AI Programming 복습

한국항공대학교
KOREA AEROSPACE UNIVERSITY

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- 인공신경망의 학습
- 객체 지향 프로그래밍 (Object Oriented Programming)
- 상속(Inheritance)
- Numpy

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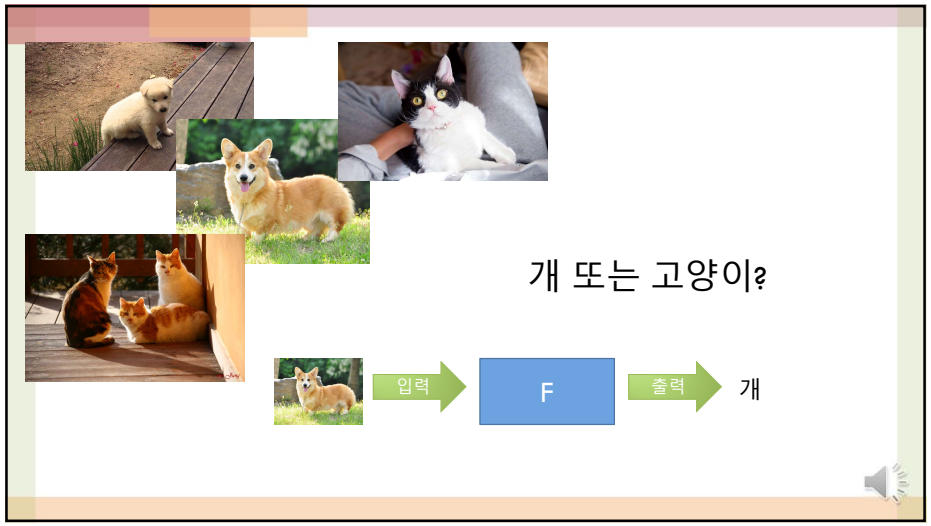
분류(classification)

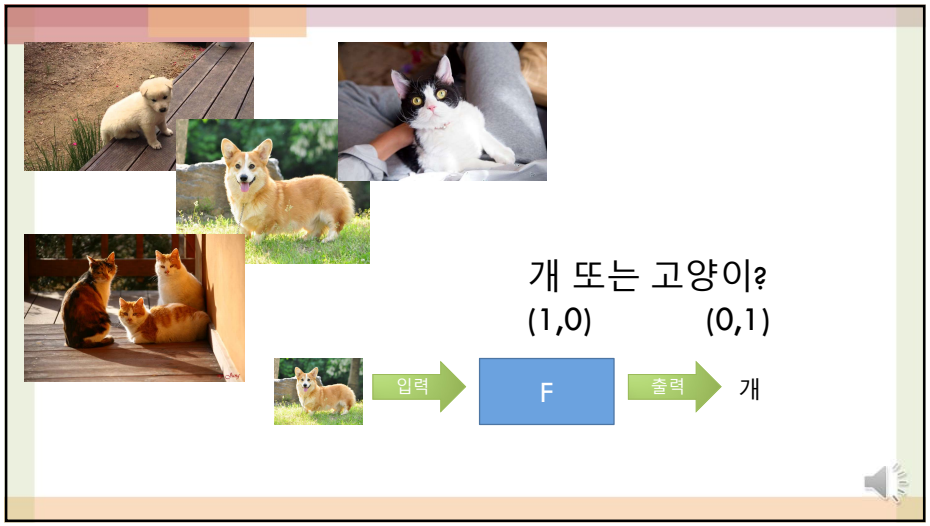
3

개 또는 고양이?

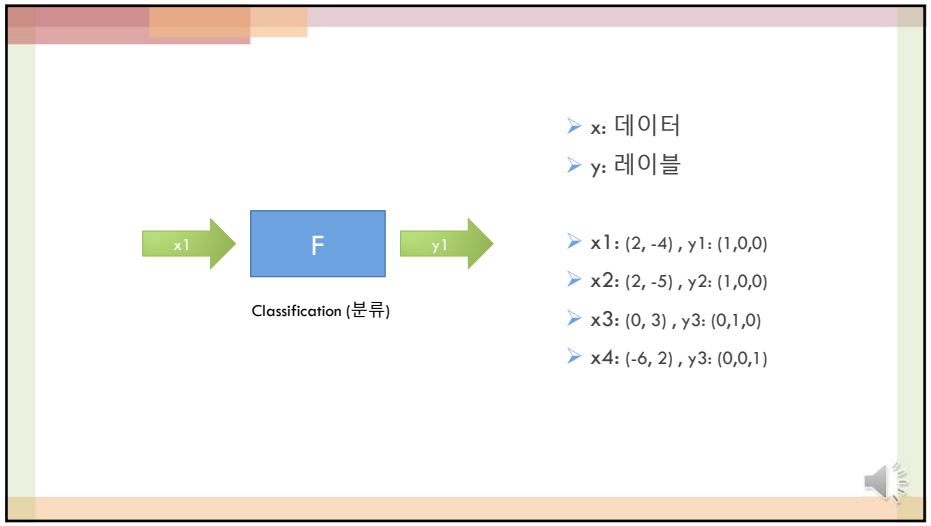
4


개 또는 고양이?
입력
F
출력
개

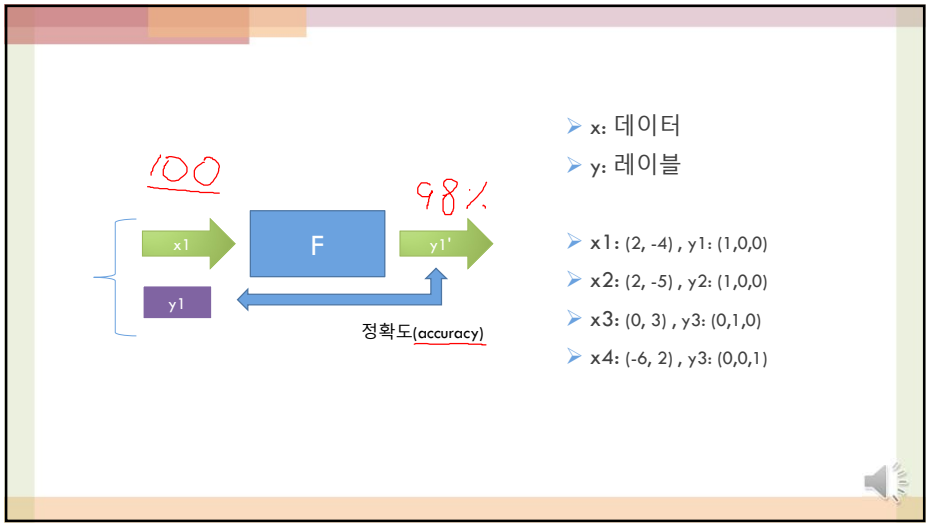
5


개 또는 고양이?
(1,0) (0,1)
입력
F
출력
개

6


x1
F
y1
Classification (분류)
x: 데이터
y: 레이블
x1: (2, -4) , y1: (1,0,0)
x2: (2, -5) , y2: (1,0,0)
x3: (0, 3) , y3: (0,1,0)
x4: (-6, 2) , y3: (0,0,1)

7


100
98%
x1
F
y1'
y1
정확도(accuracy)
x: 데이터
y: 레이블
x1: (2, -4) , y1: (1,0,0)
x2: (2, -5) , y2: (1,0,0)
x3: (0, 3) , y3: (0,1,0)
x4: (-6, 2) , y3: (0,0,1)

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인공 뉴런 (Artificial Neuron)

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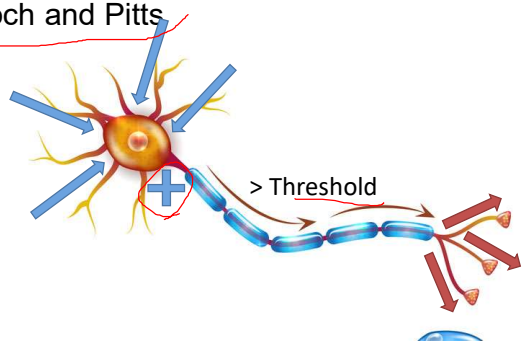
Artificial Neurons (Perceptrons)

- McCulloch and Pitts



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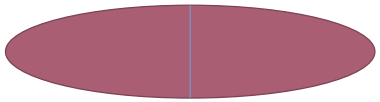

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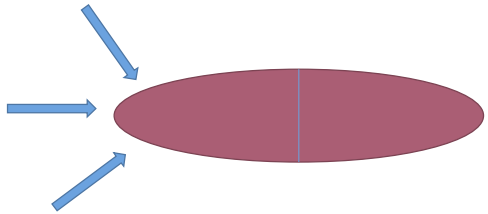

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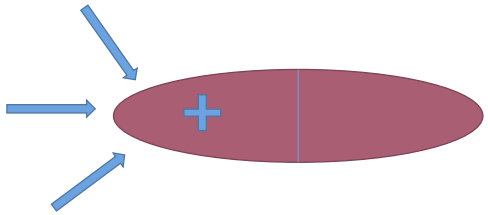

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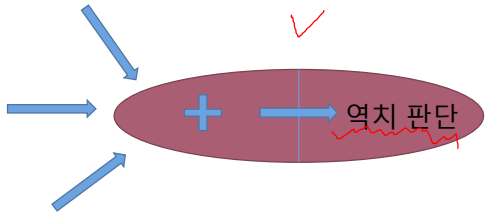

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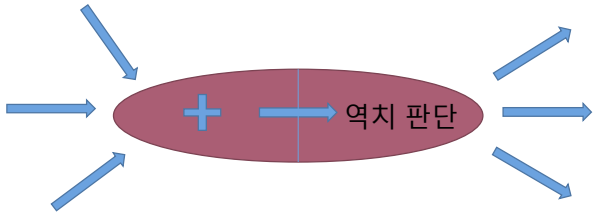

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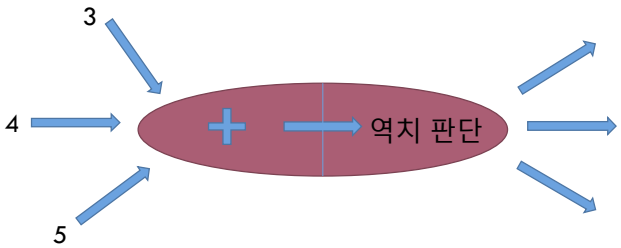

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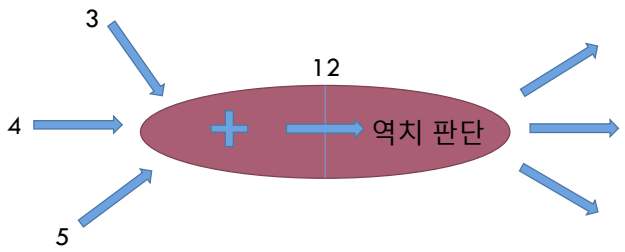

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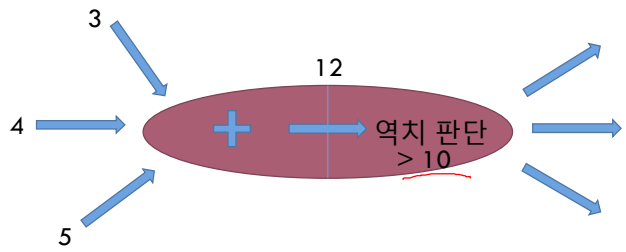

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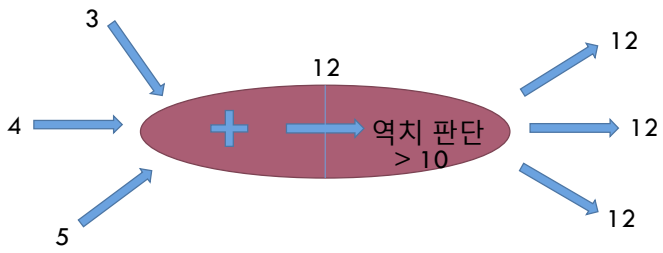

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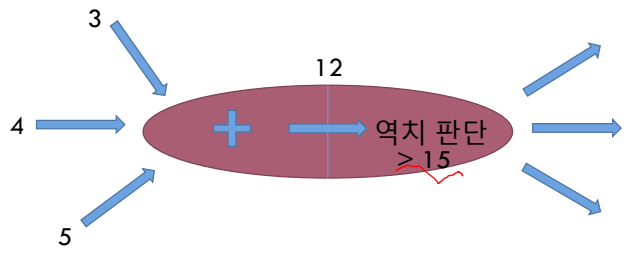

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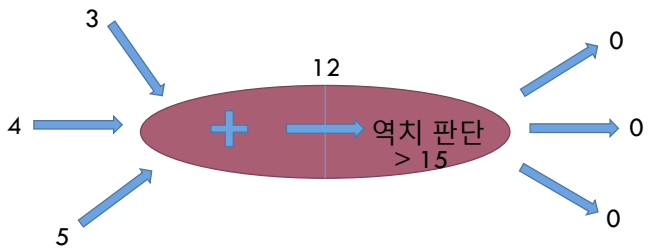

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인공 뉴런 (Artificial Neuron)의 연결

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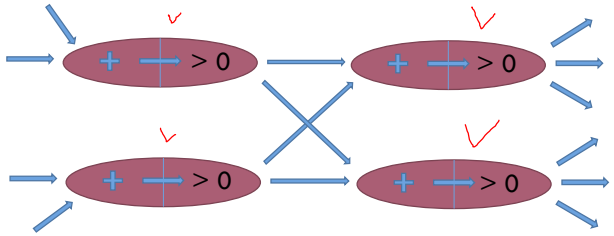
인공 뉴런(Artificial Neuron)



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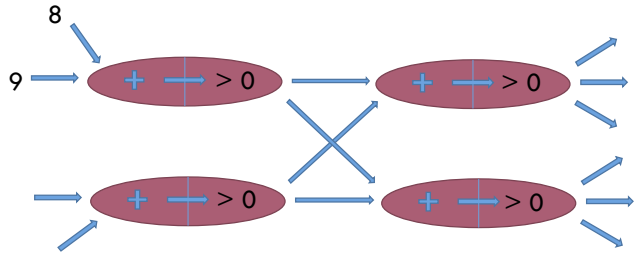

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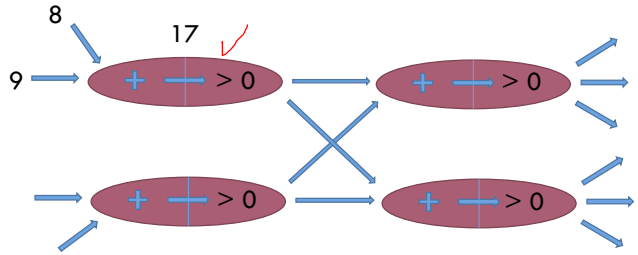

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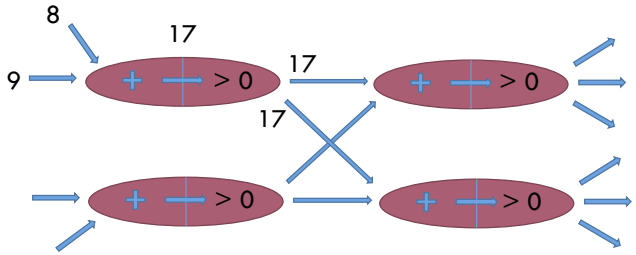

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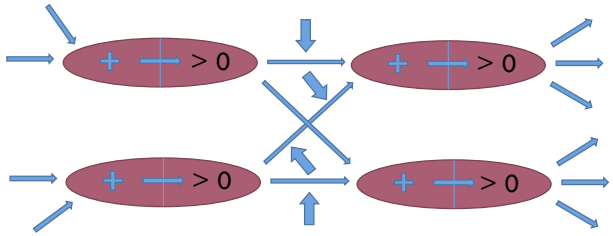
인공 뉴런(Artificial Neuron)



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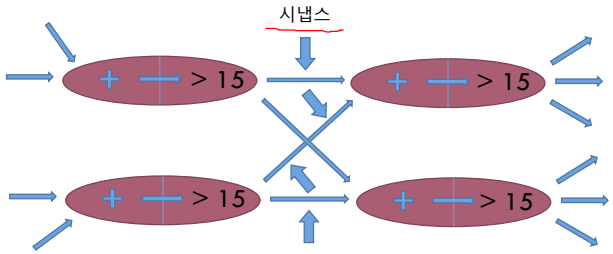
인공 뉴런(Artificial Neuron)



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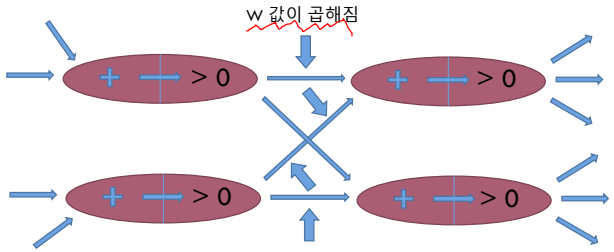
인공 뉴런(Artificial Neuron)



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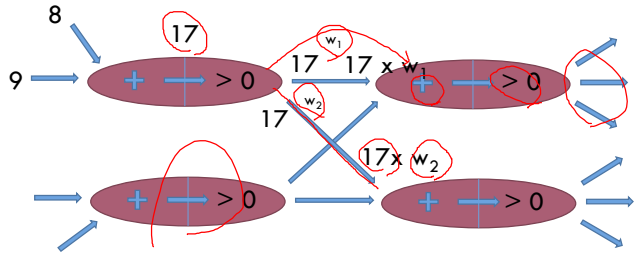

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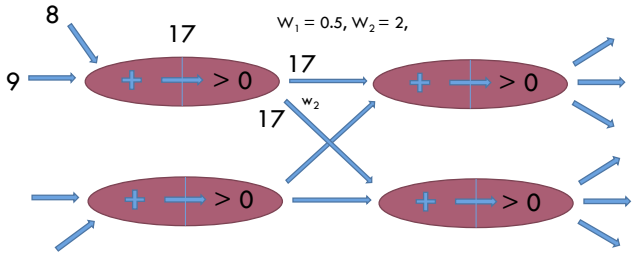
인공 뉴런(Artificial Neuron)



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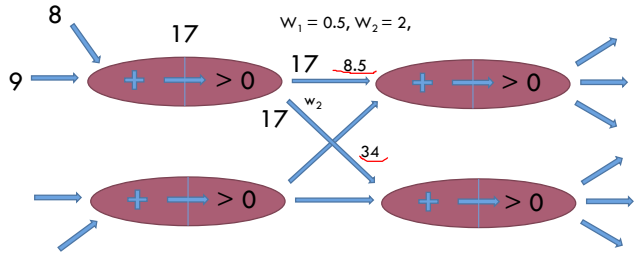

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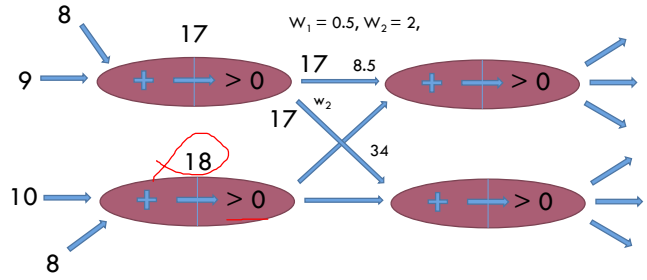
인공 뉴런(Artificial Neuron)



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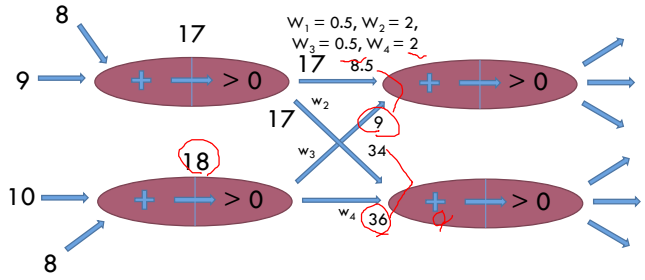
인공 뉴런(Artificial Neuron)



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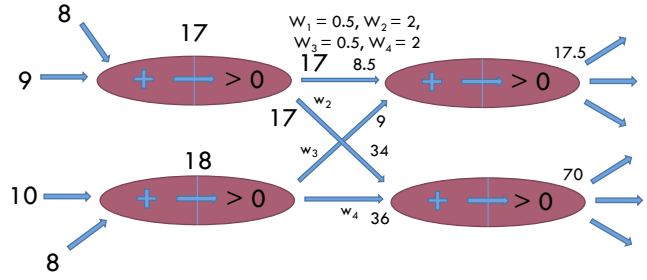
인공 뉴런(Artificial Neuron)



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인공신경망의 분류(classification)

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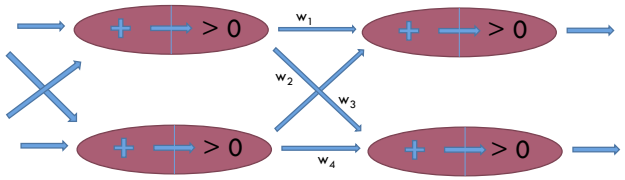
인공신경망을 이용한 분류

x1: (2, -4) , y1: (1,0)



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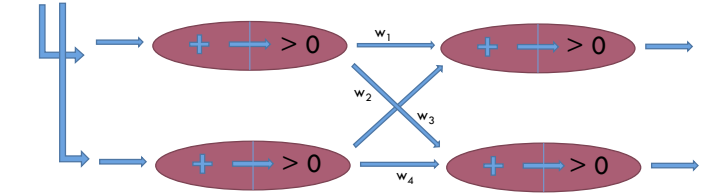
인공신경망을 이용한 분류

x1: (2, -4) , y1: (1,0)



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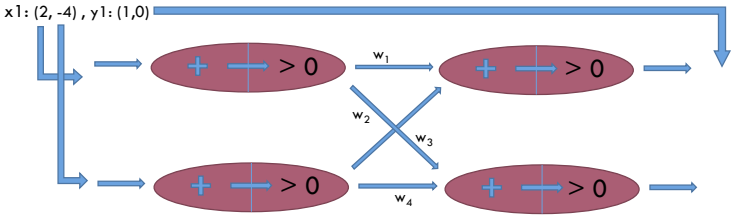
인공신경망을 이용한 분류

x1: (2, -4) , y1: (1,0)



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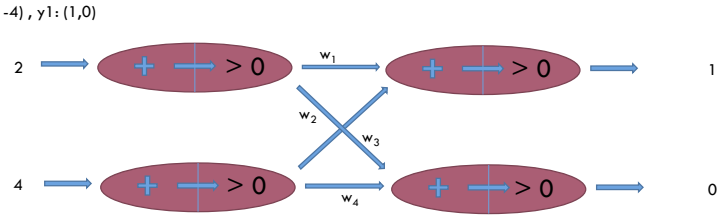
인공신경망을 이용한 분류

x1: (2, -4) , y1: (1,0)



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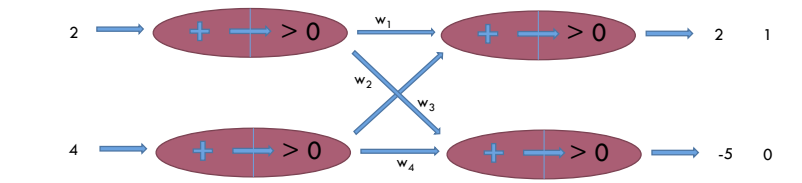
인공신경망을 이용한 분류

x1: (2, -4) , y1: (1,0)



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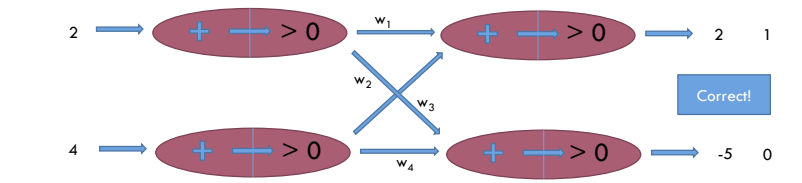
인공신경망을 이용한 분류

x1: (2, -4) , y1: (1,0)



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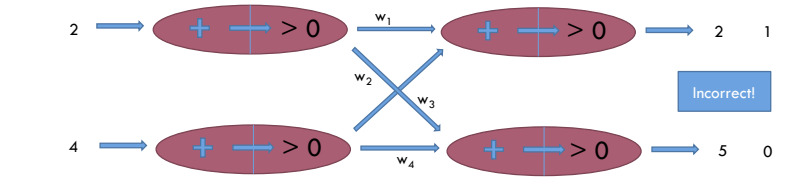
인공신경망을 이용한 분류

x1: (2, -4) , y1: (1,0)



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인공신경망의 학습

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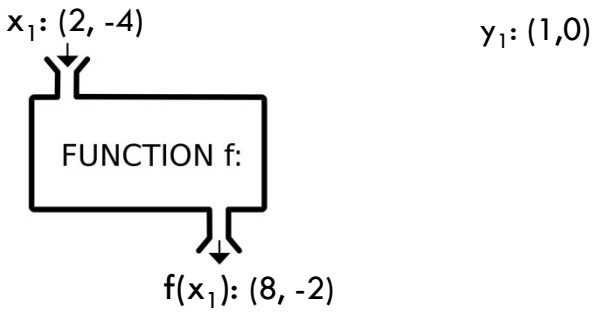
인공신경망을 이용한 분류



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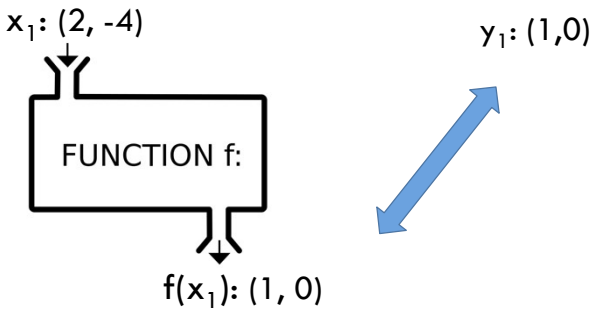
인공신경망을 이용한 분류



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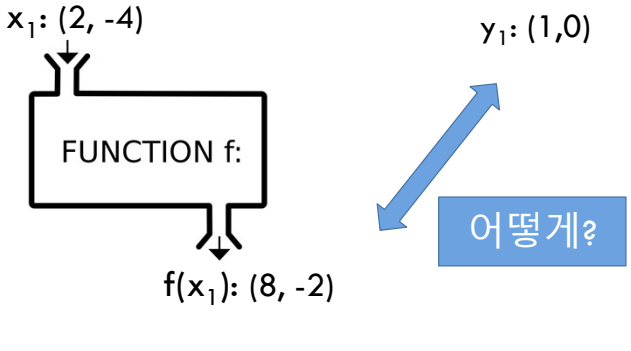

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Loss function

f(x) ~ y 와 얼마나 가까운지 판단!

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Loss function

f(x) ~ y 와 얼마나 가까운지 판단!

$f(x_1)$: (8, -2) ~ y_1: (1,0)

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Loss function

f(x) ~ y 와 얼마나 가까운지 판단!

$f(x_1)$: (8, -2) ~ y_1: (1,0)

문제 1) SCALE 이 안 맞다 (양/음수)

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Loss function

$$\text{softmax}(\mathbf{a}) = \frac{e^{a_i}}{\sum_j e^{a_j}}$$

$\mathbf{a}$ = [-0.21,0.47,1.72]

$\sum_j e^{a_j} = e^{-0.21} + e^{0.47} + e^{1.72} = 8$

$\text{softmax}(\mathbf{a}) = [\frac{e^{-0.21}}{8}, \frac{e^{0.47}}{8}, \frac{e^{1.72}}{8}]$

y = [0.1,0.2,0.7]

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Loss function

f(x) ~ y 와 얼마나 가까운지 판단!

$f(x_1)$: (8, -2) ~ y_1: (1,0)

문제 2) 어떻게 가까운지 판단하지?

Root Mean Square Deviation?

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Loss function

Cross Entropy:

$$H(p,q) = -\sum_{x \in \mathcal{X}} p(x) \log q(x)$$

p, q 모두 확률 이어야함

p → label

q → f(x)

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Loss function

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Loss function

Cross Entropy:

$$H(p,q) = -\sum_{x \in \mathcal{X}} p(x) \log q(x)$$

언제 가장 큰 값을 가질까?

p→ [0,0,1]

q → [0,0,1]

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Loss function

Cross Entropy:

$$H(p,q) = -\sum_{x \in \mathcal{X}} p(x) \log q(x)$$

p→ [0,0,1]

q → [0,0,1]

-1*(0 * log (0) + 0*log(0) + 1 * log(1)) ➔ 0

56

Loss function

Cross Entropy:

$$H(p,q) = -\sum_{x \in \mathcal{X}} p(x) \log q(x)$$

p→ [0,1,0]
q → [0,0,1]
-1*(0 * log (0) + 1*log(0) + 0 * log(1)) ➔ inf

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객체 지향 프로그래밍
(Object Oriented Programming)

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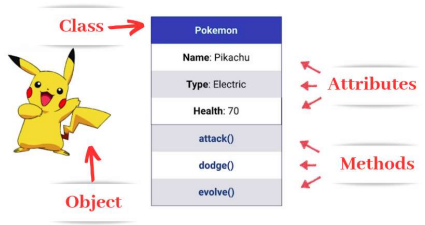
객체 (Object) 의 정의

- 객체 (Object):
  데이터(실체)와 그 데이터에 관련되는 동작(절차, 방법, 기능)을 모두 포함한 개념



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객체 (Object) 의 정의

- 객체 (Object):
  어떻게 정의할까?

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객체 (Object) 의 정의

- 객체 (Object):

어떻게 정의할까?

CLASS

필드 (field)를 미리 결정

객체를 형성

사용!

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클래스(CLASS) 정의

- 형식 (Syntex)

class (클래스 이름):

클래스를 사용하겠다

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초기화 메서드(METHOD)

```
class Person:
    def __init__(self, name):
        self.name = name
    def say_hi(self):
        print 'Hello, my name is', self.name

p = Person('Swaroop')
p.say_hi()
```

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상속(Inheritance)

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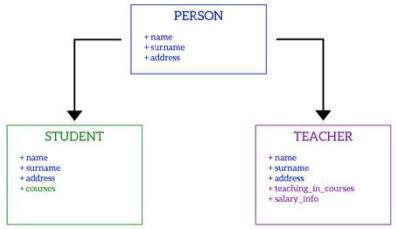
상속(Inheritance)

상속(Inheritance)

- 상속 (Inheritance):
  2. 뒤를 이음.



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상속하는 법

- 형식 (Syntex)

class (클래스 이름)(상속 클래스):

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상속하는 법

- 형식 (Syntex)

class student(상속 클래스):

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Numpy

AI Programming

한국항공대학교 KOREA AEROSPACE UNIVERSITY

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Numpy

Numpy

- 프로그램 라이브러리
- 수학의 함수 등 여러 계산을 편리하게 하기 위한 라이브러리

```
>>> import numpy as np
```

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np.array([ ])

```
>>> a = np.array([1,2,3,4,5])
>>> type(a)
<class 'numpy.ndarray'>
```

- class → ndarray
- 객체
- Attribute 과 Methods

< 사랑에 빠진 합리주의자(NT)들 >

INTP

Error 404 : 객체 love 가 정의되지 않았습니다

ENTP

사랑? 처음보는건데 일단 다 뜯어봐서 어떤건지 확인해야 겠당

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List vs ndarray

```
>>> a = [1,2,3,4,5]
>>> b = [1,2,3,4,5]
>>> a+b
[1, 2, 3, 4, 5, 1, 2, 3, 4, 5]
>>> result = []
... for i,j in zip(a,b):
...     result.append(i+j)
...
>>> result
[2, 4, 6, 8, 10]
```

```
>>> a = np.array([1,2,3,4,5])
>>> b = np.array([1,2,3,4,5])
>>> a + b
array([ 2,  4,  6,  8, 10])
```

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List vs ndarray

```
>>> a = [1,2,3,4,5]
>>> b = [1,2,3,4,5]
>>> 10*a
[1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5]
>>> a/10
Traceback (most recent call last):
  File "<input>", line 1, in <module>
TypeError: unsupported operand type(s) for /: 'list' and 'int'
>>> a+1
Traceback (most recent call last):
  File "<input>", line 1, in <module>
```

```
>>> import numpy as np
>>> a = np.array(a)
>>> b= np.array(b)
>>> a
array([1, 2, 3, 4, 5])
>>> b
array([1, 2, 3, 4, 5])
>>> a+b
array([ 2,  4,  6,  8, 10])
>>> a*10
array([10, 20, 30, 40, 50])
>>> a/10
array([0.1, 0.2, 0.3, 0.4, 0.5])
>>>
```

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Indexing

var[lower:upper:step]

```
#                -5 -4 -3 -2 -1
# indices:        0  1  2  3  4
>>> a = np.array([10,11,12,13,14])
```

```
# [10, 11, 12, 13, 14]
>>> a[1:3]
array([11, 12])

# negative indices work also
>>> a[1:-2]
array([11, 12])
>>> a[-4:3]
array([11, 12])
```

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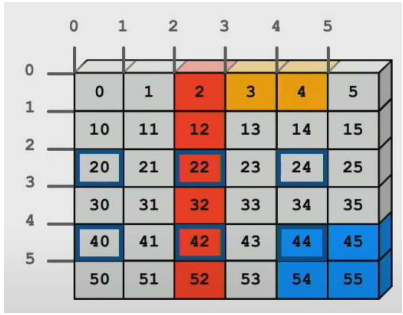
Indexing




```
>>> a[0, 3:5]
array([3, 4])

>>> a[4:, 4:]
array([[44, 45],
       [54, 55]])

>>> a[:, 2]
array([2, 12, 22, 32, 42, 52])
```

```
>>> a[2::2, ::2]
array([[20, 22, 24],
       [40, 42, 44]])
```

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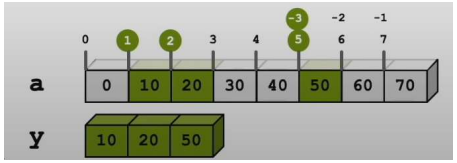
Advanced Indexing




```
>>> a = np.arange(0, 80, 10)

# fancy indexing
>>> indices = [1, 2, -3]
>>> y = a[indices]
>>> print(y)
[10 20 50]

# this also works with setting
>>> a[indices] = 99
>>> a
array([ 0, 99, 99, 30, 40, 99,
60, 70])
```

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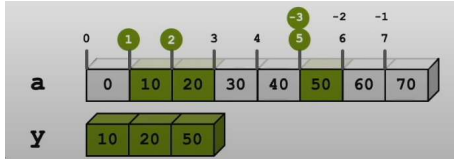
Advanced Indexing




```
>>> a = np.arange(0,80,10)
>>> indices = np.array([0,1,1,0,0,1,0,0],dtype=bool)
>>> y = a[indices]
>>> y
array([10, 20, 50])
```

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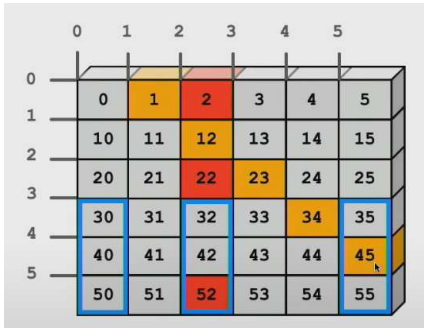
Advanced Indexing




```
>>> a[[0, 1, 2, 3, 4],
...   [1, 2, 3, 4, 5]]
array([ 1, 12, 23, 34, 45])

>>> a[3:, [0, 2, 5]]
array([[30, 32, 35],
       [40, 42, 45],
       [50, 52, 55]])

>>> mask = np.array(
...     [1, 0, 1, 0, 0, 1],
...     dtype=bool)
>>> a[mask, 2]
array([2, 22, 52])
```

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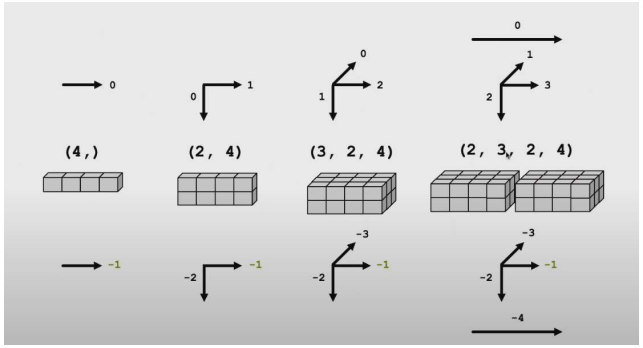
ndarray multidimension



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연산 규칙

1. 고차원 array들의 연산은 shape 이 맞는 지 확인
2. 기본적인 연산 (+, -, *, /, exp, …)는 원소 마다 계산
3. 차원이 줄어드는 연산 (mean, std, sum …)는 array 전체에 적용된다. 다만, Axis를 줄 수도 있다.
4. nan의 계산 결과는 nan이다.

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where

Mathematical functions
- sum, prod
- min, max, argmin, argmax
- ptp (max – min)

Statistics
- mean, std, var

Truth value testing
- any, all

```
>>> a = np.arange(0,40)
>>> a
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33,
       34, 35, 36, 37, 38, 39])
>>> np.ptp(a)
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>>> a.ptp()
39
>>> a.mean()
19.5
>>> a.std()
11.543396380615196
>>> a.var()
133.25
```

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목차

- 분류 (classification)
- 인공 뉴런 (Artificial Neuron)
- 인공 뉴런 (Artificial Neuron)의 연결
- 인공신경망의 분류(classification)
- 인공신경망의 학습
- 객체 지향 프로그래밍 (Object Oriented Programming)
- 상속(Inheritance)
- Numpy

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