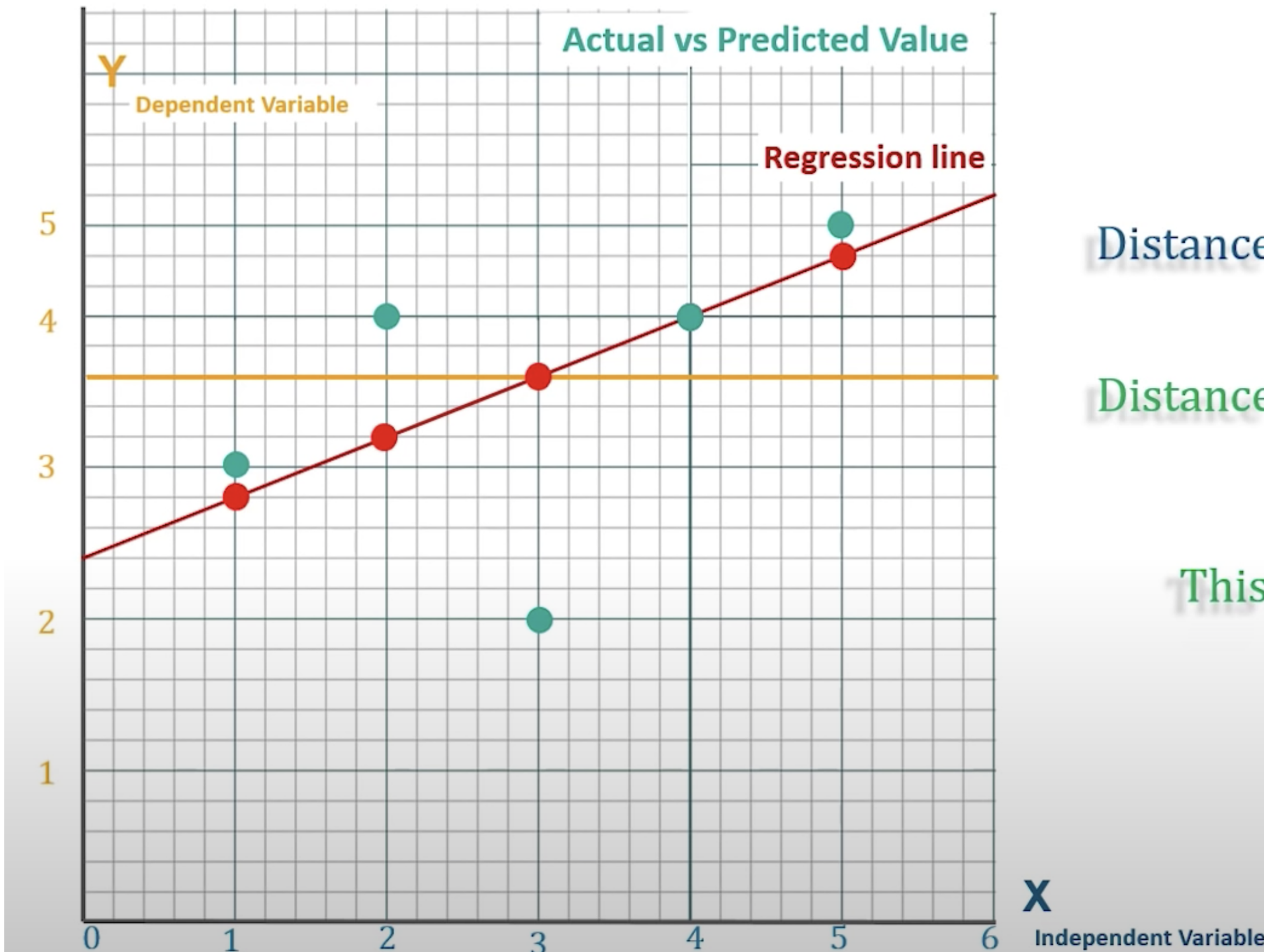
$y = 0.4 \times 2 + 2.4 = 3.2$

$y = 0.4 \times 3 + 2.4 = 3.6$

$y = 0.4 \times 4 + 2.4 = 4.0$

$y = 0.4 \times 5 + 2.4 = 4.4$

Calculation of R^2



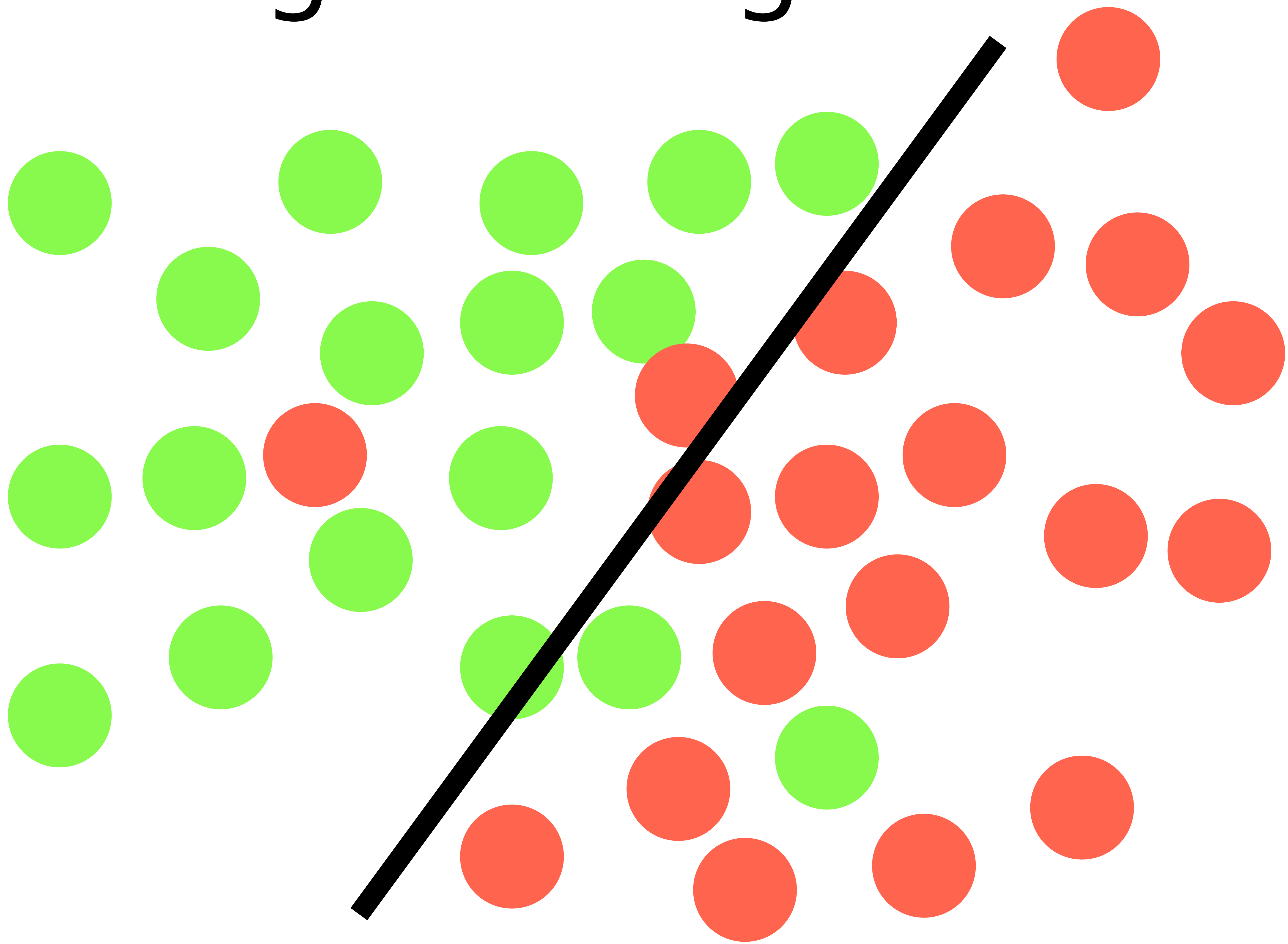
Distance actual - mean

vs

Distance predicted - mean

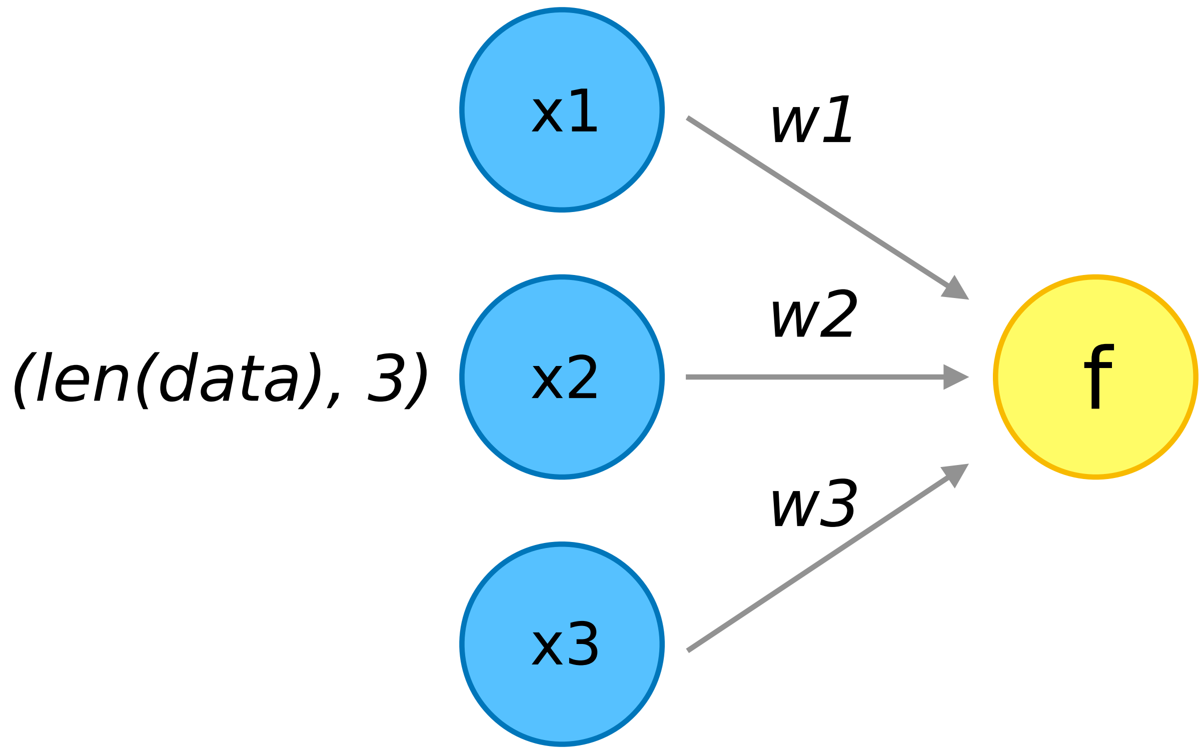
This is nothing but $R^2 = \dfrac{\sum (y_p - \bar{y})^2}{\sum (y - \bar{y})^2}$

Logistic Regression



Logistic Regression

Inference



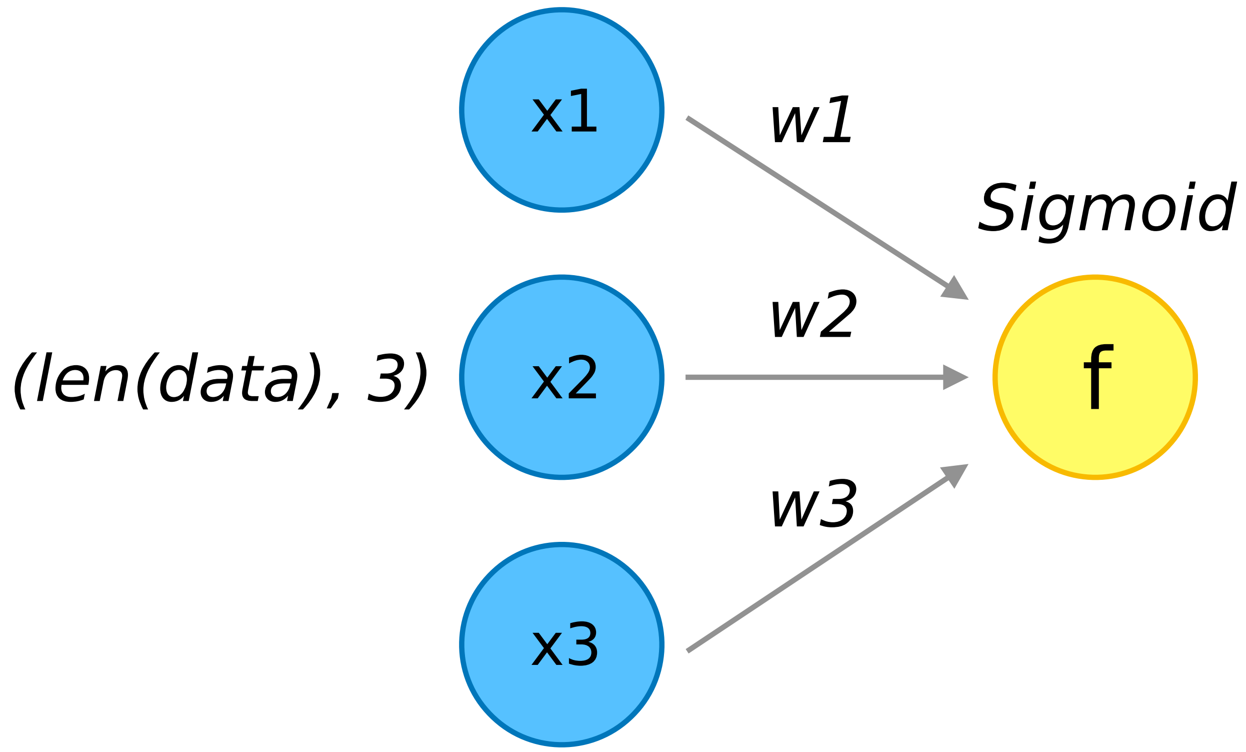
Logistic Regression

Inference

f **= x * w + b**

Logistic Regression

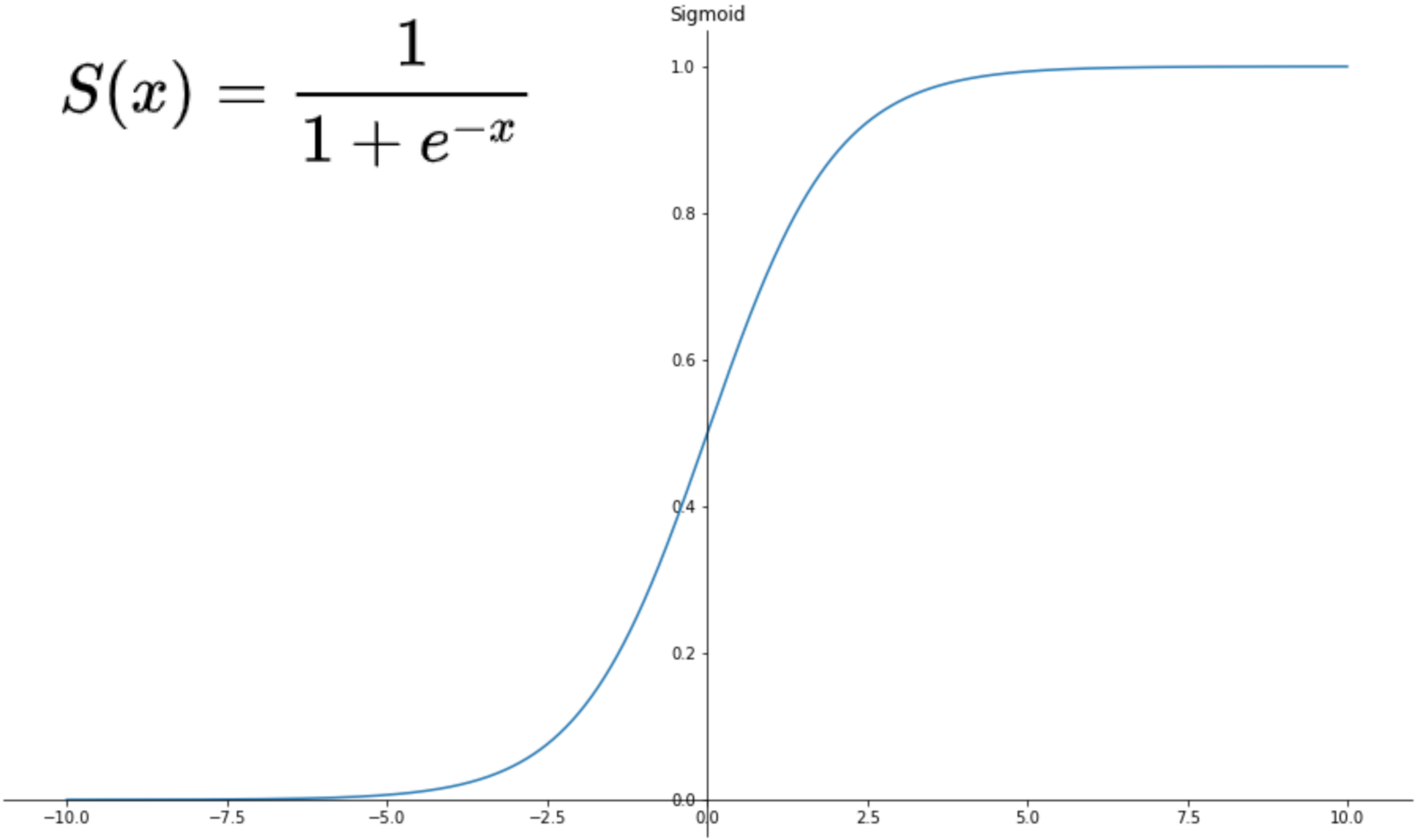
Inference



Logistic Regression

Sigmoid

$$S(x) = \frac{1}{1+e^{-x}}$$



Logistic Regression

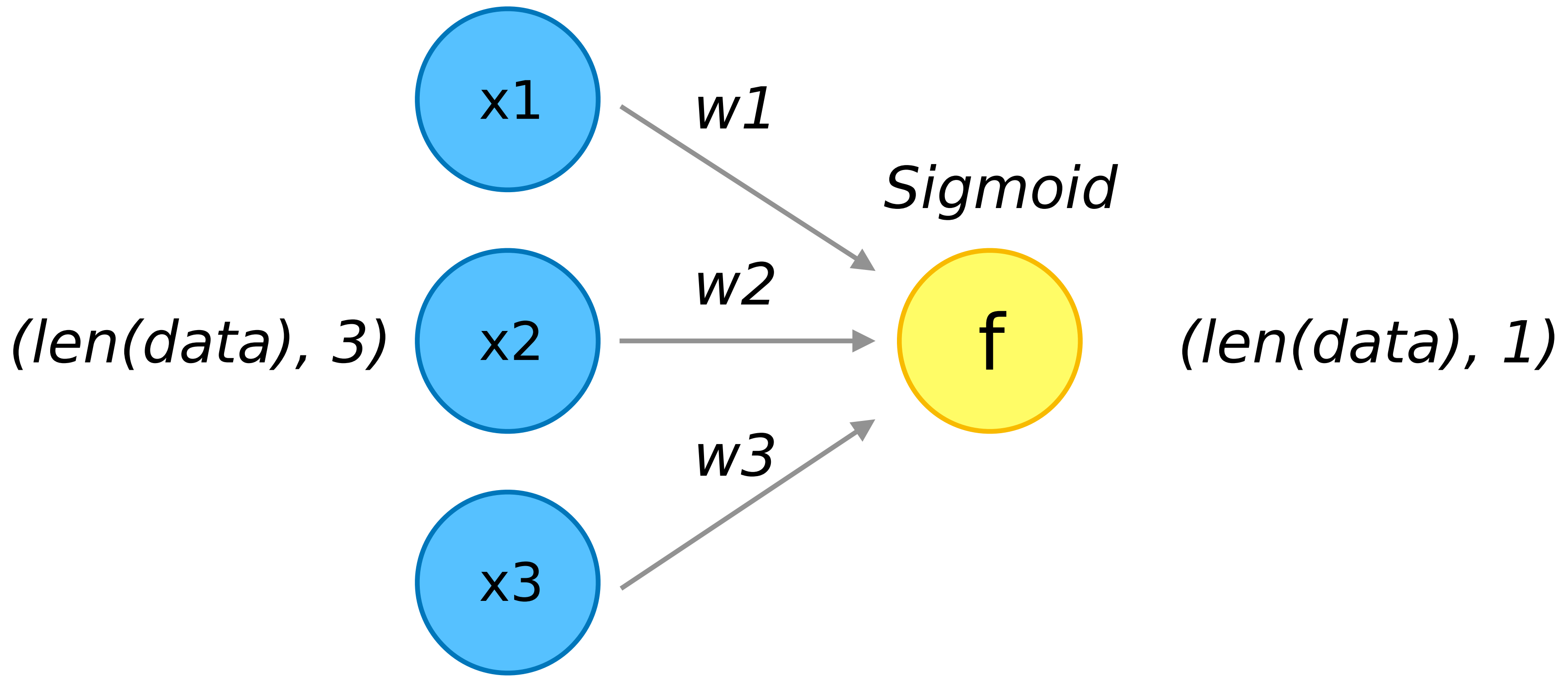
Inference

$$S(x) = \frac{1}{1 + e^{-x}}$$

f **= 1 / (1 + exp (- (x * w + b))**

Logistic Regression

Inference



w.shape = ?

Logistic Regression

Dot Product

$$c_{ij} = a_{i1}b_{1j} + a_{i2}b_{2j} + \ldots + a_{in}b_{nj} = \sum_{s=1}^{n} a_{sn}b_{sj}$$

$$A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{pmatrix}, B = \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \end{pmatrix}$$

f = np.dot(x, w) + b

$$AB = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{pmatrix} \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \end{pmatrix} = \begin{pmatrix} a_{11}b_{11} + a_{12}b_{21} & a_{11}b_{12} + a_{12}b_{22} & a_{11}b_{13} + a_{12}b_{23} \\ a_{21}b_{11} + a_{22}b_{21} & a_{21}b_{12} + a_{22}b_{22} & a_{21}b_{13} + a_{22}b_{23} \\ a_{31}b_{11} + a_{32}b_{21} & a_{31}b_{12} + a_{32}b_{22} & a_{31}b_{13} + a_{32}b_{23} \end{pmatrix}$$

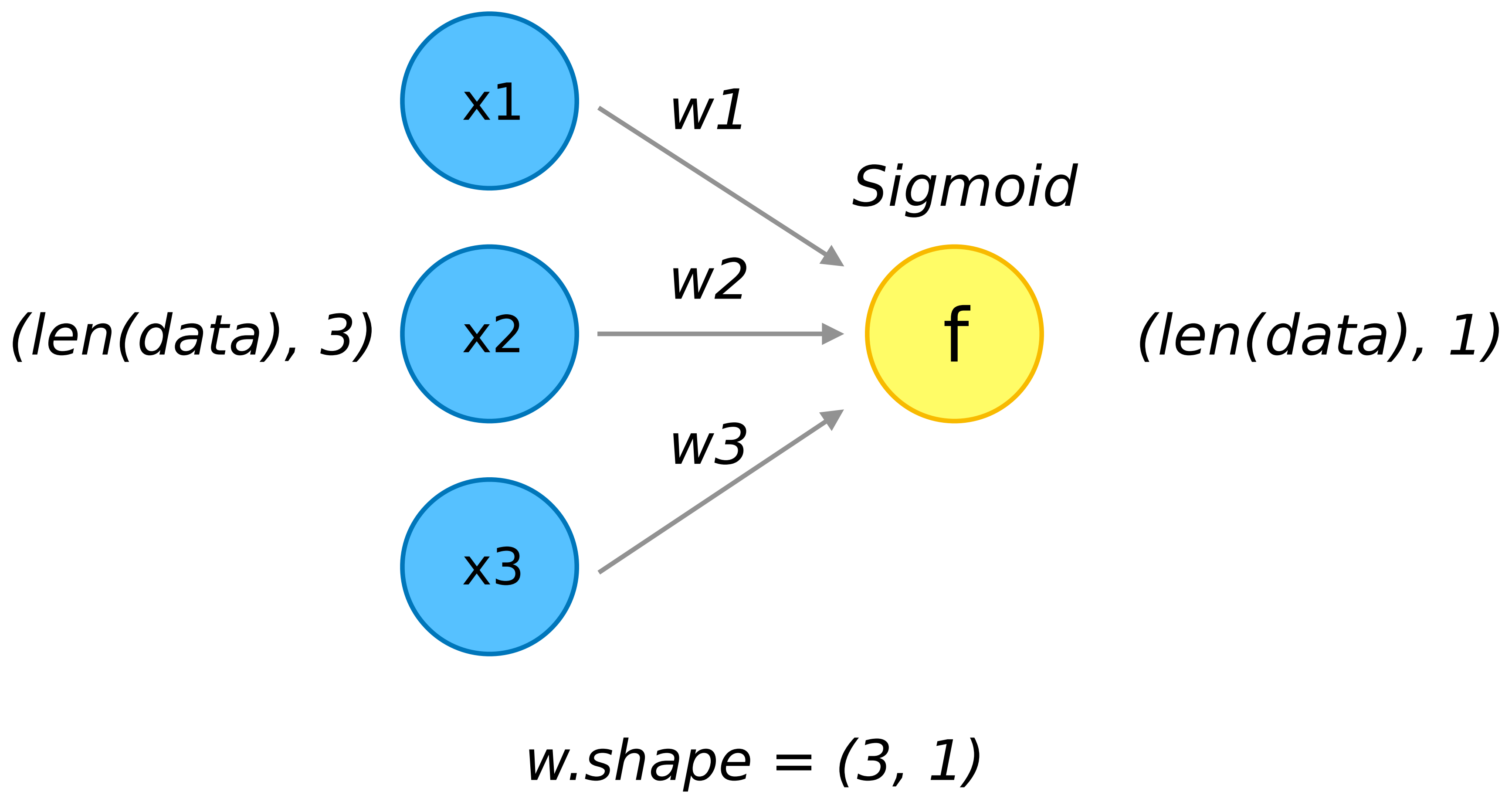
A.shape = (p, m)

B.shape = (n, k)

np.dot(A, B).shape = (p, k) if m ==

Logistic Regression

Inference



Difference between classification and regression task

Classification predictive modeling problems are different from regression predictive modeling problems.

-- Classification is the task of predicting a discrete class label.

-- Regression is the task of predicting a continuous quantity.

There is some overlap between the algorithms for classification and regression; for example:

-- A classification algorithm may predict a continuous value, but the continuous value is in the form of a probability for a class label.

-- A regression algorithm may predict a discrete value, but the discrete value in the form of an integer quantity.

More info