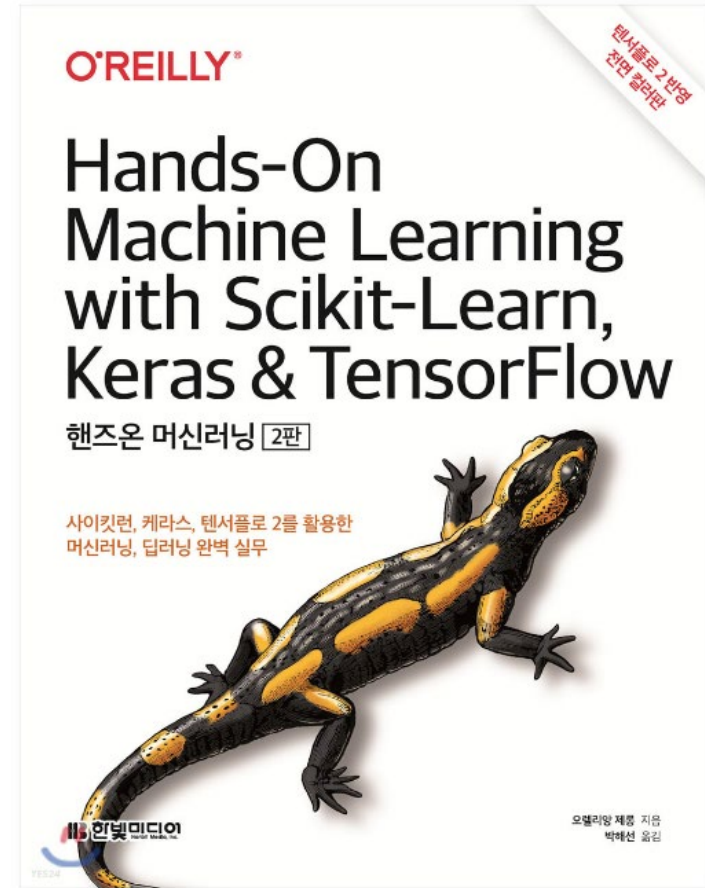
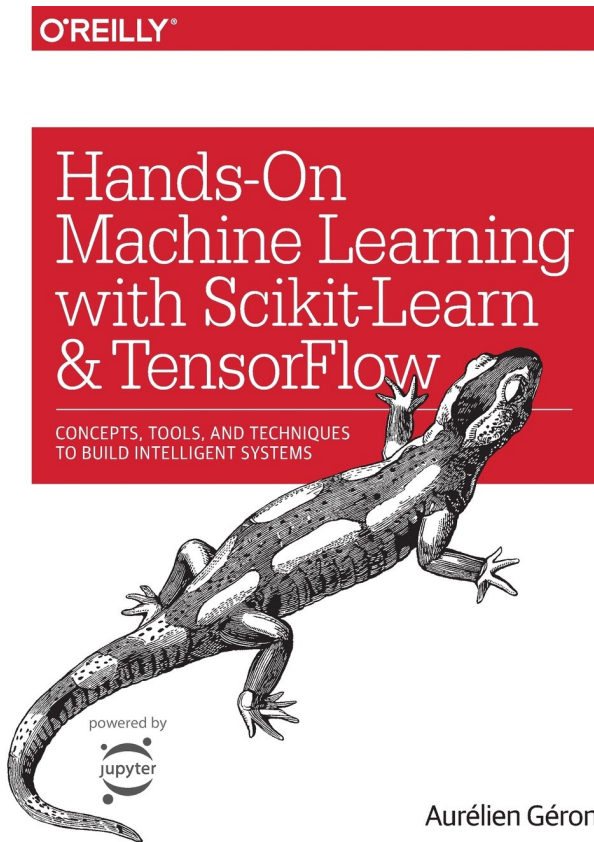




MACHINE LEARNING

MACHINE LEARNING STUDY 2022 WINTER

TEXTBOOK



Optional

PROCESS

Session 0

I ntroduce

- STUDY GOALS
- STUDY KEYPOINTS

P lan & Details

- STUDY DETAILS
- WEEKLY TASKS
- STUDY PLANS

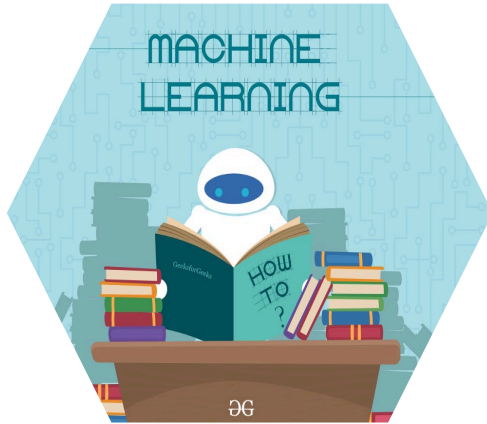
Q nA & Team Building

- TEAM BUILDING
- FIX TOPIC
- Q&A & NETWORKING TIME



INTRODUCE

STUDY GOALS



BASIC

MACHINE LEARNING STUDY 2022 WINTER

Machine Learning Basics and Utilization Study

Learn about the basic algorithms of Machine Learning

Acquire implementation capability based on theory or formula

Learning quickly through project experience with understood Machine Learning algorithms

Overall Level

Basic

Intermediate

Hard

Theory

Project



INTRODUCE

STUDY KEYPOINTS



GROUP STUDY

Group-based
Projects and Presentations



TERM PROJECT

Toy projects using
ML algorithms



WEEKLY MEETING

Weekly meeting on
Every Tuesday 6:00 PM

PLAN

WEEKLY TASKS



PERSONAL TASK

Submit Preliminary
research about topic of the
next presentation



GROUP TASK

Term Project

Prepare a presentation slide

※ Presentations should be
written in English

※ Presenter will be
assigned randomly

'Warning' to all team member
If presentation is not prepared
3 warnings == expulsion

Section PPT

[illegible]

Depth

A

Definition of SVM

Support Vector Machine

Neural Nets

Input - set of (input, output) training pair samples

Output - set of weights w

In SVM use the optimization of maximizing the **margin** ('street width') to **reduce the number of weights**

< Intro >

Depth A

Schematic approach for SVM

: Linear SVM classifier [Term]

Margin :
Gap of two plus-plane and minus plane

Support Vector :
vectors that on plus-plane or minus-plane
(observations affecting the determination of margins)

SVM Classifier :
SVM based classifier if it's decision boundary is only
depend on support vector (ignores other vectors)

Depth
A

Schematic approach for SVM

: Linear SVM classifier [Hard Margin-Soft Margin]

Hard margin

Decision boundary

Margin

Soft margin

Decision boundary

Margin

Hard Margin :
All samples are correctly determined by the decision boundary.

All data class have to be classified linearly if not it does not work.

Have a high level of anomaly input.

● Class 1 ● Class 2 ○ Support vector
● Class 1 ● Class 2 ○ Sample retaining constraint

Soft Margin :
Margin model for greater flexibility by ignoring C anomalies

Model flexibility is improved but margin error is also increase

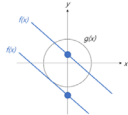
< Graphical Inst >

A

Depth

Background knowledge for mathematical access of svm

: Linear SVM classifier [Lagrange multiplier method]



"Finding maximum or minimum value
in constraint condition"

$f(x)$: linear
 $g(x)$: constraint \rightarrow at least one coordinate of $g(0)$ meets $f(x)$

$f(x)$'s y-intercept takes it

Then – which value is minimum(maximum) ?

Depth

7

Schematic approach for SVM

: Linear SVM classifier (Karush-Kuhn-Tucker & Duality)

If x^* and u^* , v^* are primal and dual solutions, with zero duality gap, then x^* , u^* , v^* satisfy the KKT conditions

x^*, u^*, v^* 가 KKT 조건을 만족

\longleftrightarrow

+strong duality

x^* 는 primal 문제의 solution
 u^*, v^* 는 dual 문제의 solution

For a problem with strong duality (e.g., assume Slater's condition: convex problem and there exists x strictly satisfying non-linear inequality constraints):

x^* and u^* , v^* are primal and dual solutions
 $\Leftrightarrow x^*$ and u^* , v^* satisfy the KKT conditions

In the theory of optimization, **duality** is the principle that certain optimization problems can be viewed from two perspectives: the fundamental problem and the dual problem.

양방향(duality)이란 어떤 최적화 문제가 원문제(the primal problem)와 쌍대문제(the dual problem)의 두 가지 관점에서 볼 수 있다는 것을 말함

< Mathematical Inst >

RNN Implementation

그림 5-20 RNN 계층의 계산 그래프(역방향 흐름)

```
def backward(self, dh_next):
    Wx, Wh, b = self.params
    x, hprev, hnext = self.cache
    # 뒤쪽에서 뒤쪽으로 <= last()
    dt = dh_next * (1 - hnext ** 2)
    do = no_grad()
    assert isinstance(dt, Tensor)
    dhn = no_detach(hprev, T, dt)
    dparameter = no_detach(Wx, T)
    dWh = no_detach(Wh, T)
    dx = no_detach(x, T)
    self.grads[0][:] = dhn
    self.grads[1][:] = dhn
    self.grads[2][:] = db
    return dx, dparameter
```

전이(트랜지션) 블록
batch_size = 10
wordvec_size = 100
hidden_size = 100 # RNN의 은닉 상태 벡터의 요소 수
time_size = 5 # Truncated BPTT가 한 번에 풀리는 시간 크기
lr = 0.1
max_epoch = 100

학습 데이터 읽기(전체 총 1000개)
corpus, word_to_idx, idx_to_word = ptb.load_data('train')
corpus_size = 1000
corpus = corpus[:corpus_size]
vocab_size = int(max(corpus) + 1)

x = corpus[:-1] # 입력
ts = corpus[1:] # 출력(final output)
data_size = len(x)
print('데이터 길이: %d, 출력 중 %d' % (corpus_size, vocab_size))

모델 파라미터를 초기화
num_hidden = data_size // (batch_size * time_size)
time_dim = 0
total_loss = 0
loss_count = 0
sol_list = []

모델 생성
model = SimpleRNN(vocab_size, wordvec_size, hidden_size)
optimizer = SGD(lr)

Part of Penn TreeBank Dataset	
VBZ	Verb, 3rd ps. sg. present
WDTF	Wh-determiner
WP	Wh-pronoun
WPS	Possessive wh-pronoun
WRB	Wh-adverb
#	Pound sign
\$	Dollar sign
.	Sentence-final punctuation
,	Comma
:	Colon, semi-colon

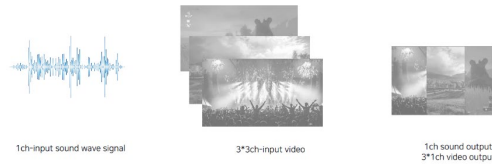
< Implement >

EXAMPLE

Progress PPT & Weekly Assignment

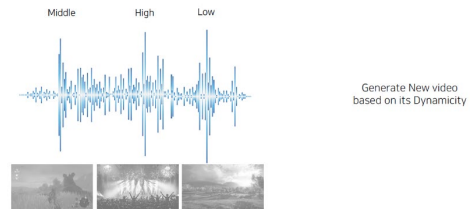
Section 1 Introduction

Image-Sound Match Algorithm based on Dynamicity Values that extracted via Soundwave Form and Image Channel



Section 1 Introduction

Image-Sound Match Algorithm based on Dynamicity Values that extracted via Soundwave Form and Image Channel

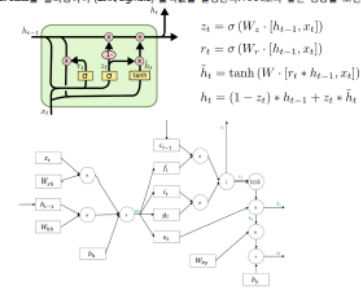


< Project Progress >

KW ML STUDY #3, #4 | 제출자 주혜경 | 2019.08.01

Topic #4 Long Short-Term Memory (LSTM)

LSTM은 RNN의 긴 의존 기간의 vanishing gradient 문제를 극복하기 위해 설계되었다. 기본적인 RNN은 NN 모듈을 반복하는 채인 형태를 갖는다. LSTM은 각 반복 모듈에 cell-state를 추가한 채인 형태이다. 직전 시점의 그래디언트 값에 영향을 받아 cell-state의 하인 state가 재귀적으로 구해진다. Cell-state는 gate (sigmoid, dot)를 통해서 정보를 더하거나(가) 제거하는(잊음) 기능을 수행한다. 세 게이트는 새로운 정보를 잊을지 결정하고, 새로운 정보를 기억할 지 결정하여 다음 cell-state를 갱신하고, 이 새 cell-state를 밀려들려 (tanh, sigmoid) 숨박값을 결정한다. RNN보다 좋은 성능을 보인다.



<Preliminary research>

PLAN

STUDY PLANS

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 Meetup #0	4	5	6	7
8	9	10 Meetup #1	11	12	13	14
15	16	17 Meetup #2	18	19	20	21
22	23	24	25	26	27	28
29	30	31 Meetup #3	1	2	3	4

Jan

Meetup #0

- Introduce Study
- Team-Building & Set Topic

Meetup #1

- Basic of Machine Learning (1)
- Topic Presentation #1 – Basic Probability Theorems and Metrics for ML

Meetup #2

- Basic of Machine Learning (2)
- Topic Presentation #2 → k-means and k-Nearest Neighbor algorithm
- Pre-conference: Project presentation

Meetup #3

- Topic Presentation #3 — Linear Regression and Logistic Regression
- Project Progress sharing (1/3)

PLAN

STUDY PLANS

Sun	Mon	Tue	Wed	Thu	Fri	Sat
29 →	30	31 Meetup #3	1 →	2	3	4
5 →	6	7 Meetup #4	8 →	9	10	11
12 →	13	14 Meetup #5	15 →	16	17	18
19 →	20	21 Meetup #6	22	23	24	25
26	27	28	9	10	11	12

Feb

Meetup#4

- Topic Presentation #4 - Decision Tree and Random Forest
- Project Progress sharing (2/3)

Meetup#5

- Topic Presentation #5 - Dimensionality Reduction
- Project Progress sharing (3/3)

Meetup#6

- Final Project Presentation

Team-Building

TOPICS

List of Topic

- Topic Presentation #1 - Basic Probability Theorems and Metrics for ML
- Topic Presentation #2 - K-means and K-Nearest Neighbors
- Topic Presentation #3 - Linear Regression and Logistic Regression
- Topic Presentation #4 - Decision Tree and Random Forest
- Topic Presentation #5 - Dimensionality Reduction

Easy  Hard

TOPIC	TOPIC 1	TOPIC 2	TOPIC 3	TOPIC 4	TOPIC 5
Team	Jiwoon	B, F	C, D	A, G	E

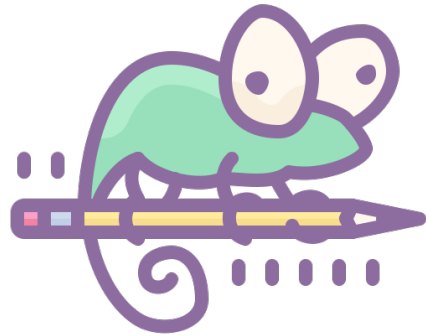
Team-Building

Team Build

TEAM A	김민지	정현기	윤태호	양지석
TEAM B	이지홍	정성현	오민성	
TEAM C	이정훈	김효민	김준혁	
TEAM D	김기수	황정원	류한웅	
TEAM E	심재윤	이혜미	박정원	장우현
Team F	졸업작품팀1			
Team G	졸업작품팀2			

TOPIC	TOPIC 1	TOPIC 2	TOPIC 3	TOPIC 4	TOPIC 5
Team	Jiwoon	B, F	C, D	A, G	E

Q&A



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