

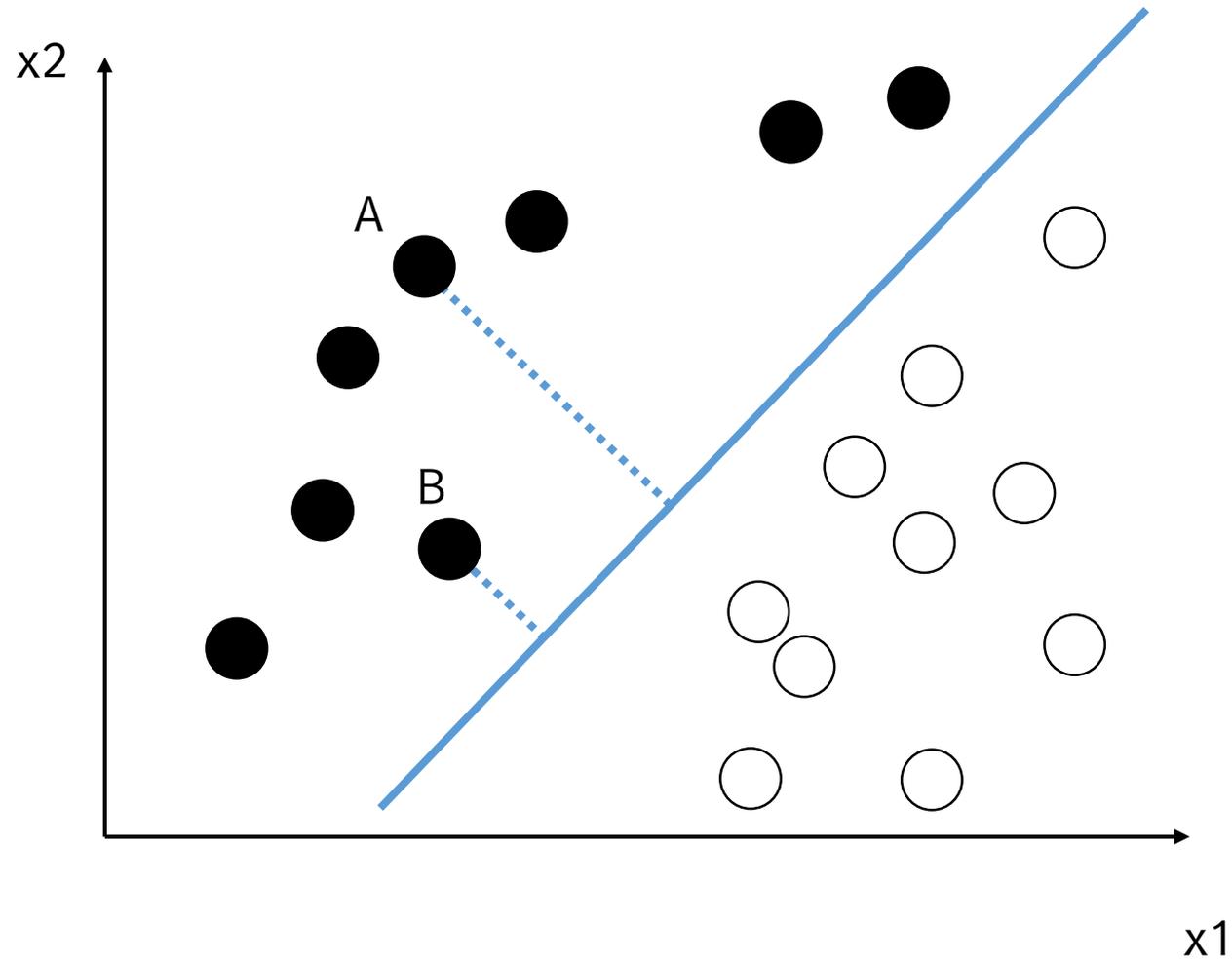
디지털미디어랩 머신러닝 여름캠프 4주차

(4) Logistic Regression, Softmax Function

목차

- Logistic Regression
- Softmax Regression (Multinomial Logistic Regression)

검정색 원일 가능성이 더 높은 것?



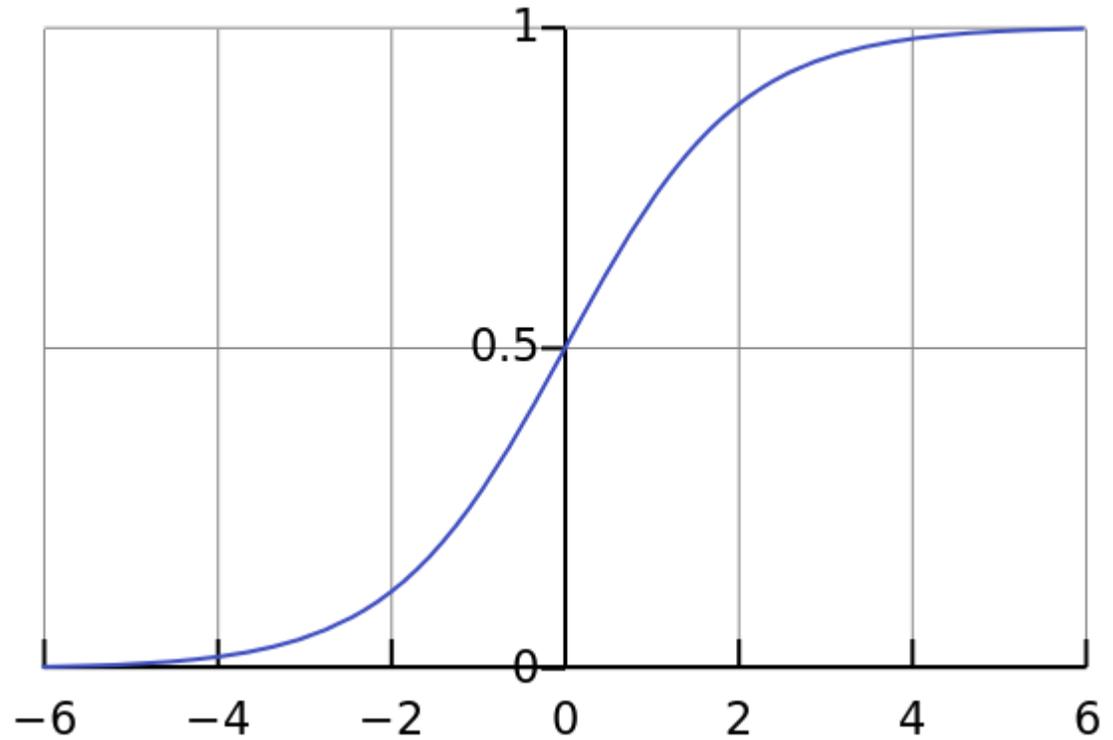
이진 분류에서 어떤 클래스에 속할 확률

- 확률은 0과 1사이의 값을 가진다.
- 그러나 경계에서부터의 거리는 $-\infty$ 에서 ∞ 까지
- $-\infty$ 에서 ∞ 까지의 범위를 0과 1사이의 값으로 변환할 필요가 있음.

Sigmoid 함수

- S자 형태를 가지는 함수

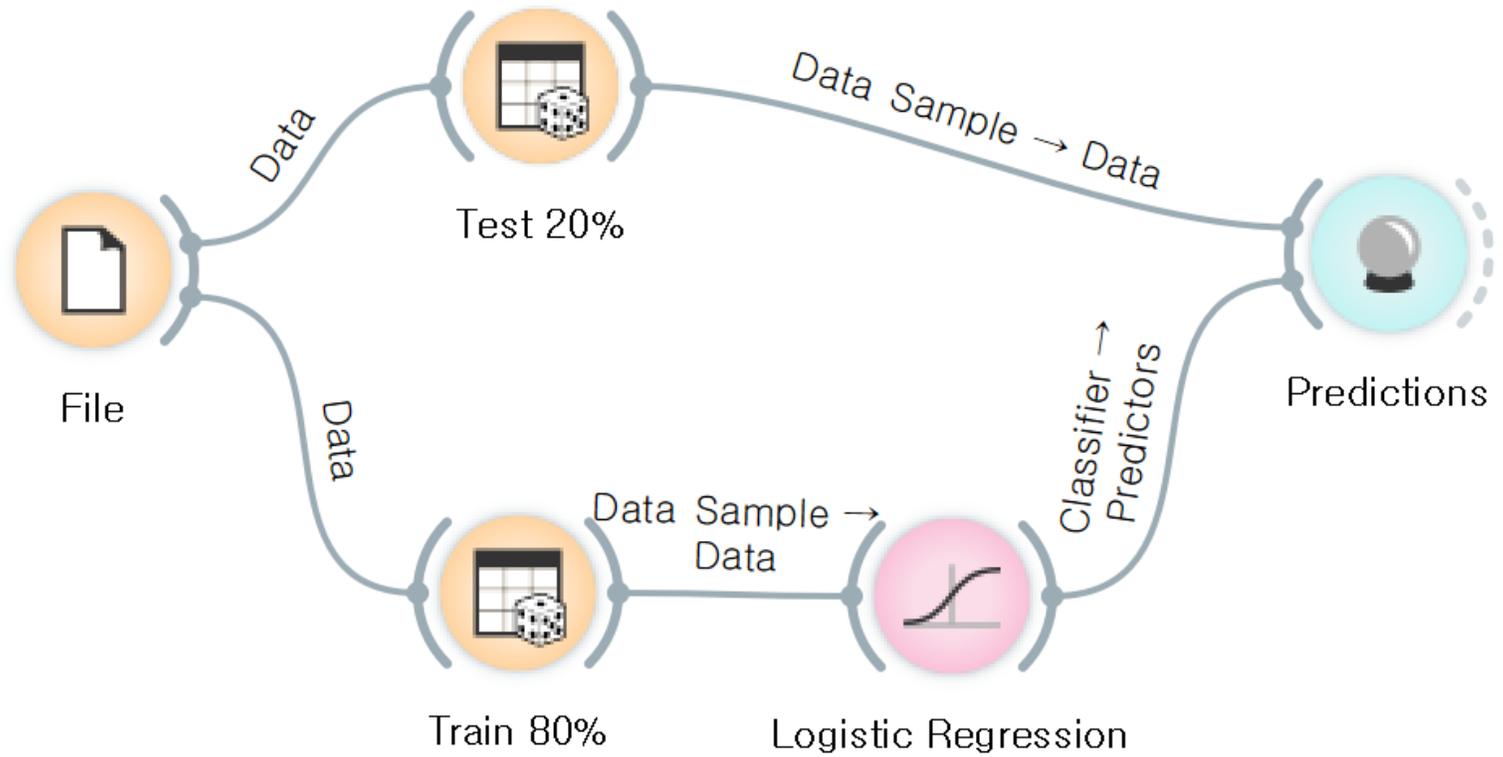
$$S(x) = \frac{1}{1 + e^{-x}}$$



로지스틱 회귀분석

$$\text{Logistic } H(x) = \frac{1}{1 + e^{-H(x)}}$$

로지스틱 회귀 실습



로지스틱 회귀 실습

Predictions

Info

Data: 441 instances.
Predictors: 1
Task: Classification

Restore Original Order

Show

Predicted class
 Predicted probabilities for:

- no
- yes

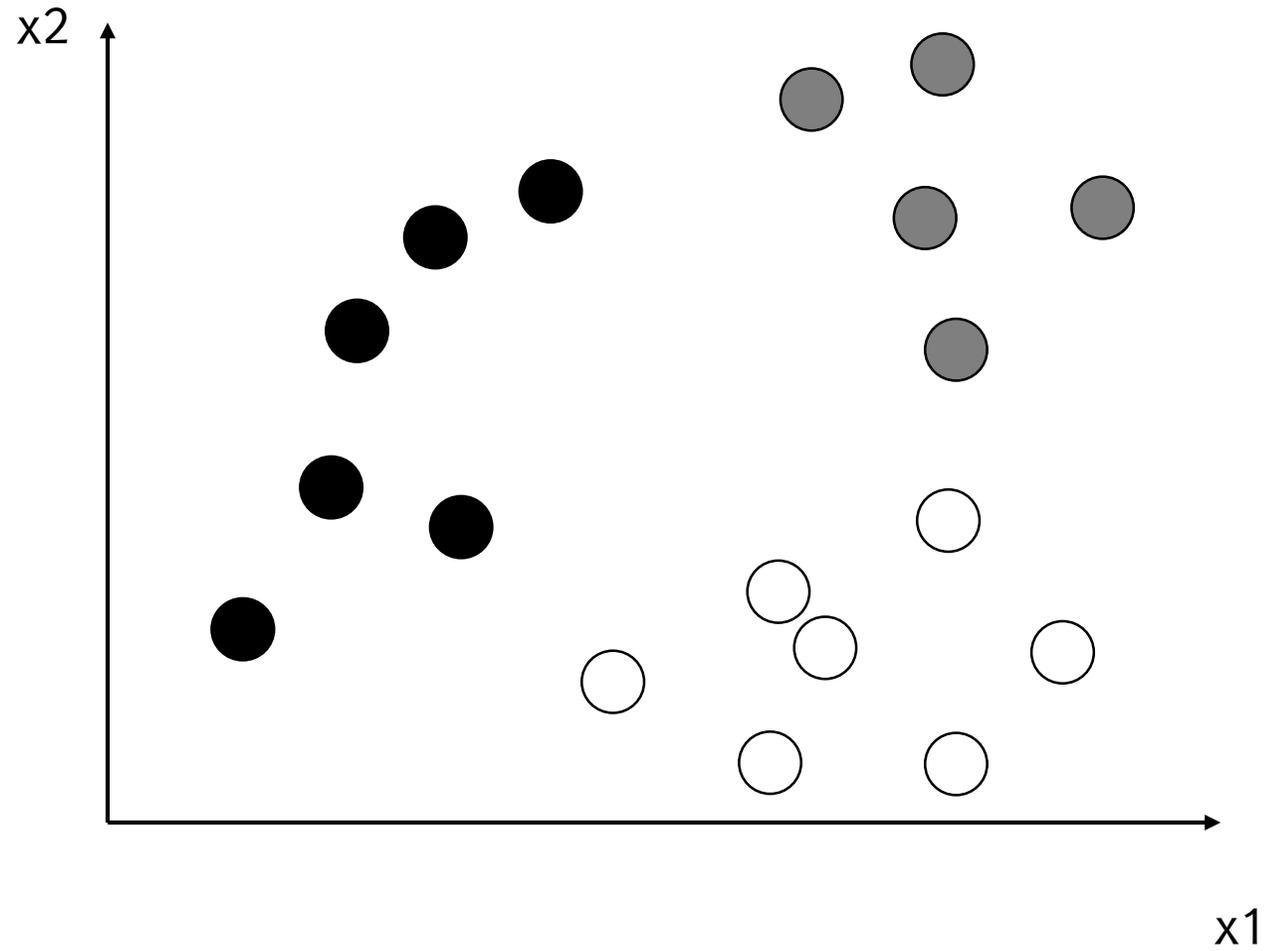
Draw distribution bars

Data View

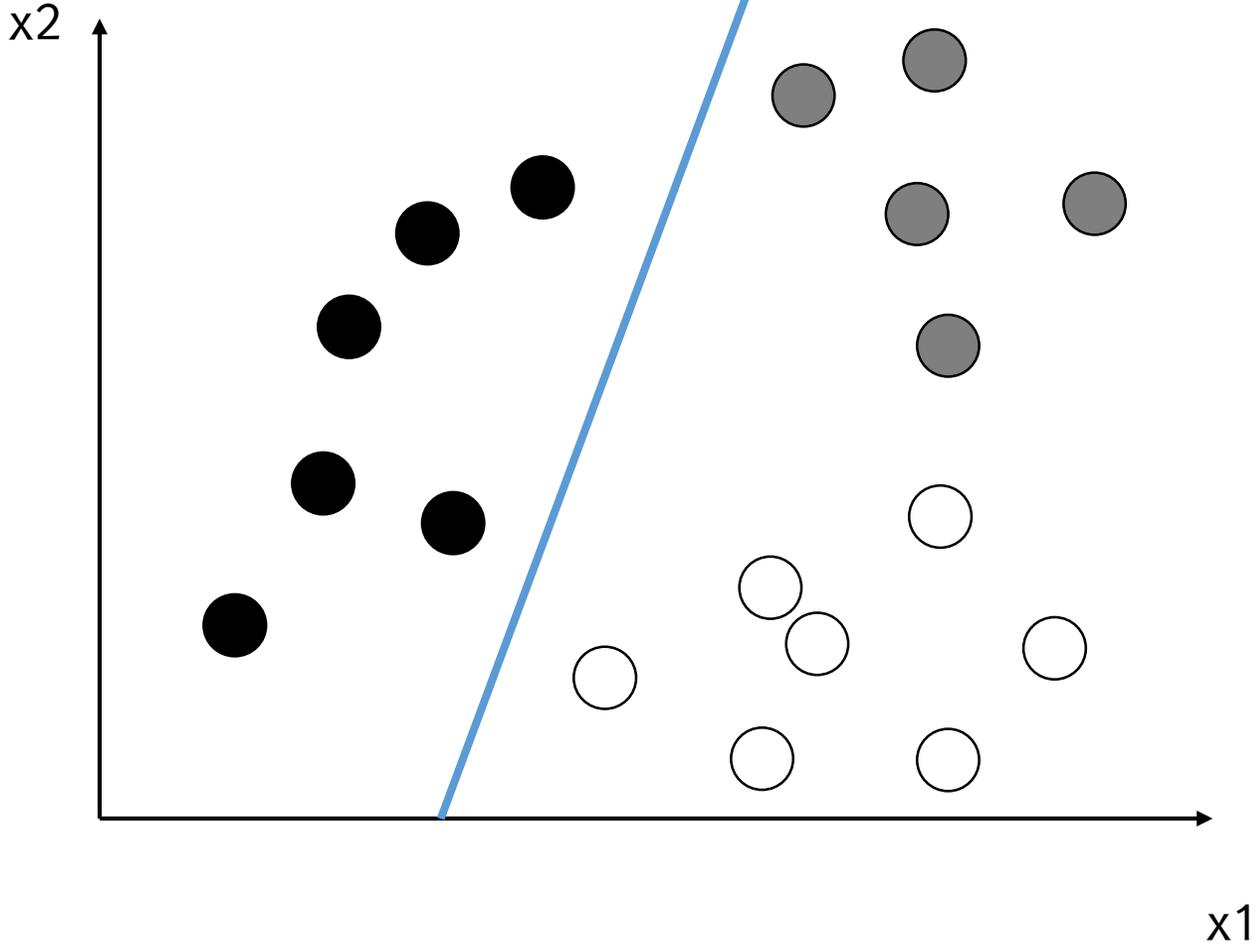
Show full data set

	Logistic Regression	survived	status	age	sex
1	0.26 : 0.74 → yes	yes	second	adult	female
2	0.42 : 0.58 → yes	no	third	adult	female
3	0.89 : 0.11 → no	no	third	adult	male
4	0.78 : 0.22 → no	no	crew	adult	male
5	0.12 : 0.88 → yes	yes	first	adult	female
6	0.78 : 0.22 → no	no	crew	adult	male
7	0.78 : 0.22 → no	no	crew	adult	male
8	0.60 : 0.40 → no	no	first	adult	male
9	0.89 : 0.11 → no	no	third	adult	male
10	0.78 : 0.22 → no	yes	crew	adult	male
11	0.75 : 0.25 → no	no	third	child	male
12	0.26 : 0.74 → yes	yes	second	adult	female
13	0.78 : 0.22 → no	no	crew	adult	male

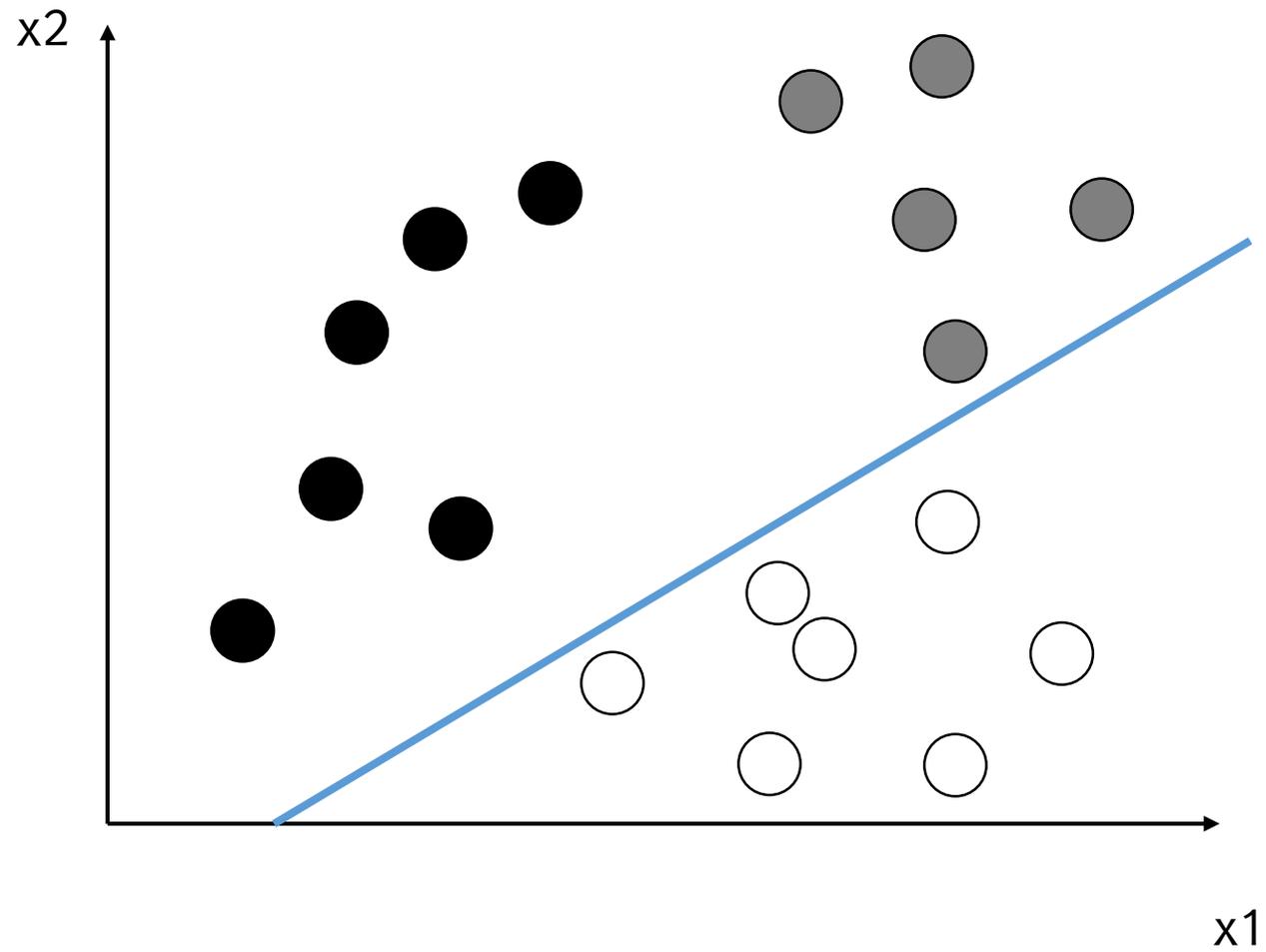
3개 이상의 클래스를 분류하고 싶을 때?



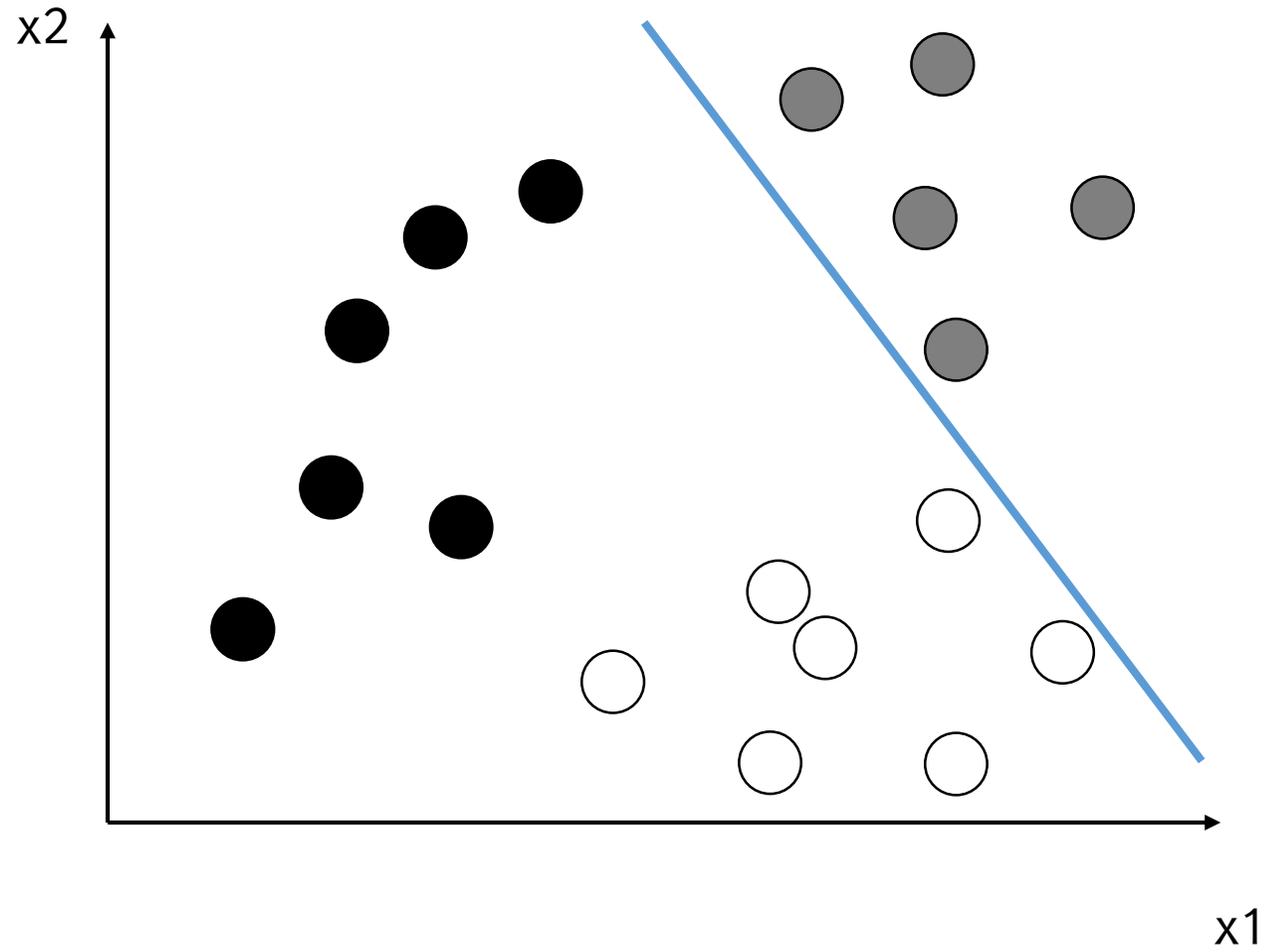
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3개 이상의 클래스를 분류

- 각 클래스의 이름을 A, B, C라고 하자.

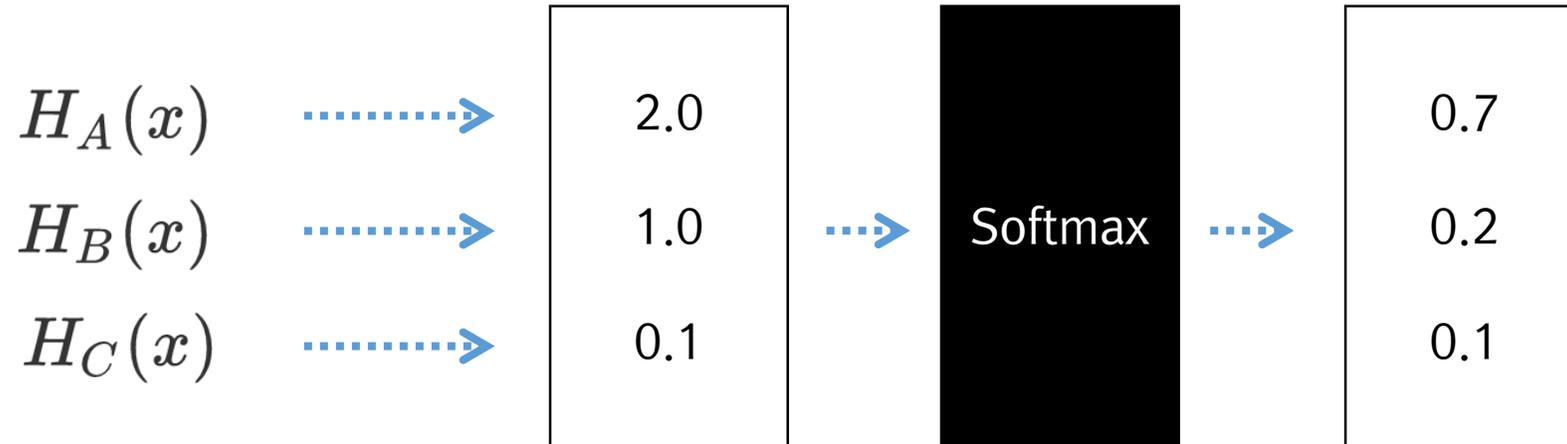
• A 인지 아닌지 $H_A(x)$ 

• B 인지 아닌지 $H_B(x)$ 

• C 인지 아닌지 $H_C(x)$ 

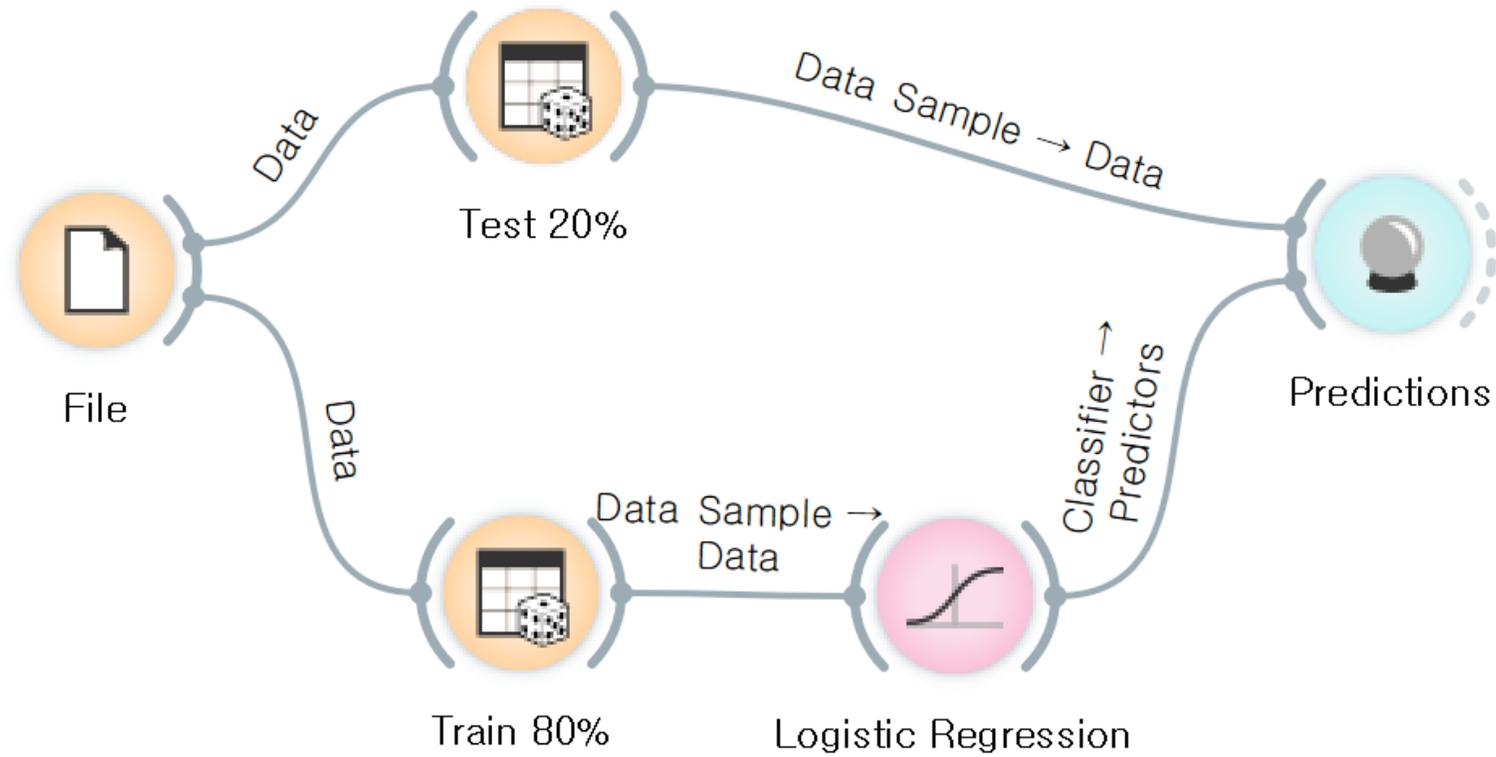
2.0
1.0
0.1

Softmax Function



$$S(x_j) = \frac{e^{x_j}}{\sum_i e^{x_i}}$$

로지스틱 회귀 실습



로지스틱 회귀 실습

Predictions

Info
Data: 30 instances.
Predictors: 1
Task: Classification
[Restore Original Order](#)

Show
 Predicted class
 Predicted probabilities for:
Iris-setosa
Iris-versicolor
Iris-virginica
 Draw distribution bars

Data View
 Show full data set

Output
 Original data
 Predictions
 Probabilities
[Report](#)

	Logistic Regression	iris	sepal length	sepal width	petal length	petal width
1	0.00 : 0.40 : 0.59 → Iris-virginica	Iris-versicolor	6.000	2.700	5.100	1.600
2	0.00 : 0.38 : 0.61 → Iris-virginica	Iris-virginica	6.200	2.800	4.800	1.800
3	0.00 : 0.34 : 0.66 → Iris-virginica	Iris-virginica	7.100	3.000	5.900	2.100
4	0.00 : 0.24 : 0.76 → Iris-virginica	Iris-virginica	6.700	3.000	5.200	2.300
5	0.85 : 0.15 : 0.00 → Iris-setosa	Iris-setosa	4.600	3.200	1.400	0.200
6	0.90 : 0.10 : 0.00 → Iris-setosa	Iris-setosa	4.600	3.400	1.400	0.300
7	0.79 : 0.21 : 0.00 → Iris-setosa	Iris-setosa	4.800	3.000	1.400	0.100
8	0.94 : 0.06 : 0.00 → Iris-setosa	Iris-setosa	5.200	4.100	1.500	0.100
9	0.00 : 0.30 : 0.70 → Iris-virginica	Iris-virginica	5.800	2.700	5.100	1.900
10	0.86 : 0.14 : 0.00 → Iris-setosa	Iris-setosa	5.000	3.400	1.500	0.200
11	0.00 : 0.43 : 0.57 → Iris-virginica	Iris-virginica	7.300	2.900	6.300	1.800
12	0.78 : 0.22 : 0.00 → Iris-setosa	Iris-setosa	5.000	3.000	1.600	0.200
13	0.05 : 0.41 : 0.54 → Iris-virginica	Iris-versicolor	6.000	3.400	4.500	1.600
14	0.02 : 0.54 : 0.45 → Iris-versicolor	Iris-versicolor	6.000	2.900	4.500	1.500
15	0.90 : 0.10 : 0.00 → Iris-setosa	Iris-setosa	5.000	3.500	1.300	0.300
16	0.00 : 0.26 : 0.74 → Iris-virginica	Iris-virginica	6.500	3.000	5.800	2.200
17	0.87 : 0.13 : 0.00 → Iris-setosa	Iris-setosa	5.400	3.400	1.500	0.400
18	0.80 : 0.20 : 0.00 → Iris-setosa	Iris-setosa	4.900	3.000	1.400	0.200
19	0.81 : 0.19 : 0.00 → Iris-setosa	Iris-setosa	4.800	3.100	1.600	0.200

참고 자료

연세대학교 정보대학원 2017-1 “데이터마이닝과 비즈니스 인텔리전스”

모두를 위한 머신러닝/딥러닝

<http://hunkim.github.io/ml/>