



DEEP
LEARNING
INSTITUTE

TensorFlow를 이용한 단어 생성 Word Generation with TensorFlow

TOPICS

- Overview
- 순환 신경망 Recurrent Neural Networks
- One-Hot Encoding
- LSTM(Long Short-Term Memory)
- Dropout
- MSCOCO
- 랩
 - 단어 및 문장 생성 랩
 - 랩 리뷰 Lab Review

OVERVIEW

The background of the slide features a smooth gradient from a vibrant green on the left to a clean white on the right. Overlaid on this gradient is a complex, abstract network of thin white lines connecting numerous small white dots, creating a mesh-like or molecular structure that spans the entire width of the image.

이미지가 아닌 데이터

NON-IMAGE DATA

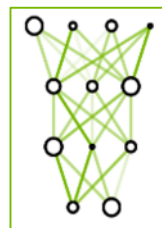
- 이미지로 변환
 - 음파
 - 주가 (Stock price)
- 새로운 워크플로우
 - 다양한 입력 및 출력 유형
 - 시간과 같이 새로운 구성요소를 처리
 - 아직 학습중인 입력 → 출력 매핑

이미지 그 이상, WHAT THIS LAB IS

Classifier data flow



100	37	59	87	55	29	13	44
62	79	54	62	23	93	93	26
50	57	93	17	67	53	60	75
3	54	70	37	17	20	69	7
86	42	2	55	90	45	74	77
59	39	100	52	10	8	20	37
61	2	62	92	83	18	12	82
11	7	87	20	5	13	4	34



Deep Neural Network

0.04	0	0.02	0.01	0.92	0.01
Kites	Harrier	Vulture	Hawk	Eagle	Buzzards



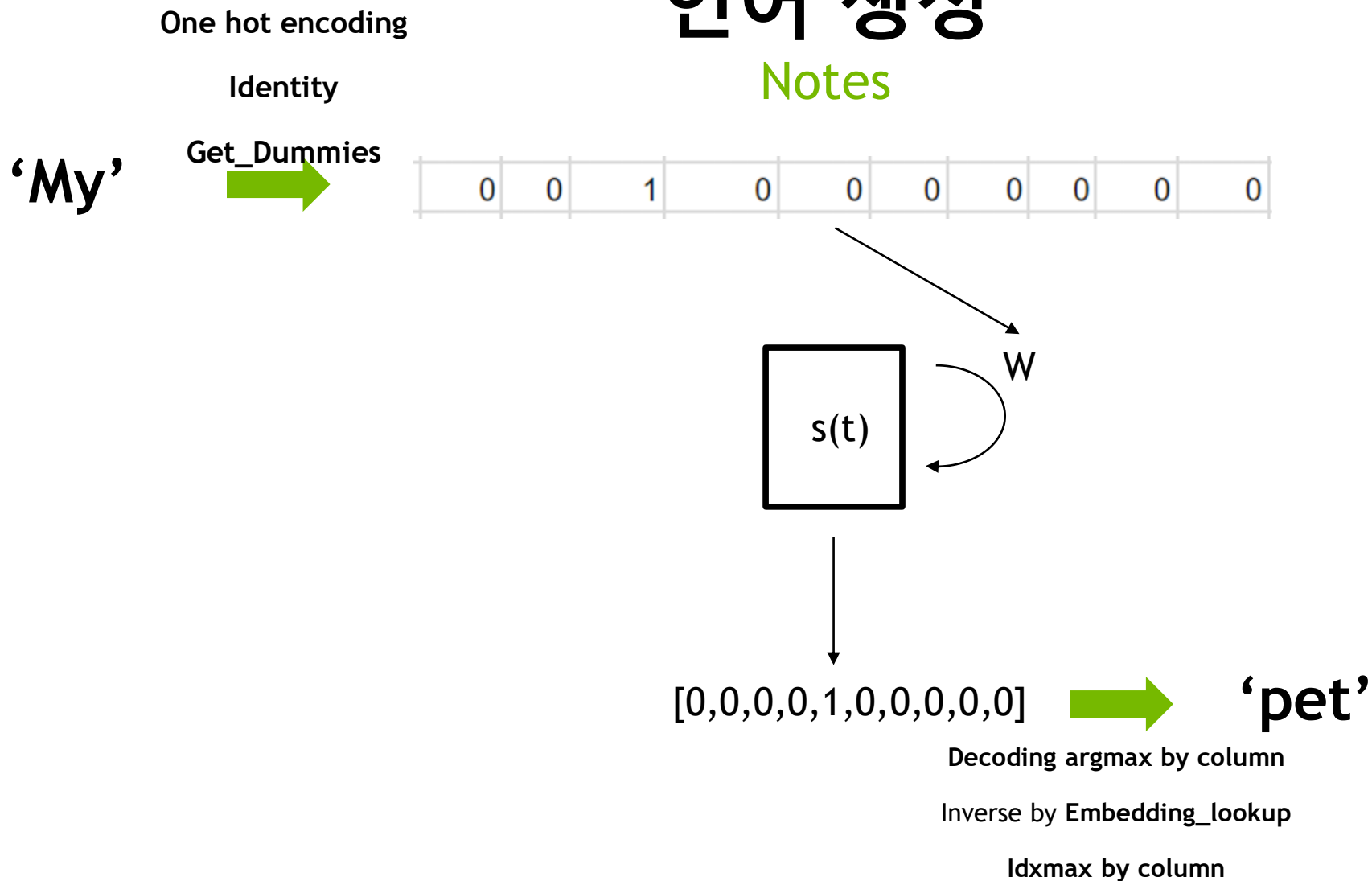
Eagle

순환 신경망

RECURRENT NEURAL NETWORKS

언어 생성

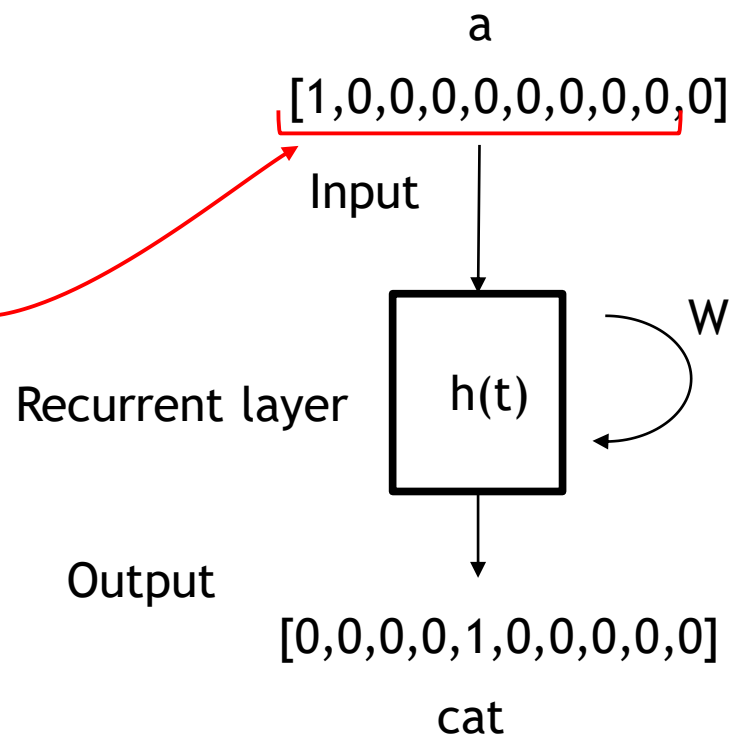
Notes



순환 신경망의 예

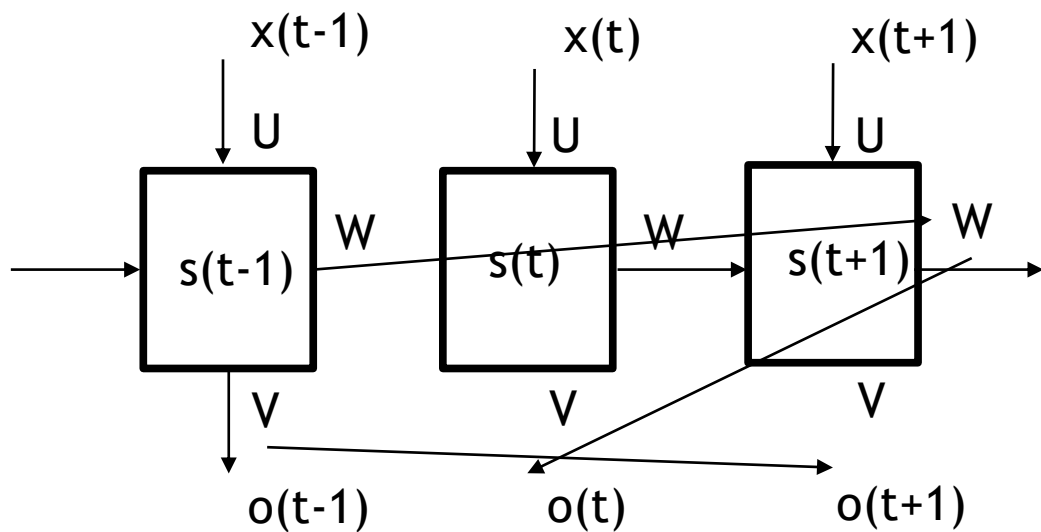
Word prediction example

a	1	0	0	0	0	0	0	0	0	0
cat	0	0	0	0	1	0	0	0	0	0
is	0	0	0	1	0	0	0	0	0	0
on	0	0	1	0	0	0	0	0	0	0
the	0	1	0	0	0	0	0	0	0	0
grass	0	0	0	0	0	0	0	0	1	0



순환 신경망의 예

a	the	on	is	cat	park	play	swing	grass	sitting
0	1	2	3	4	5	6	7	8	9



Unrolled Recurrent Layer

[0 , 4 , 3 , 2 , 1 , 8]

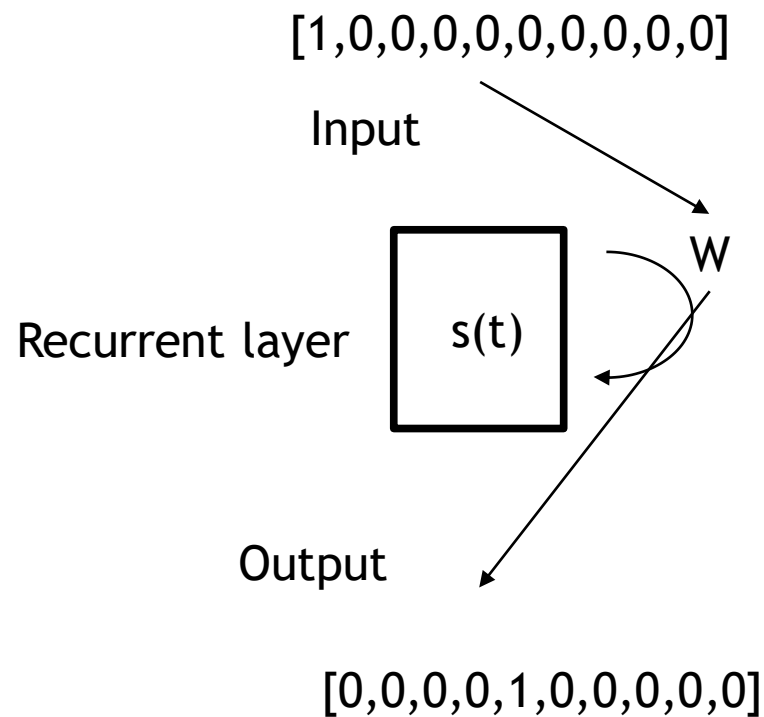
A cat is on the grass.

RNN은 말뭉치에서 예측된 다음 단어와 실제 다음 단어 사이의 오류를 줄임으로써 학습한다. RNN은 예측으로 이어지는 단어를 "기억"하도록 구성되어 있다.

시계열 정보 TIME SERIES INFORMATION

순환 신경망(Recurrent neural networks)은 대중적인 접근방식

번역과 마찬가지로 문장과 코드 생성의 효과성을 입증



ONE-HOT ENCODING

The background of the slide features a smooth color gradient transitioning from a deep green on the left to a bright yellow on the right. Overlaid on this gradient is a complex, abstract network of small white dots connected by thin white lines, resembling a molecular structure or a data network. The density of these connections increases towards the right side of the image.

ONE-HOT ENCODING

```
small_dict=['EOS','a','my','sleeps','on','dog','cat','the','bed','floor'] #'EOS' means end of sentence.
```

```
import numpy as np #numpy is "numerical python" and is used in deep learning mostly for its n-dimensional array  
X=np.array([[2,6,3,4,2,8,0],[1,5,3,4,7,9,0]],dtype=np.int32)  
print([small_dict[ind] for ind in X[1,:]]) #Feel free to change 1 to 0 to see the other sentence.
```

```
['a', 'dog', 'sleeps', 'on', 'the', 'floor', 'EOS']
```

one-hot encoded inputs

```
[[[ 0.  0.  1.  0.  0.  0.  0.  0.  0.  0.]  
  [ 0.  0.  0.  0.  0.  0.  1.  0.  0.  0.]  
  [ 0.  0.  0.  1.  0.  0.  0.  0.  0.  0.]  
  [ 0.  0.  0.  0.  1.  0.  0.  0.  0.  0.]  
  [ 0.  0.  1.  0.  0.  0.  0.  0.  0.  0.]  
  [ 0.  0.  0.  0.  0.  0.  0.  0.  1.  0.]  
  [ 1.  0.  0.  0.  0.  0.  0.  0.  0.  0.]  
  
  [[ 0.  1.  0.  0.  0.  0.  0.  0.  0.  0.]  
   [ 0.  0.  0.  0.  0.  1.  0.  0.  0.  0.]  
   [ 0.  0.  0.  1.  0.  0.  0.  0.  0.  0.]  
   [ 0.  0.  0.  0.  1.  0.  0.  0.  0.  0.]  
   [ 0.  0.  0.  0.  0.  0.  0.  1.  0.  0.]  
   [ 0.  0.  0.  0.  0.  0.  0.  0.  0.  1.]  
   [ 1.  0.  0.  0.  0.  0.  0.  0.  0.  0.]]]
```

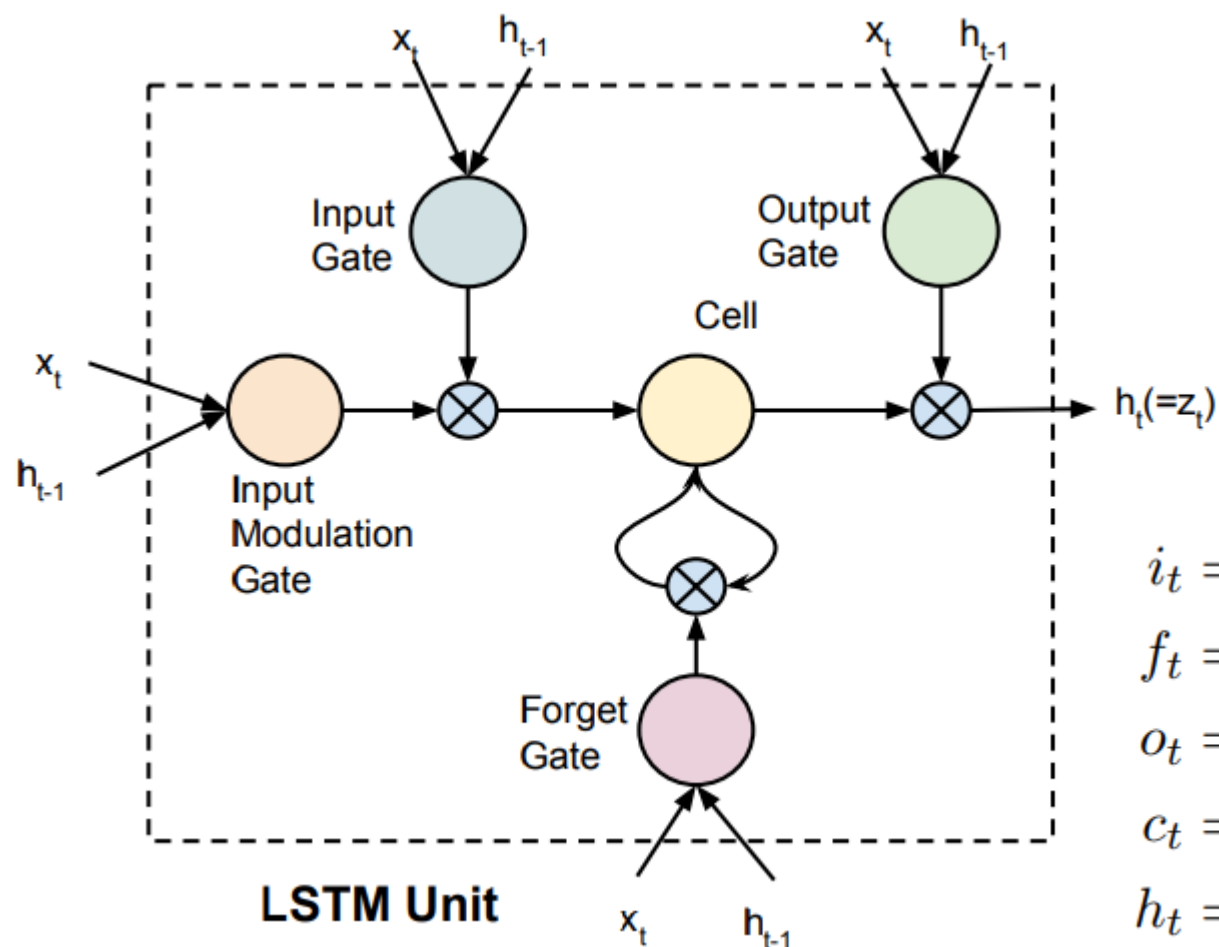
shape of the input

```
(2, 7, 10)
```

LSTM(Long Short-Term Memory)

The background of the slide features a smooth gradient from a vibrant green on the left to a deep blue on the right. Overlaid on this gradient is a complex, abstract network of small white dots connected by thin white lines, resembling a neural network or a data mesh. This network is more densely packed and visible on the right side of the slide, fading into the background on the left.

LSTM



$$i_t = \sigma(W_{xi}x_t + W_{hi}h_{t-1})$$

$$f_t = \sigma(W_{xf}x_t + W_{hf}h_{t-1})$$

$$o_t = \sigma(W_{xo}x_t + W_{ho}h_{t-1})$$

$$c_t = f_t \odot c_{t-1} + i_t \odot \phi(W_{xc}x_t + W_{hc}h_{t-1})$$

$$h_t = o_t \odot \phi(c_t)$$

Dropout



드롭 아웃

Dropout

Training 중 random하게 특정 unit들을 제외하여 overfitting 문제를 개선하는 regularization 기법

여러개의 모델을 합칠 경우 성능이 좋아지는 경우가 machine learning(ML)에 있는데 그게 neural net(NN)에 선 계산량 때문에 쉽지 않음.

Dropout을 통해 마치 서로 다른 네트워크 여러개를 학습한 average model을 test set에 적용하는 효과를 얻을 수 있음

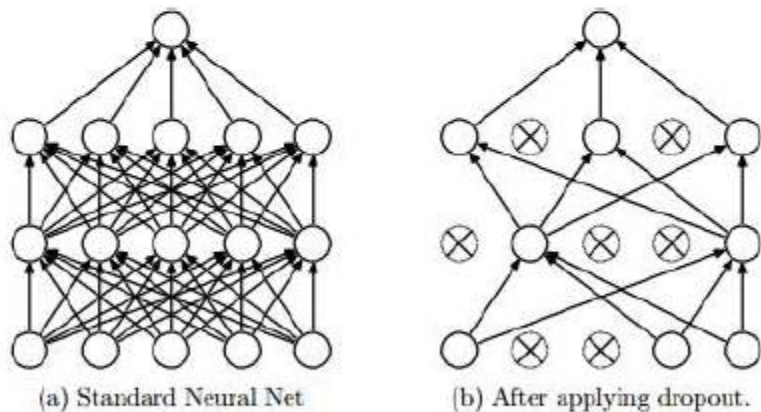
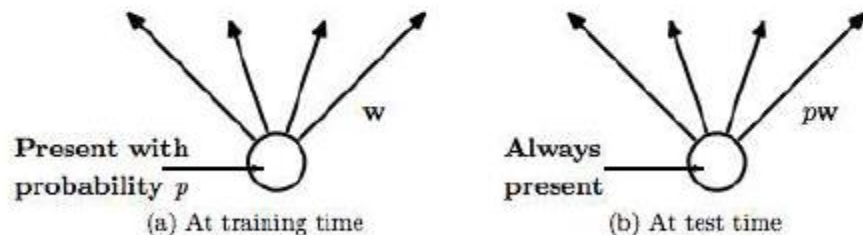


Figure 1: Dropout Neural Net Model. **Left:** A standard neural net with 2 hidden layers. **Right:** An example of a thinned net produced by applying dropout to the network on the left. Crossed units have been dropped.



Training할 땐 p 의 확률로 해당 unit의 on/off를 결정하고
Test할 땐 weight에 p 를 곱해서 합하는 방법을 사용함



MSCOCO

MSCOCO (MICROSOFT COMMON OBJECTS IN CONTEXT)



A man is skate boarding down a path and a dog is running by his side.
A man on a skateboard with a dog outside.
A person riding a skate board with a dog following beside.
This man is riding a skateboard behind a dog.
A man walking his dog on a quiet country road.





단어 및 문장 생성 랩

WORD AND SENTENCE GENERATION LAB

LAB 실습 1

- 실습 1:
 - RNN 생성 후 두개의 간단한 문장으로 학습시키는 방법을 배운다.
 - 딥러닝 네트워크 생성
 - Dropout 추가

LAB 실습 2

- 실습 2:
 - Microsoft Common Objects in Context (MSCOCO) 캡션을 사용하여 문장들을 생성하도록 RNN을 학습시킴
 - 4개의 코드 실행: COCO 2015 Image Captioning Task
 - Data preparation
 - Hyperparameter settings
 - Network architecture
 - Training



The man at bat readies to swing at the pitch while the umpire looks on.



A large bus sitting next to a very tall building.

LAB REVIEW

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LAB 실습 1

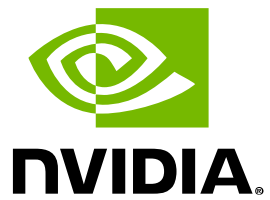
- 딥러닝 네트워크 생성 시 발생 가능한 부정적인 영향 중 한가지는?
- 딥러닝 네트워크의 부정적 영향력을 상쇄할 수 있는 방법 중 한가지는?

LAB 실습 2

- 성능 개선을 위해 무엇을 할 수 있을까?
- 몇 단계를 사용했습니까?
- 몇 개의 레이어를 가지고 있습니까?

PART 2 순환 신경망

- 성능 개선을 위해 무엇을 할 수 있을까?
 - 답: Hidden units의 수를 늘리고, drop out을 변경하고, learning rate을 변경하고, learning policy를 추가하여 개선 가능합니다.
- 몇 단계를 사용했습니까?
 - 답: 20
- 몇 개의 레이어를 가지고 있습니까?
 - 답: 2



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