ML/DL for Everyone Season2

with PYT⬡RCH
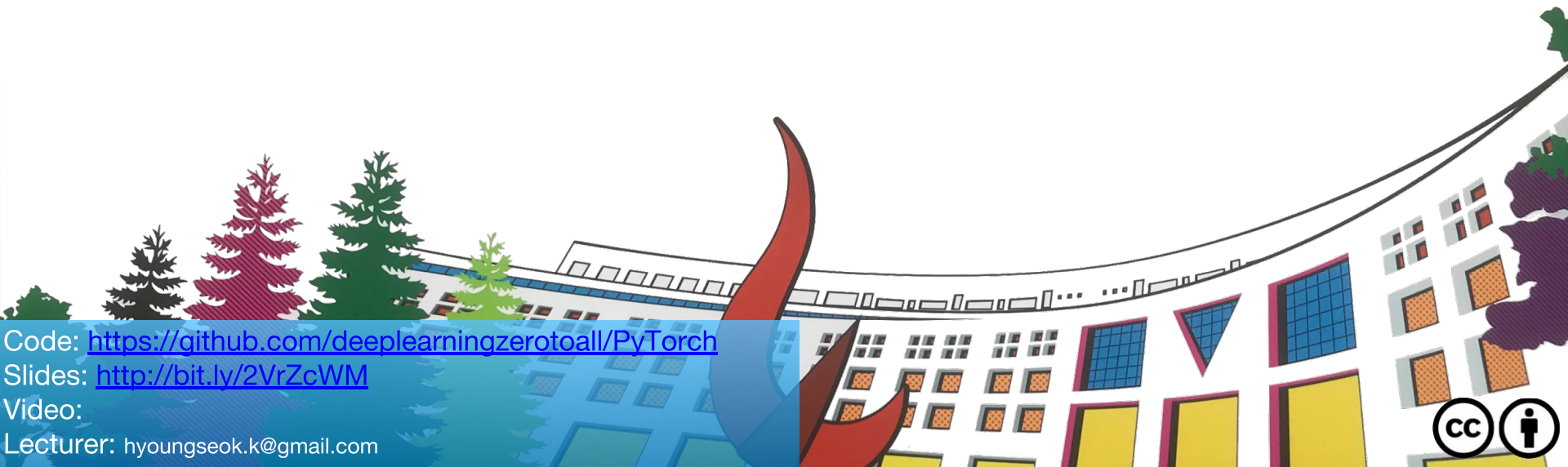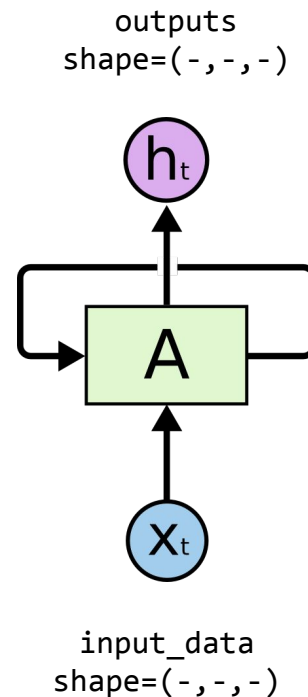
RNN - Basics

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- RNN in PyTorch
- Simple Example
  - Input
  - Hidden State
  - Sequence Length
  - Batch Size

RNN in PyTorch

```
rnn = torch.nn.RNN(input_size, hidden_size)

outputs, _status = rnn(input_data)
```
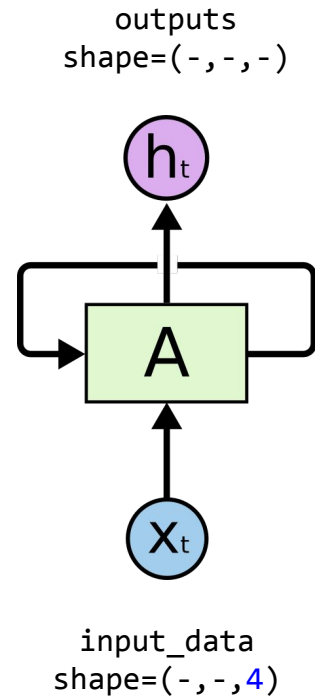
outputs
shape=(-,-,-)

h_t

A

x_t

input_data
shape=(-,-,-)

Example : Input

"hello"

```
# 1-hot encoding
h = [1, 0, 0, 0]
e = [0, 1, 0, 0]
l = [0, 0, 1, 0]
o = [0, 0, 0, 1]
```

```
input_size = 4
```

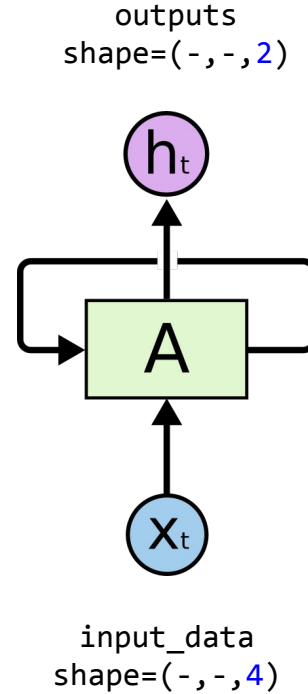outputs
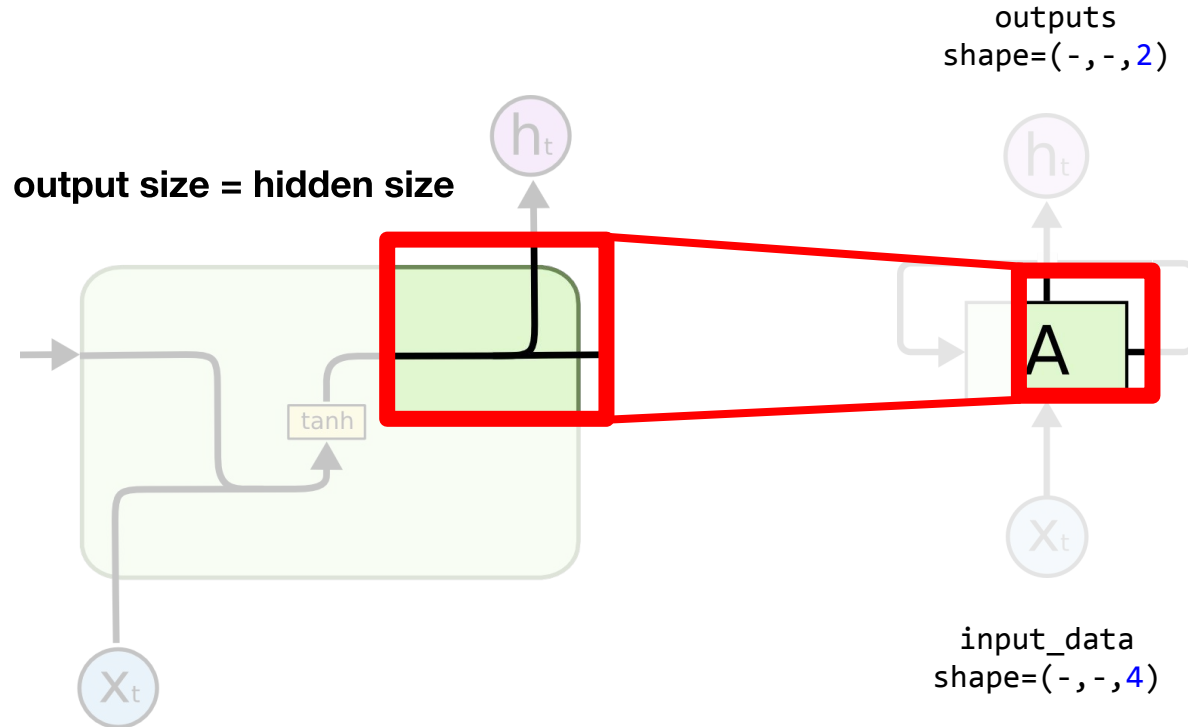shape=(-,-,-)

h_t

A

x_t

input_data
shape=(-,-,4)

Example : Hidden State

outputs
shape=(-,-,2)

desirable output size   ▶   `hidden_size = 2`   ➡

outputs
shape=(-,-,2)

h_t

A

x_t

input_data
shape=(-,-,4)

Example : Hidden State

outputs
shape=(-,-,2)

output size = hidden size

h_t

h_t

tanh

A

X_t

X_t

input_data
shape=(-,-,4)

http://colah.github.io/posts/2015-08-Understanding-LSTMs

Example : Sequence Length

outputs
shape=(-,-,2)

sequence length

input_data
shape=(-,-,4)

Example : Sequence Length

outputs
shape=(-,5,2)
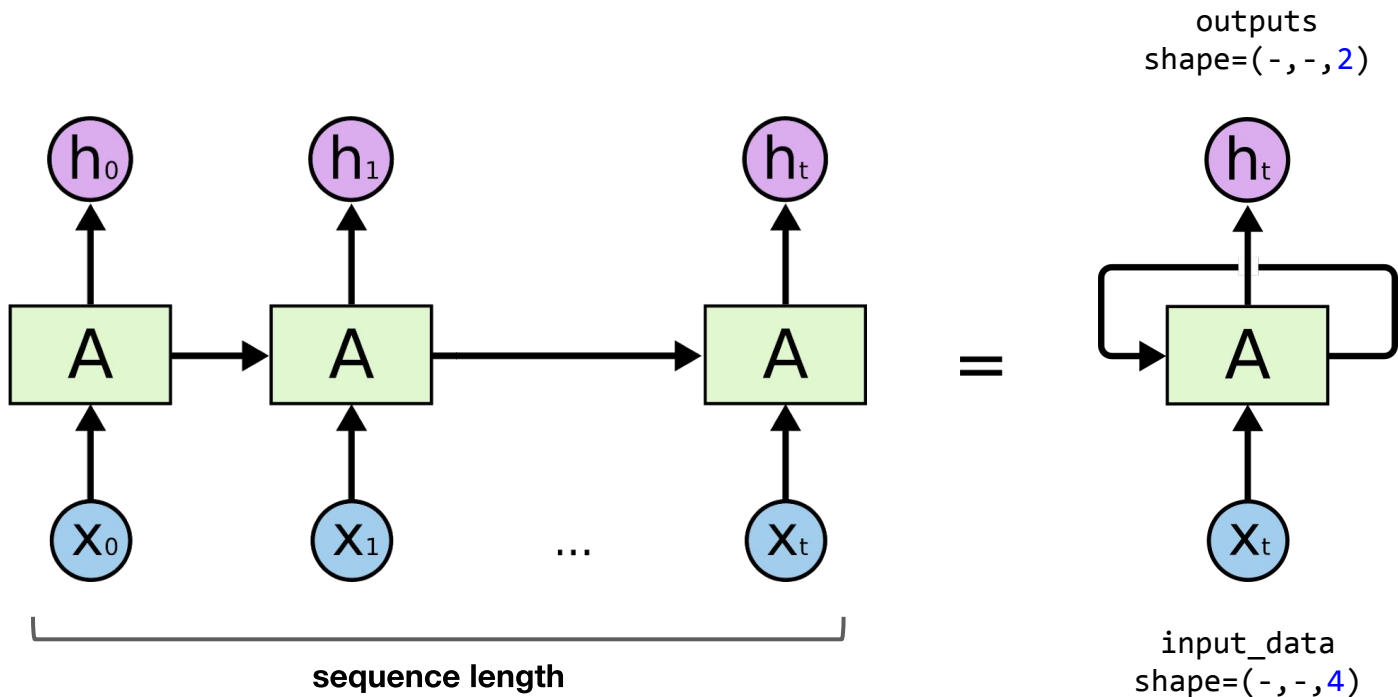
$$x_0 = [1, 0, 0, 0]$$
$$x_1 = [0, 1, 0, 0]$$
$$x_2 = [0, 0, 1, 0]$$
$$x_3 = [0, 0, 1, 0]$$
$$x_4 = [0, 0, 0, 1]$$

h, e, l, l, o

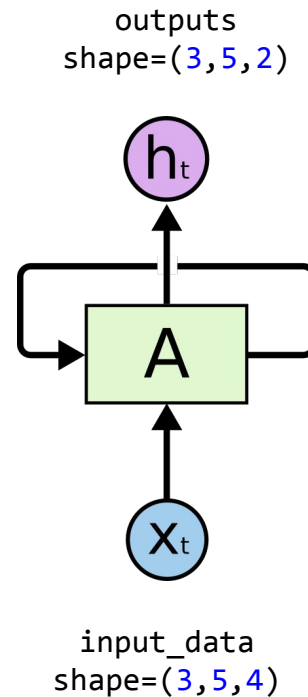**Automatically Calculated**

h_t

A

x_t
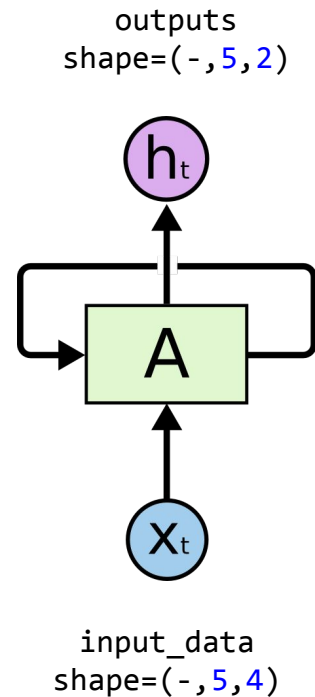
input_data
shape=(-,5,4)

Example : Batch Size

$$\begin{bmatrix} h, e, l, l, o \\ \\ e, o, l, l, l \\ \\ l, l, e, e, l \end{bmatrix}$$

Set
batch input

Automatically Calculated

outputs
shape=(3,5,2)

h_t

A

x_t

input_data
shape=(3,5,4)

Example : Run

```python
import torch
import numpy as np

input_size = 4
hidden_size = 2

# 1-hot encoding
h = [1, 0, 0, 0]
e = [0, 1, 0, 0]
l = [0, 0, 1, 0]
o = [0, 0, 0, 1]
input_data_np = np.array([[h, e, l, l, o],
                          [e, o, l, l, l],
                          [l, l, e, e, l]], dtype=np.float32)

# transform as torch tensor
input_data = torch.Tensor(input_data_np)

rnn = torch.nn.RNN(input_size, hidden_size)

outputs, _status = rnn(input_data)
```

What's Next?

- Train RNN in PyTorch