ML/DL for Everyone Season2

with TensorFlow

Lab10-1
Relu activation function

Code: https://github.com/deeplearningzerotoall/TensorFlow
Slides: http://bit.ly/2LQMKvk
Lecturer: 김준호 takis0112@gmail.com

Lab10-1: Relu activation function

- Problem of Sigmoid
- Why Relu ?
- Code
  - load dataset
  - create network
  - define loss function
  - experiments
    - parameters
    - model
    - eager mode
- What's Next

Problem of Sigmoid

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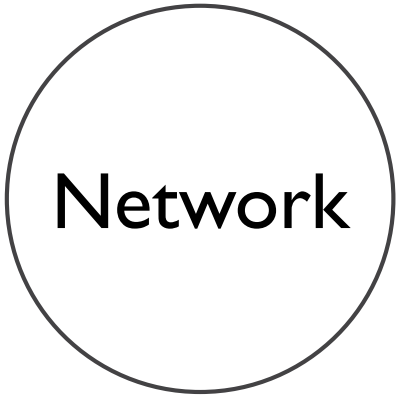

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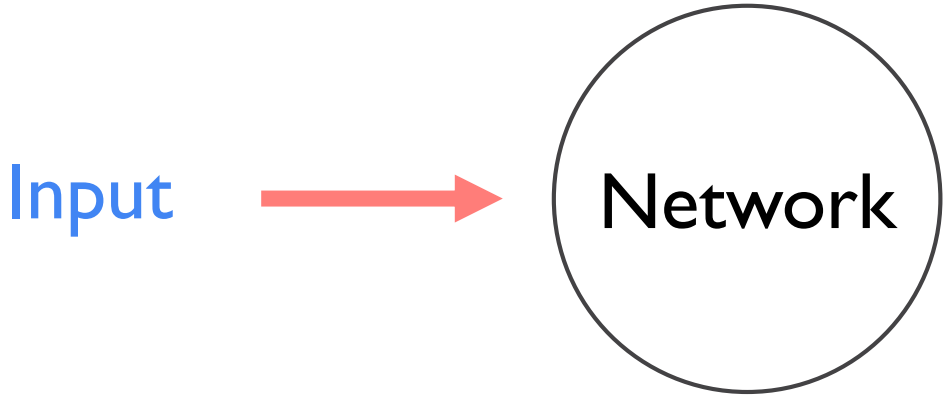

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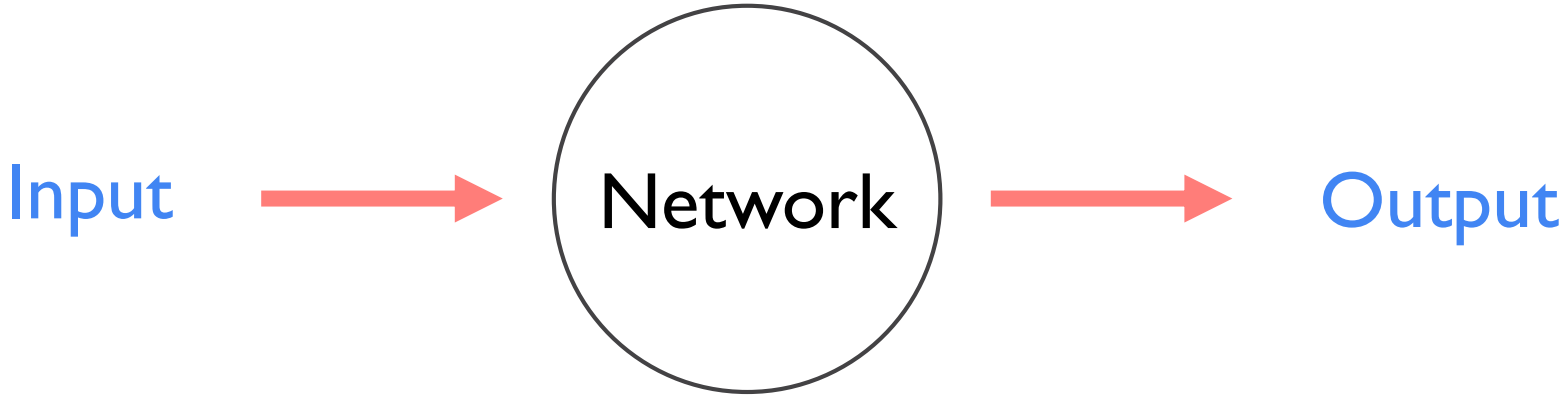

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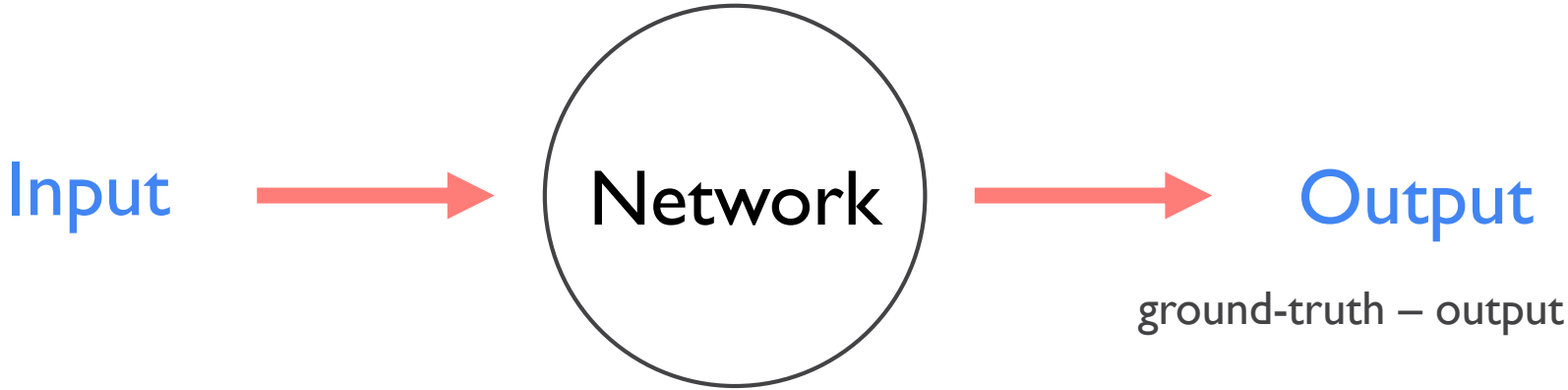

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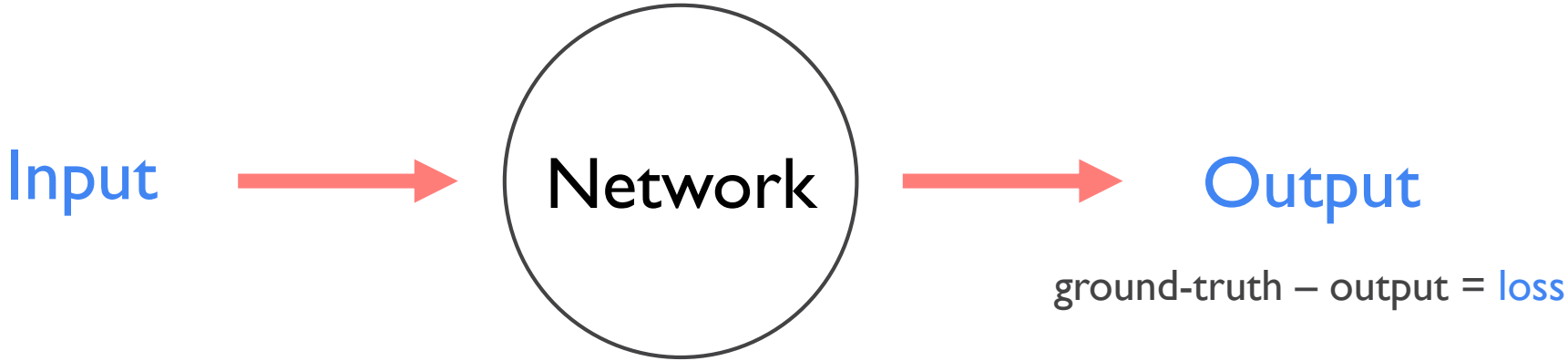

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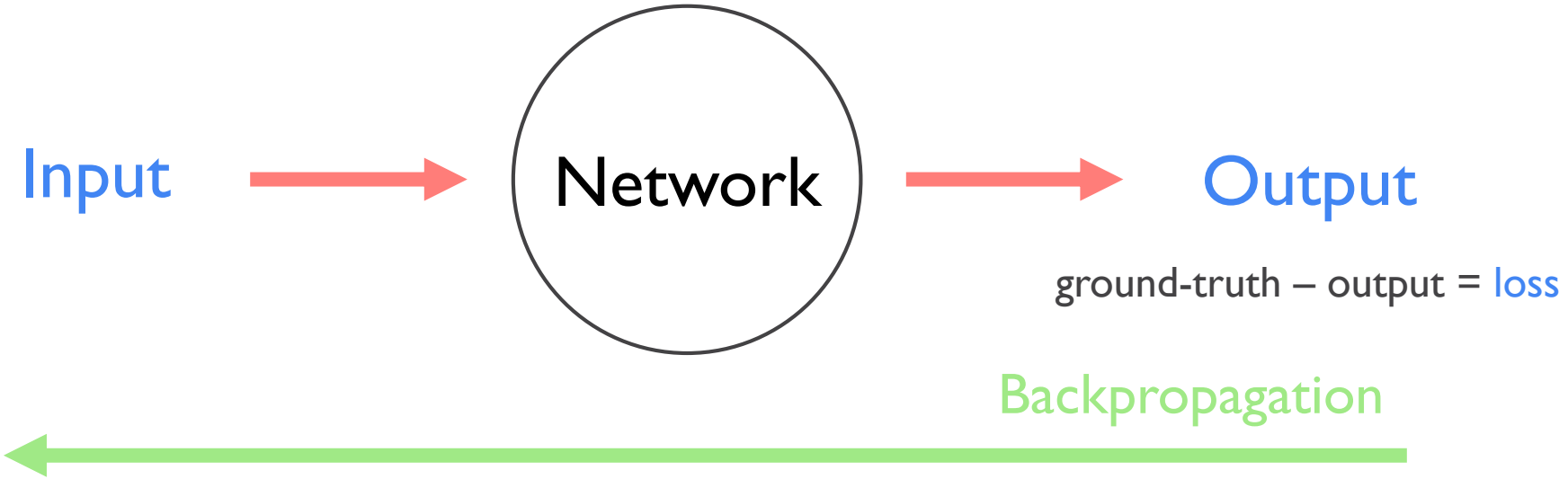

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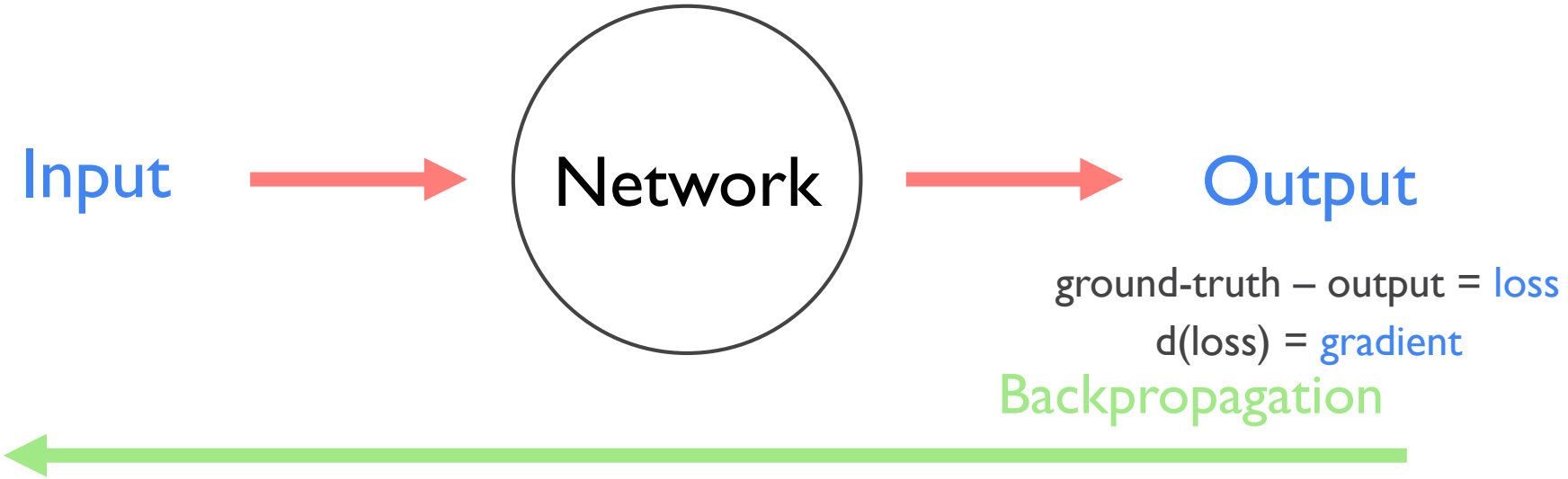

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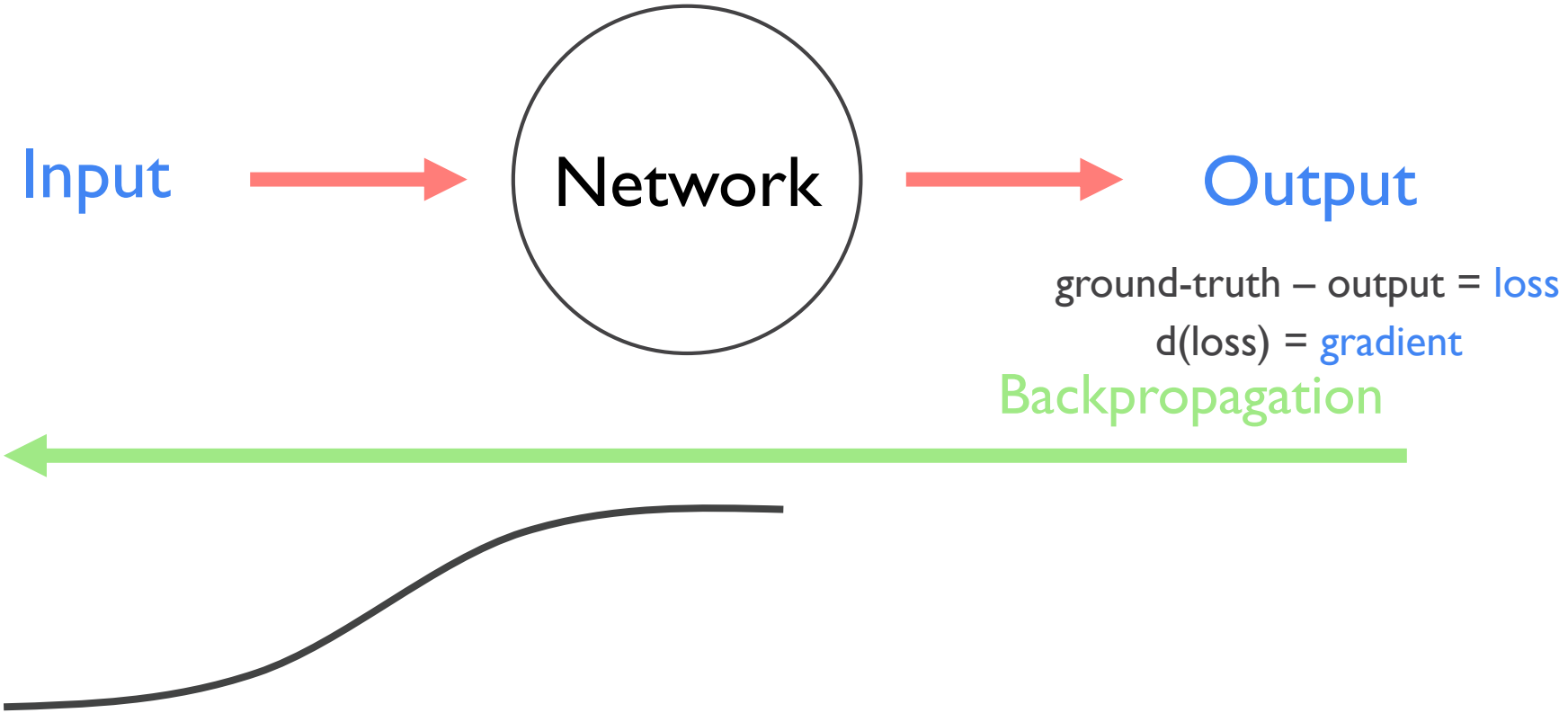

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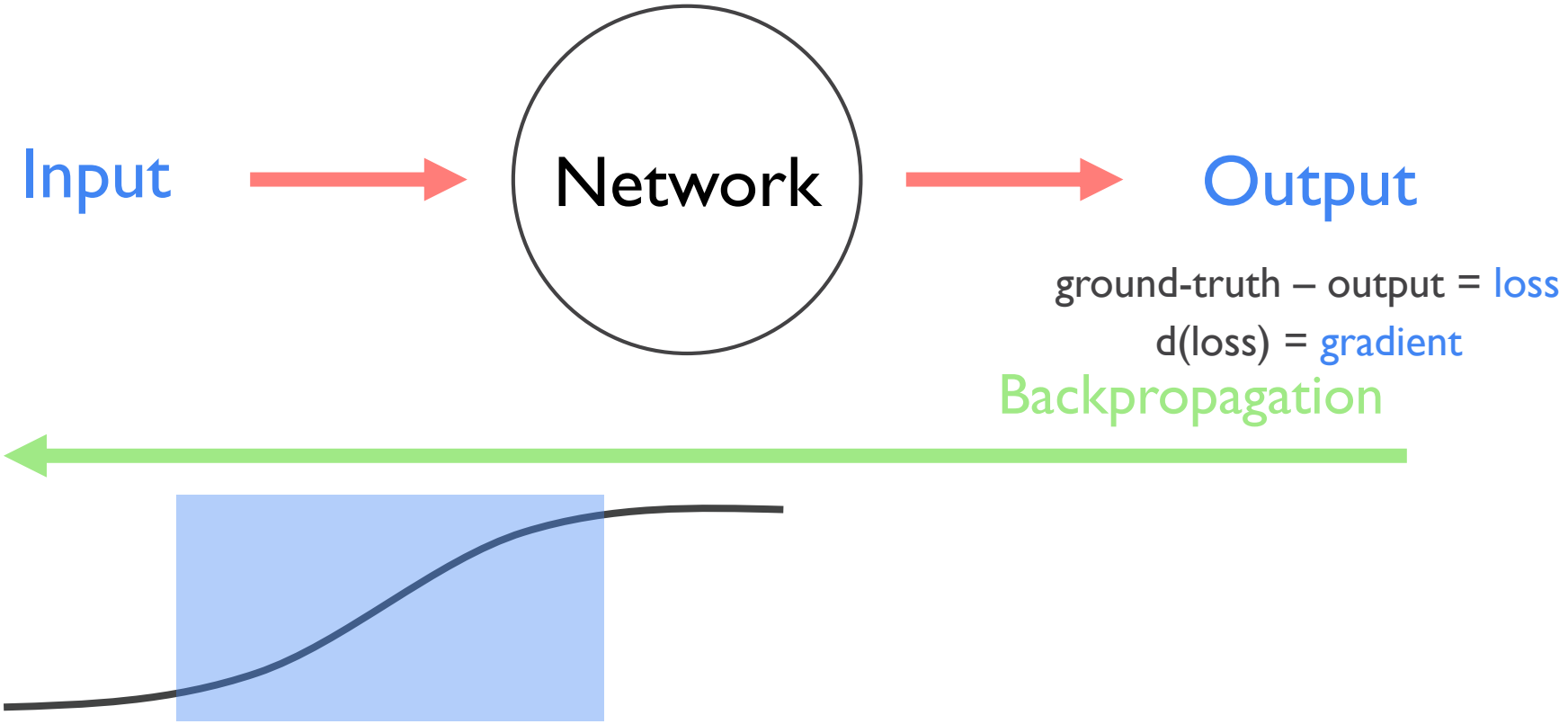

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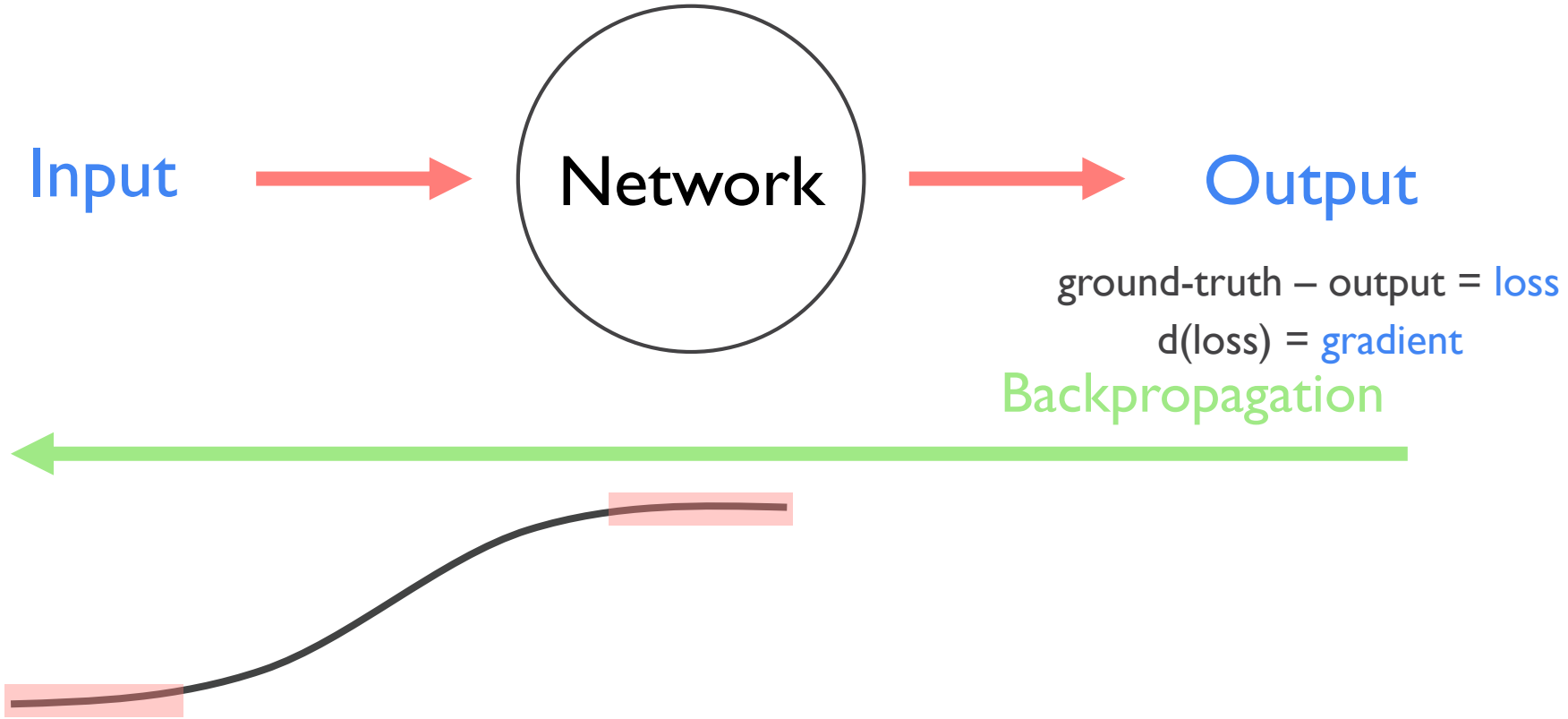

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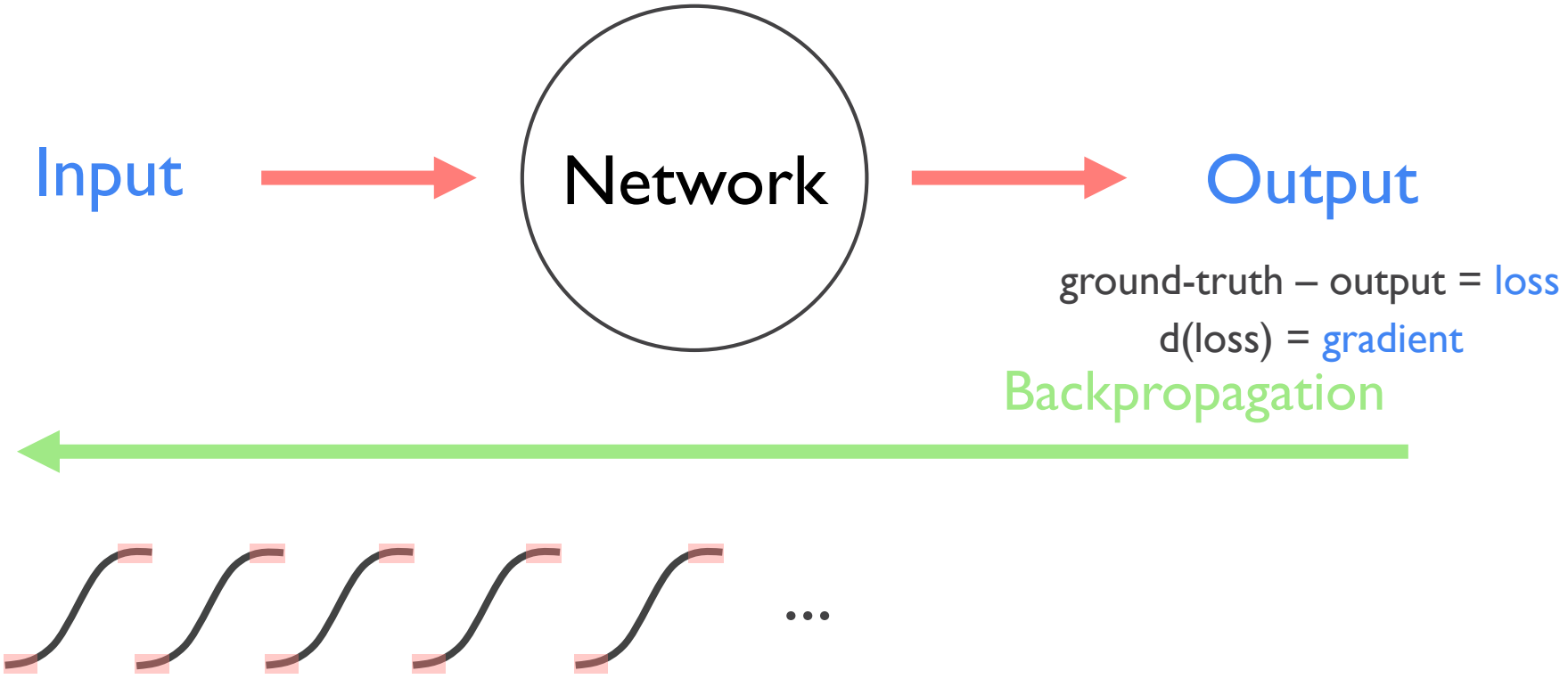

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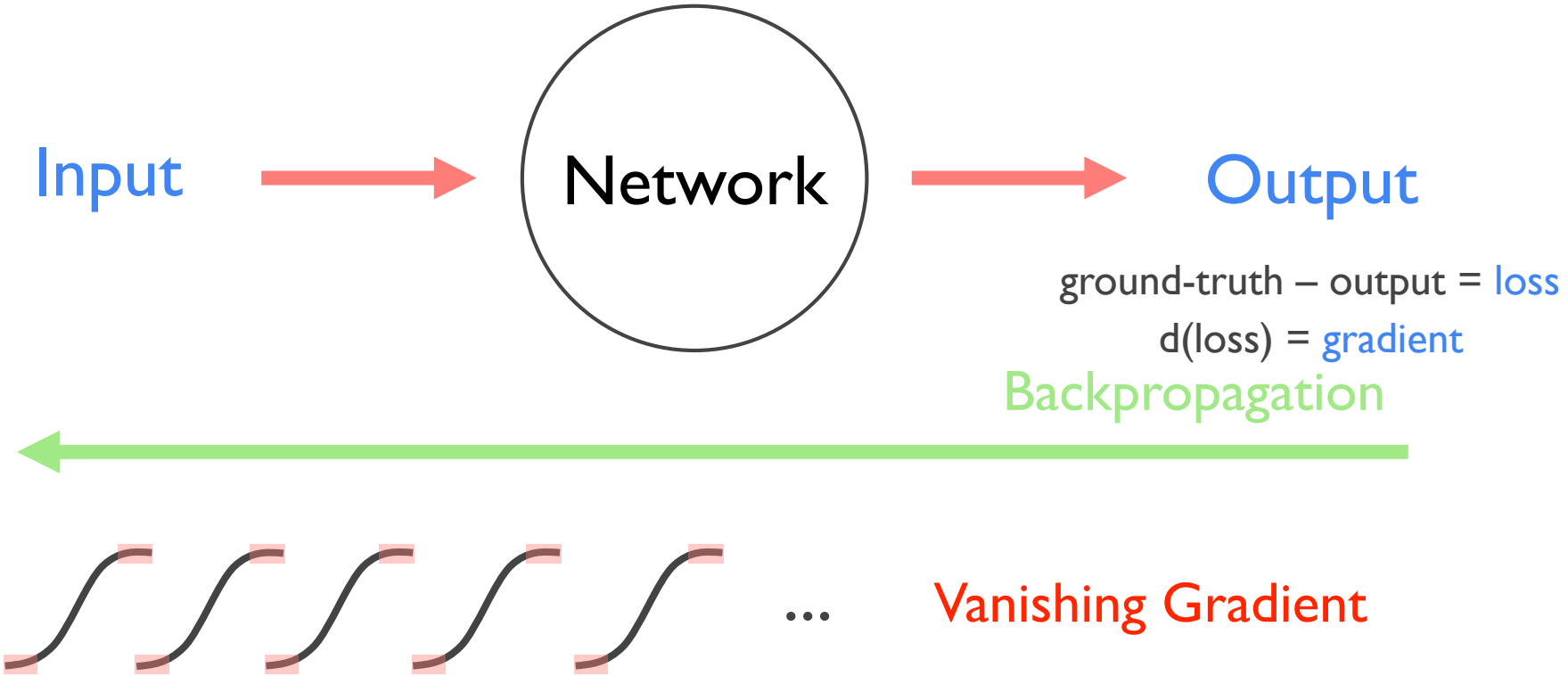

Why Relu ?

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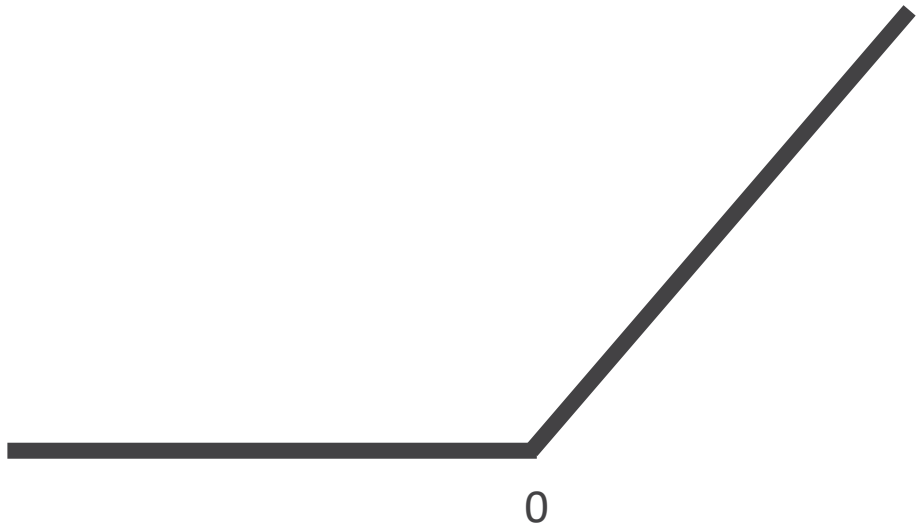

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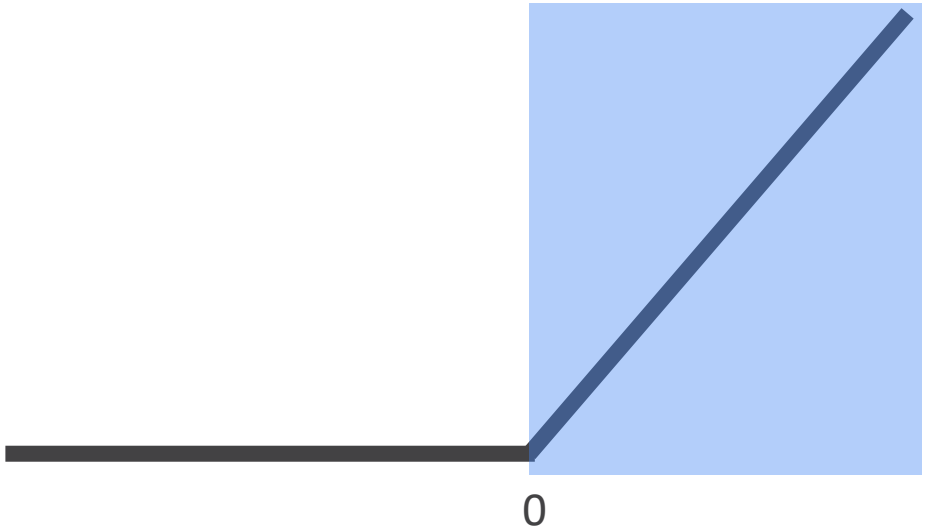

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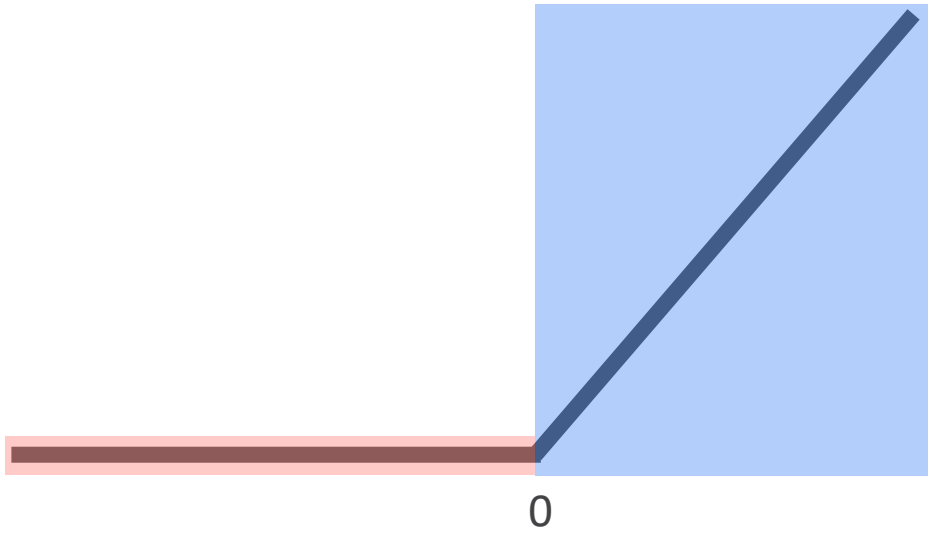

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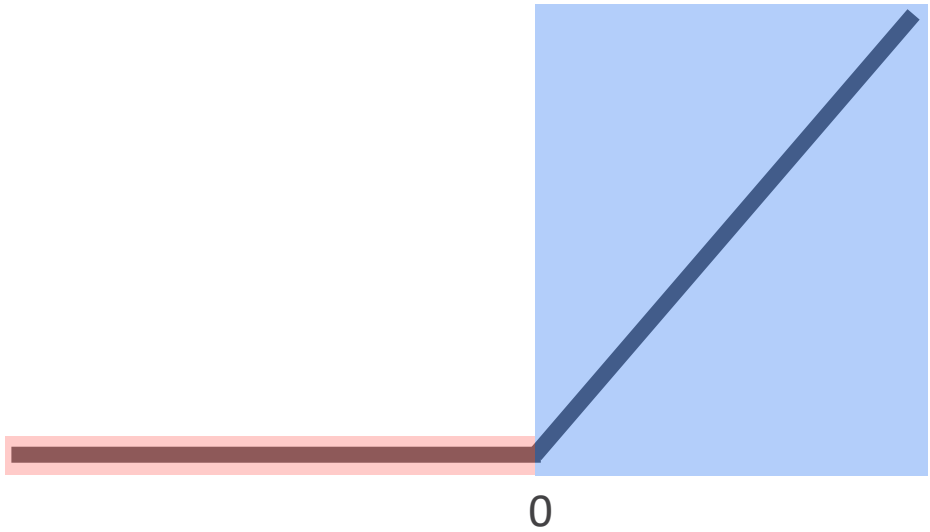

sigmoid, tanh
relu, elu, selu

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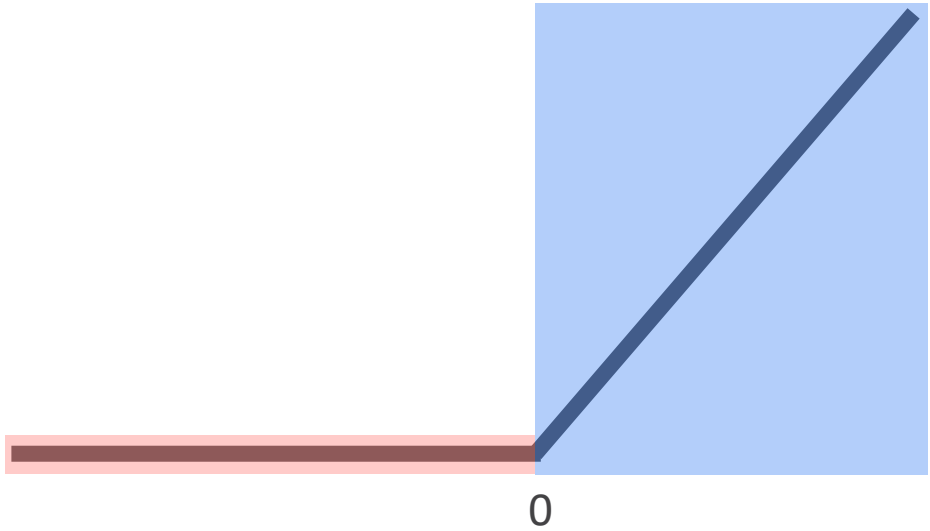

`tf.keras.activations` → `sigmoid, tanh`
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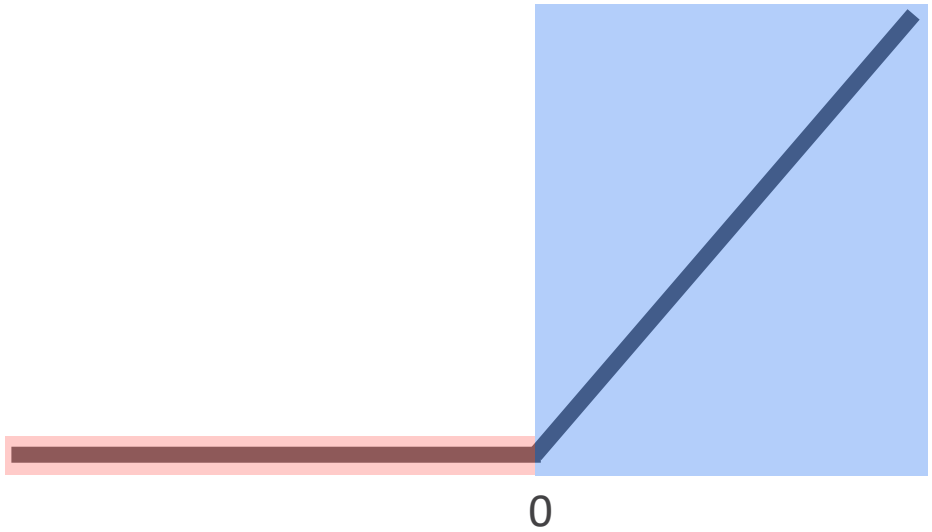

`tf.keras.activations` → `sigmoid, tanh`
`relu, elu, selu`

`leaky relu`

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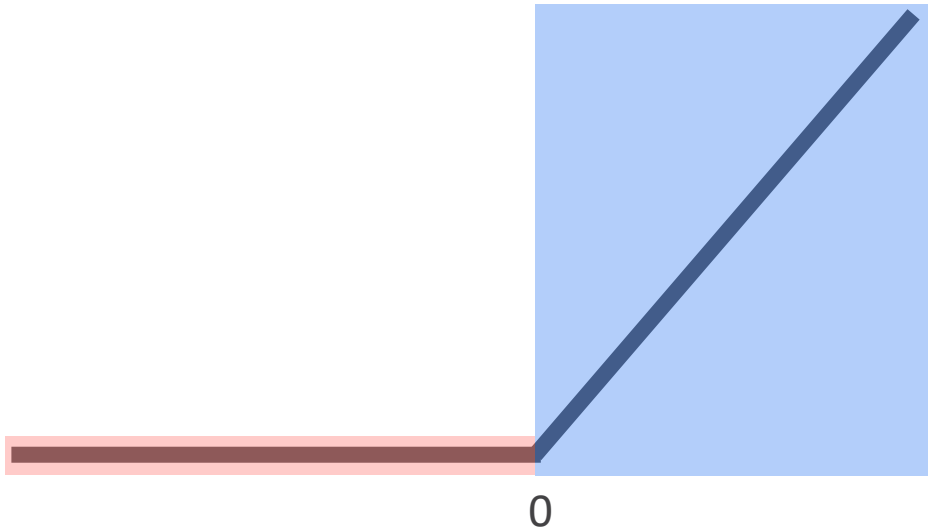

`tf.keras.activations` → `sigmoid, tanh relu, elu, selu`

`tf.keras.layers` → `leaky relu`

Code

Load mnist

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import tensorflow as tf
import numpy as np
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.datasets import mnist # fasion_mnist, cifar10, cifar100
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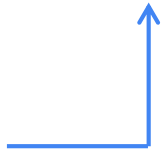
[batch_size, height, width, channel]



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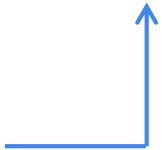

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One hot incoding

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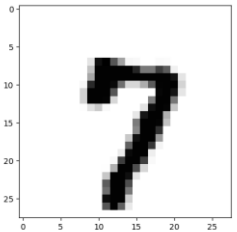

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One hot incoding

7

0	0	0	0	0	0	0	1	0	0

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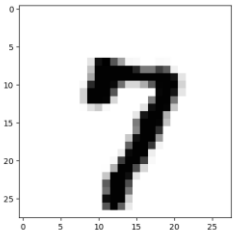

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    return train_data, train_labels, test_data, test_labels

def normalize(train_data, test_data):
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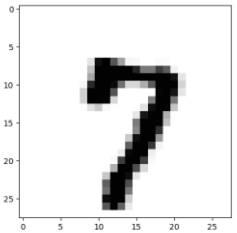
[batch_size, height, width, channel]

One hot incoding

7

0	0	0	0	0	0	0	1	0	0



Create network

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def flatten() :
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def relu() :
    return tf.keras.layers.Activation(tf.keras.activations.relu)
```

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    def __init__(self, label_dim):
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        weight_init = tf.keras.initializers.RandomNormal()
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Create network

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class create_model(tf.keras.Model):
    def __init__(self, label_dim):
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        self.model = tf.keras.Sequential()
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        self.model.add(flatten()) # [N, 28, 28, 1] -> [N, 784]
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        for i in range(2):
            # [N, 784] -> [N, 256] -> [N, 256]
            self.model.add(dense(256, weight_init))
            self.model.add(relu())
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        self.model.add(dense(label_dim, weight_init)) # [N, 256] -> [N, 10]
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            self.model.add(relu())

        self.model.add(dense(label_dim, weight_init)) # [N, 256] -> [N, 10]

    def call(self, x, training=None, mask=None):
        x = self.model(x)

        return x
```

Create network

```
def create_model(label_dim) :

    weight_init = tf.keras.initializers.RandomNormal()

    model = tf.keras.Sequential()
    model.add(flatten())

    for i in range(2) :
        model.add(dense(256, weight_init))
        model.add(relu())

    model.add(dense(label_dim, weight_init))

    return model
```

Define loss

Define loss

```
def loss_fn(model, images, labels):
    logits = model(images, training=True)
    loss = tf.reduce_mean(tf.nn.softmax_cross_entropy_with_logits_v2(logits=logits, labels=labels))
    return loss


def accuracy_fn(model, images, labels):
    logits = model(images, training=False)
    prediction = tf.equal(tf.argmax(logits, -1), tf.argmax(labels, -1))
    accuracy = tf.reduce_mean(tf.cast(prediction, tf.float32))
    return accuracy



def grad(model, images, labels):
    with tf.GradientTape() as tape:
        loss = loss_fn(model, images, labels)
    return tape.gradient(loss, model.variables)
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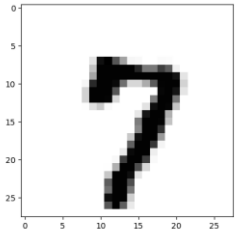
```



0	0	0	0	0	0	0	1	0	0

label

0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0

softmax(logit)

Define loss

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[batch size, label_dim]

Define loss

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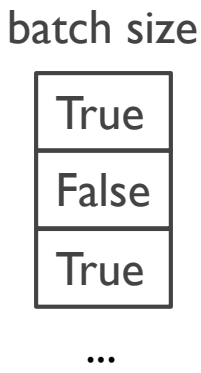
[batch size, label_dim]



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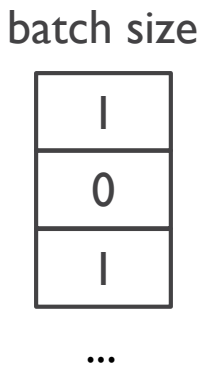
[batch size, label_dim]



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```
def grad(model, images, labels):
    with tf.GradientTape() as tape:
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```

Experiments (parameters)

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```
""" dataset """
train_x, train_y, test_x, test_y = load_mnist()
```

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```
""" parameters """
learning_rate = 0.001
batch_size = 128

training_epochs = 1
training_iterations = len(train_x) // batch_size

label_dim = 10
```

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```
""" Graph Input using Dataset API """
train_dataset = tf.data.Dataset.from_tensor_slices((train_x, train_y)).\



test_dataset = tf.data.Dataset.from_tensor_slices((test_x, test_y)).\
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train_dataset = tf.data.Dataset.from_tensor_slices((train_x, train_y)).\
    shuffle(buffer_size=100000).\



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```

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    shuffle(buffer_size=100000).\
    prefetch(buffer_size=batch_size).\



test_dataset = tf.data.Dataset.from_tensor_slices((test_x, test_y)).\
    shuffle(buffer_size=100000).\
    prefetch(buffer_size=len(test_x)).\
```

Experiments (parameters)

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```

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    repeat()

test_dataset = tf.data.Dataset.from_tensor_slices((test_x, test_y)).\
    shuffle(buffer_size=100000).\
    prefetch(buffer_size=len(test_x)).\
    batch(len(test_x)).\
    repeat()
```

Experiments (model)

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```
""" Dataset Iterator """
train_iterator = train_dataset.make_one_shot_iterator()
test_iterator = test_dataset.make_one_shot_iterator()
```

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```
""" Model """
network = create_model(label_dim)
```

Experiments (model)

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```

```
""" Model """
network = create_model(label_dim)
```

```
""" Training """
optimizer = tf.train.AdamOptimizer(learning_rate=learning_rate)
```

Experiments (Eager mode)

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```
checkpoint = tf.train.Checkpoint(dnn=network)
global_step = tf.train.create_global_step()
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for epoch in range(start_epoch, training_epochs):
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        train_input, train_label = train_iterator.get_next()
```

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for epoch in range(start_epoch, training_epochs):
    for idx in range(start_iteration, training_iterations):
        train_input, train_label = train_iterator.get_next()

        grads = grad(network, train_input, train_label)
        optimizer.apply_gradients(grads_and_vars=zip(grads, network.variables), global_step=global_step)
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        test_accuracy = accuracy_fn(network, test_input, test_label)

        print("Epoch: [%2d] [%5d/%5d], train_loss: %.8f, train_accuracy: %.4f, test_Accuracy: %.4f" \
            % (epoch, idx, training_iterations, train_loss, train_accuracy, test_accuracy))
        counter += 1
```

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        counter += 1

checkpoint.save(file_prefix=checkpoint_prefix + '-{}'.format(counter))
```

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```

Sigmoid : 81.31 %

Relu : 85.35 %

What's Next?

- Weight initialization
  - Xavier
  - He