Introduction To Deep Learning

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TRAIN AND TEST

Contents

TRAIN AND TEST

NLP Team Rule

1. 매주 화요일 20시~22시 사당역 Moim에서 진행
2. 커리큘럼은 주제와 관련된 논문 리뷰하는 방식으로 진행
3. 한두명의 발제자가 한 주제와 관련한 논문 3편 정도 리뷰
4. 발제자가 아니더라도 웬만하면 다음 진행할 논문은 다 읽어오기 !
5. 디스커션시 과대망상 환영 !
6. 프로젝트는 자유롭게 진행 ! 함께 하고 싶으면 팀에 제안하는 식으로

TRAIN AND TEST

Self Test

모 스타트업의 지원 요건

▼ 딥러닝 질문: 10개 *(삼각형을 클릭하세요)*

- [ ] Gradient Descent란?
- [ ] Sigmoid의 단점은?
- [ ] Validation 세트, Test 세트의 각각의 역할은?
- [ ] Auto Encoder란?
- [ ] Dropout의 효과는?
- [ ] CNN의 장점은?
- [ ] Word2Vec의 원리는?
- [ ] Adam Optimizer의 동작은?
- [ ] Batch Normalization의 동작은?
- [ ] CycleGAN이란?

▼ 딥러닝 모델 개발자 기술 질문: 9개 중 5개 이상 잘 대답할 수 있어야 함 *(삼각형을 클릭하세요)*

- [ ] Gradient Descent란?
- [ ] Loss Surface란?
- [ ] Attention이란?
- [ ] Transformer란?
- [ ] Collaborative filtering이란?
- [ ] Few-Shot Learning이란?
- [ ] Federated Learning이란?
- [ ] SVD란?
- [ ] 중심극한정리란?

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Self Test

What is ML/DL?

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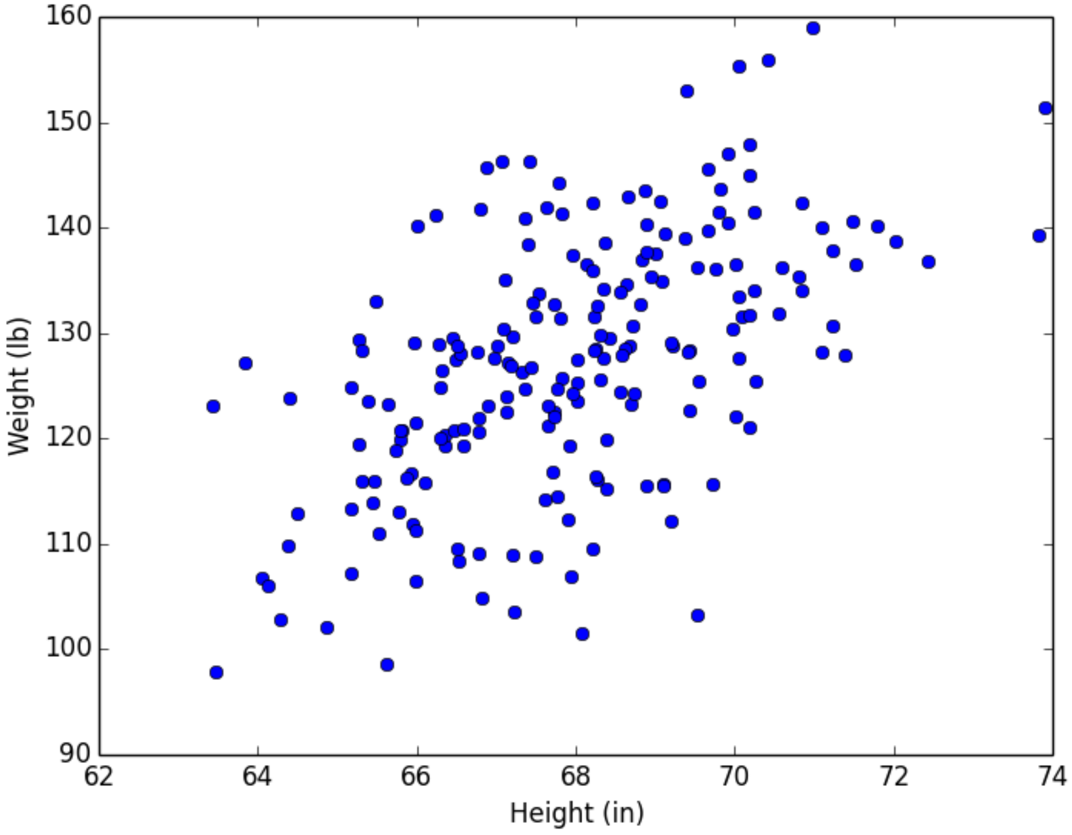
Basic Machine Learning (Linear Regression)

Weight Prediction

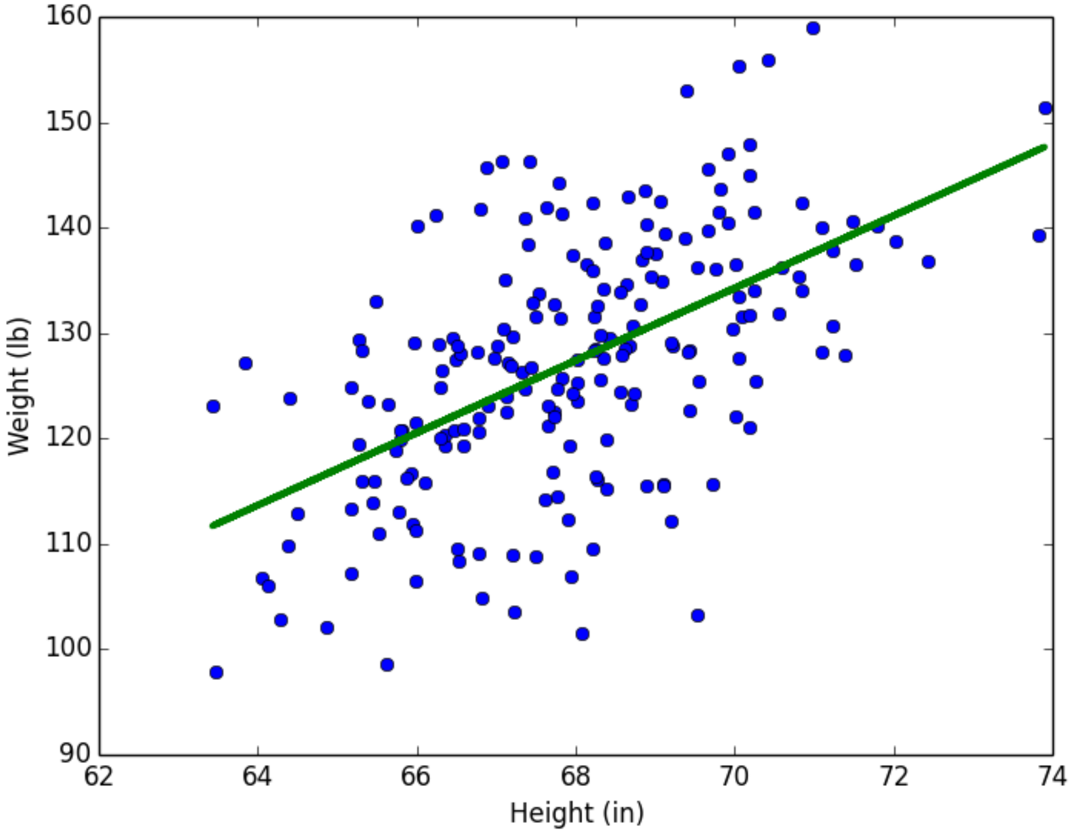


Q1.

몸무게를 맞추고자 할 때 생각할 수 있는 좋은 방법은 무엇일까?

Basic Machine Learning (Linear Regression)

Weight Prediction

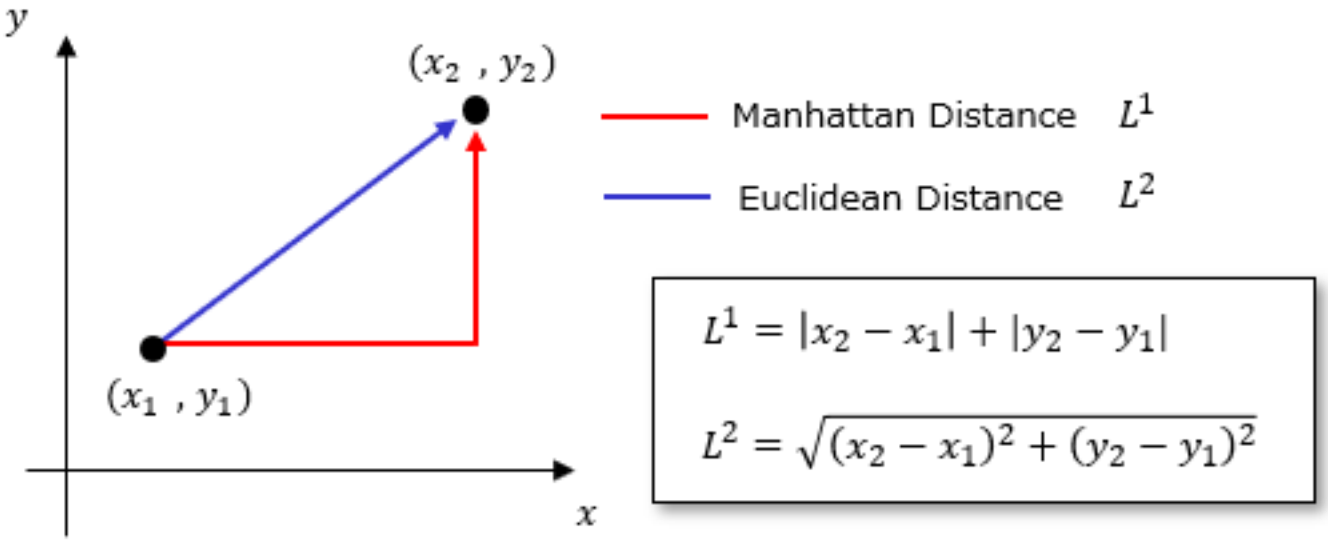


Q2.

초록선을 구하기 위해서 어떤 방식을 취할 수 있을까?

Basic Machine Learning (Linear Regression)

Distance Metrics



$$L^1 = |x_2 - x_1| + |y_2 - y_1|$$

$$L^2 = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

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Basic Machine Learning (Linear Regression)

Method For Linear Regression

Normal Equation

$$A^T A\hat{x} = A^T b \rightarrow \hat{x} = \left(A^T A\right)^{-1} A^T b$$

Coefficient

$$y = \text{intercept} + \text{coefficient} \times x_{value}$$

$$\text{coefficient} = \beta_1 = \frac{cov(x, y)}{var(x)}$$

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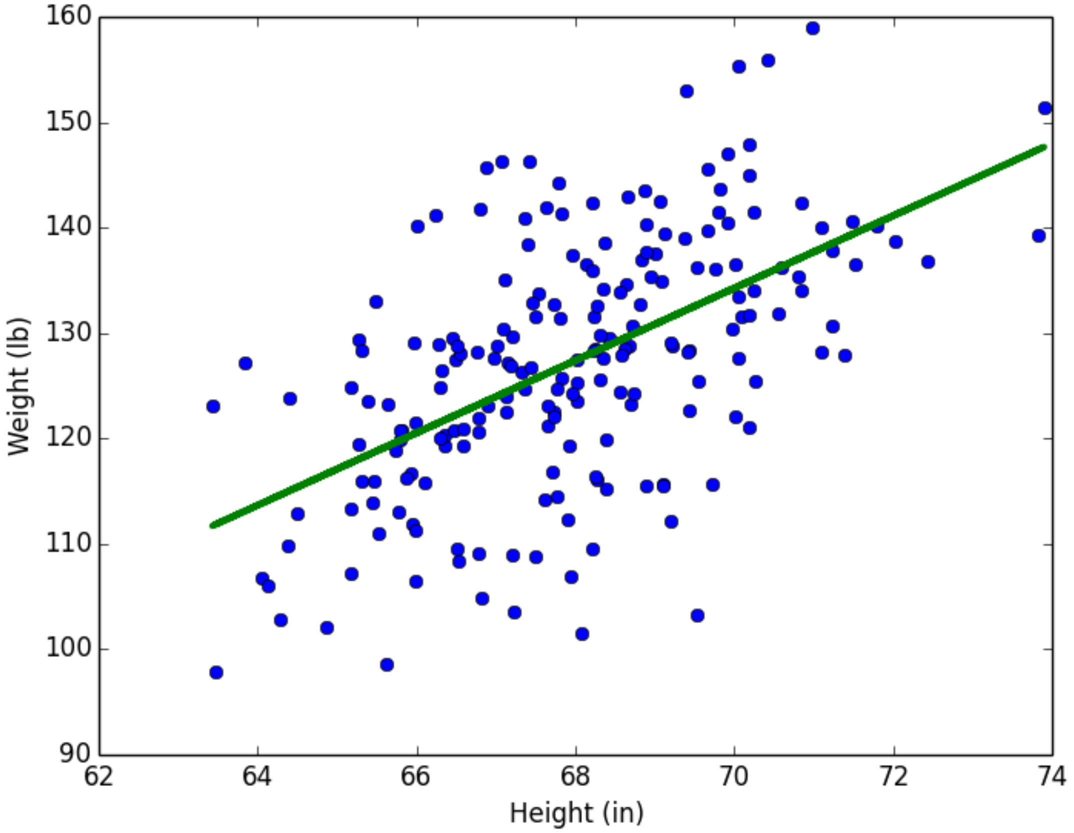
Basic Machine Learning (Linear Regression)

Weight Prediction



Q3.

몸무게 예측을 위해 키 피쳐만을 사용하는 것이 최선일까?

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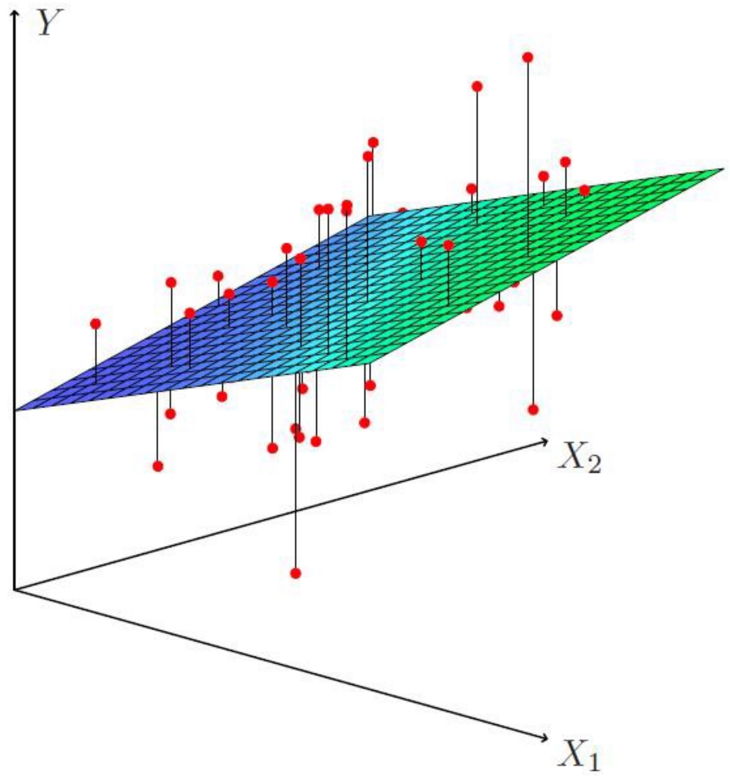
Basic Machine Learning (Linear Regression)

Weight Prediction with Multi Variable



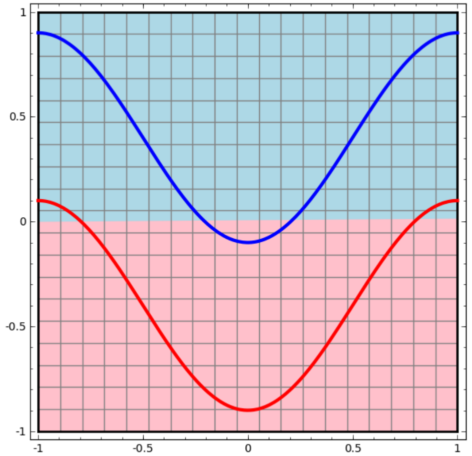
Input:
Scala -> Vector

Output:
Scala -> Scala

Space:
2D -> 3D

Basic Machine Learning (Linear Regression)

Limit of Linear Regression



Non-Linear Pattern

Q4.

직선 하나로 두 곡선을
분류할 수 있을까?

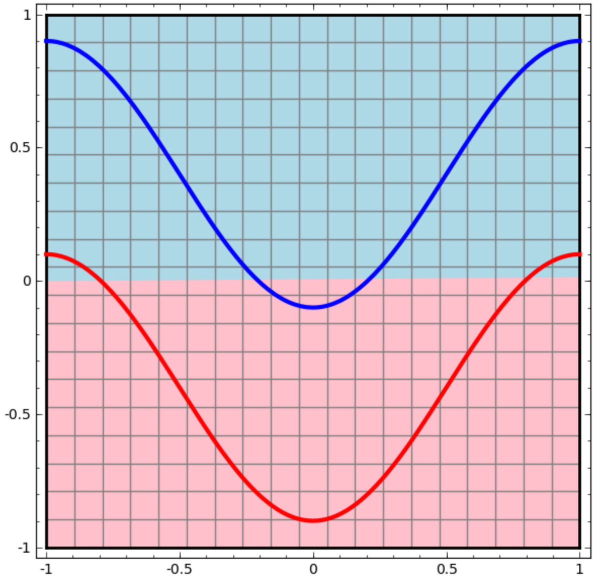
Unstrucrtured Data

Q5.

이미지 가진 숫자들을 의미 있는
벡터로 볼 수 있을까?

Introduction To Deep Learning

How to Solve Non-Linear Problem



Q6.

두 곡선을 분류할 수 있도록 변환을 가하면 되지 않을까? 근데 어떻게?

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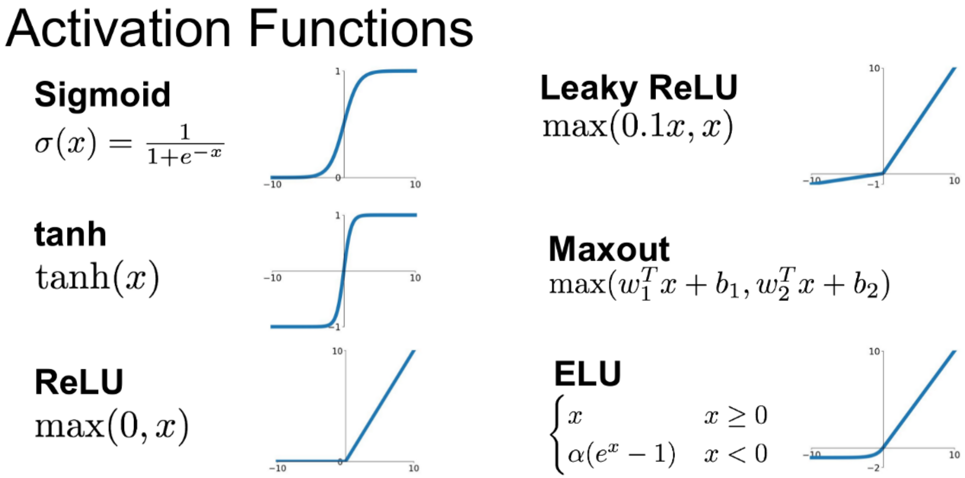
Introduction To Deep Learning

How to Solve Non-Linear Problem

Linear Transformation With Non Linear Function



Q7.

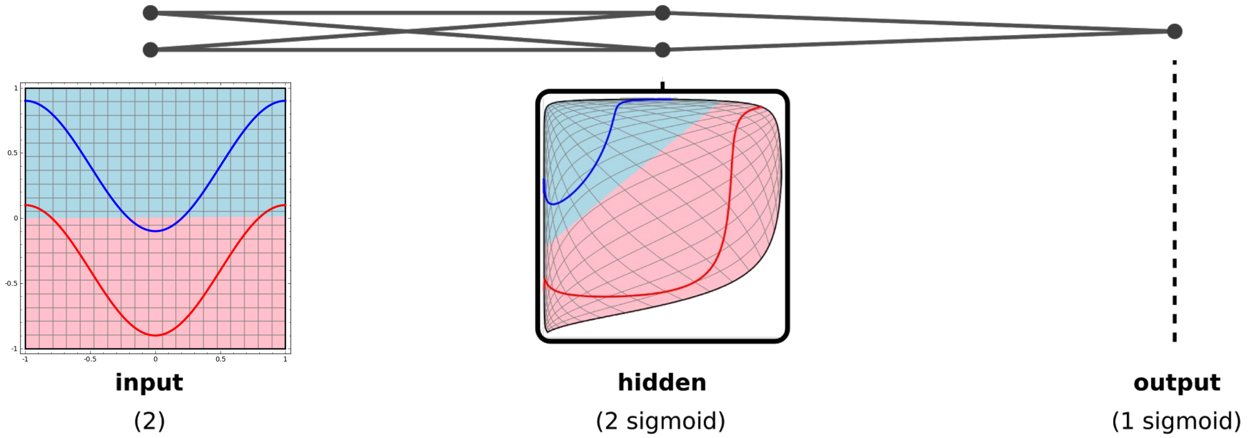
Activation Function 연산은 가역일까?

Q8.

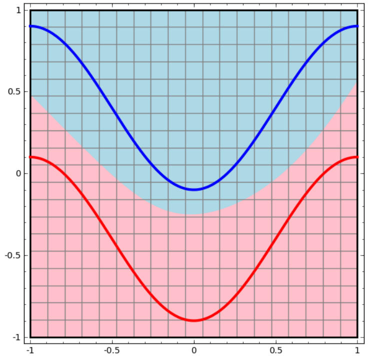
Activation Function 연산은 데이터가 놓인 Space의 Rank를 바꿀 수 있을까?

Introduction To Deep Learning

How to Solve Non-Linear Problem



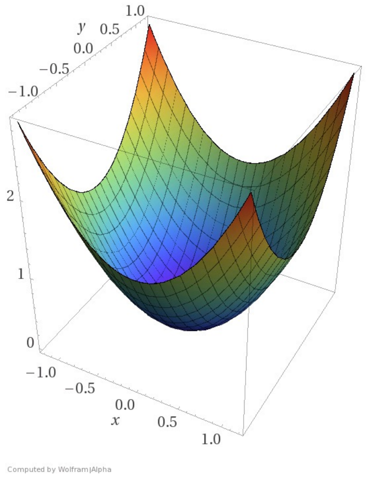
Result:

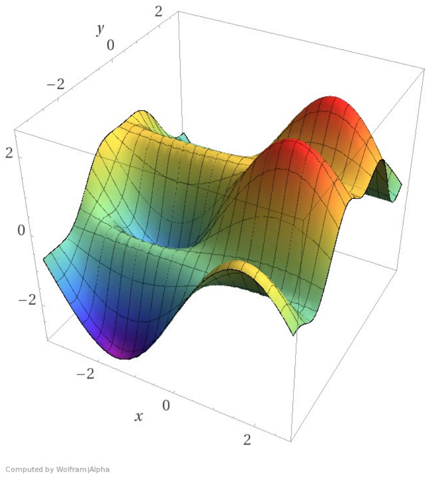


Introduction To Deep Learning

Non-Linear Optimization

Linear Regression Have Convex Function as Loss Function,
But Non-Linear Regression Have Non-Convex Function as Loss Function
We can’t compute analytic solution, So we must compute numerical solution





Introduction To Deep Learning

Non-Linear Optimization

Numerical Solution: Gradient Descent

Cost Function

$$J(\Theta_0, \Theta_1) = \frac{1}{2m}\sum_{i=1}^{m}[\underbrace{h_\Theta(x_i)}_{\text{Predicted Value}} - \underbrace{y_i}_{\text{True Value}}]^2$$

Gradient Descent

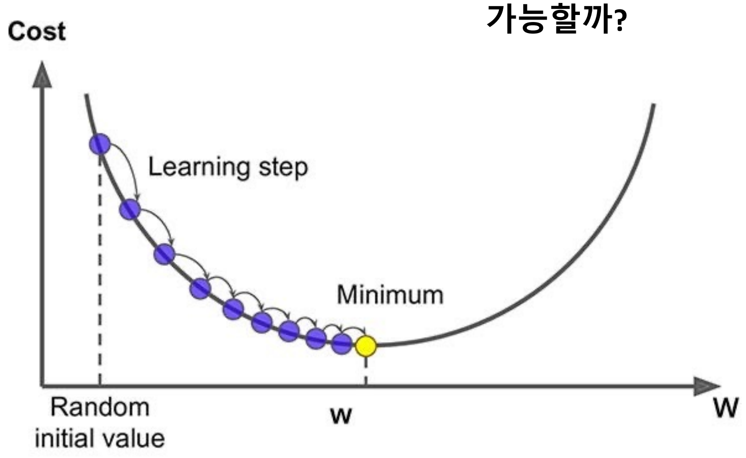
$$\boxed{\Theta_j = \Theta_j - \underbrace{\alpha}_{\text{Learning Rate}}\frac{\partial}{\partial \Theta_j}J(\Theta_0, \Theta_1)}$$

Now,

$$\begin{aligned}\frac{\partial}{\partial \Theta}J_\Theta &= \frac{\partial}{\partial \Theta}\frac{1}{2m}\sum_{i=1}^{m}[h_\Theta(x_i) - y]^2 \\ &= \frac{1}{m}\sum_{i=1}^{m}(h_\Theta(x_i) - y)\frac{\partial}{\partial \Theta_j}(\Theta x_i - y) \\ &= \frac{1}{m}(h_\Theta(x_i) - y)x_i\end{aligned}$$

Therefore,

$$\boxed{\Theta_j := \Theta_j - \frac{\alpha}{m}\sum_{i=1}^{m}[(h_\Theta(x_i) - y)x_i]}$$



Q9.

Learning Rate는 무슨 의미를 가질까?

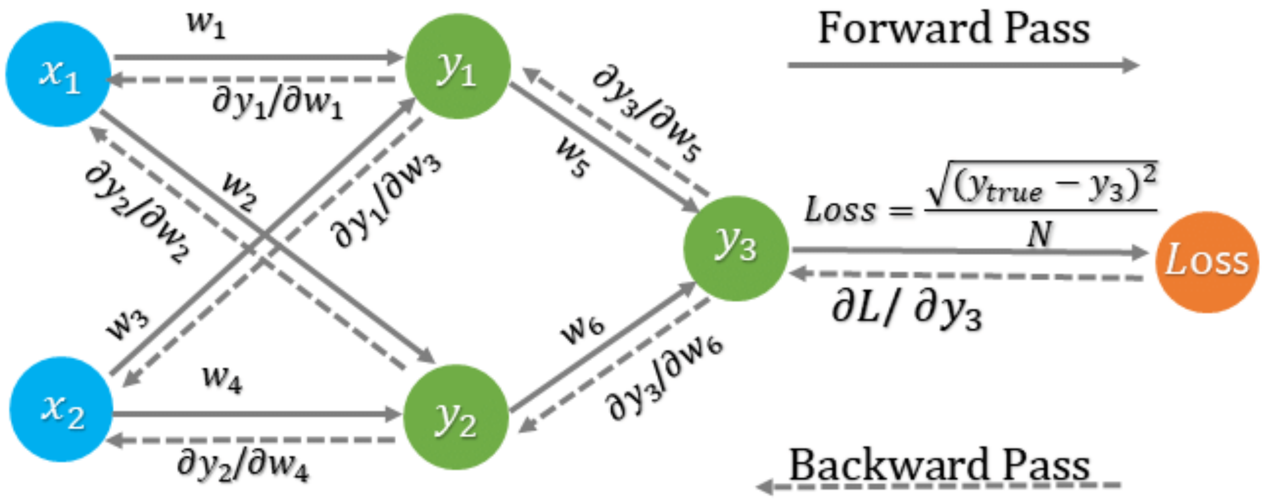
Q10.

합성함수에 대해서도 Gradient Descent가 가능할까?

Introduction To Deep Learning

Non-Linear Optimization

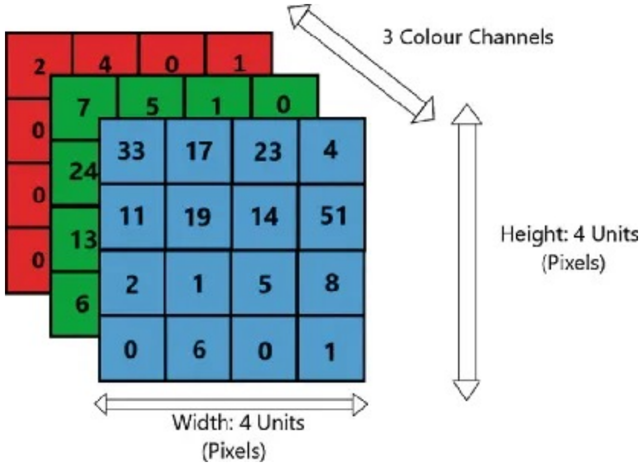
Backpropagation



Introduction To Deep Learning

How to Model Unstructured Data

Natural Language and Image are byte data in computer




```
[(base) been@Been-MacBook-Pro math % ascii -d
    0 NUL    16 DLE    32       48 0    64 @    80 P    96 `   112 p
    1 SOH    17 DC1    33 !     49 1    65 A    81 Q    97 a   113 q
    2 STX    18 DC2    34 "     50 2    66 B    82 R    98 b   114 r
    3 ETX    19 DC3    35 #     51 3    67 C    83 S    99 c   115 s
    4 EOT    20 DC4    36 $     52 4    68 D    84 T   100 d   116 t
    5 ENQ    21 NAK    37 %     53 5    69 E    85 U   101 e   117 u
    6 ACK    22 SYN    38 &     54 6    70 F    86 V   102 f   118 v
    7 BEL    23 ETB    39 '     55 7    71 G    87 W   103 g   119 w
    8 BS     24 CAN    40 (     56 8    72 H    88 X   104 h   120 x
    9 HT     25 EM     41 )     57 9    73 I    89 Y   105 i   121 y
   10 LF     26 SUB    42 *     58 :    74 J    90 Z   106 j   122 z
   11 VT     27 ESC    43 +     59 ;    75 K    91 [   107 k   123 {
   12 FF     28 FS     44 ,     60 <    76 L    92 \   108 l   124 |
   13 CR     29 GS     45 -     61 =    77 M    93 ]   109 m   125 }
   14 SO     30 RS     46 .     62 >    78 N    94 ^   110 n   126 ~
   15 SI     31 US     47 /     63 ?    79 O    95 _   111 o   127 DEL
```

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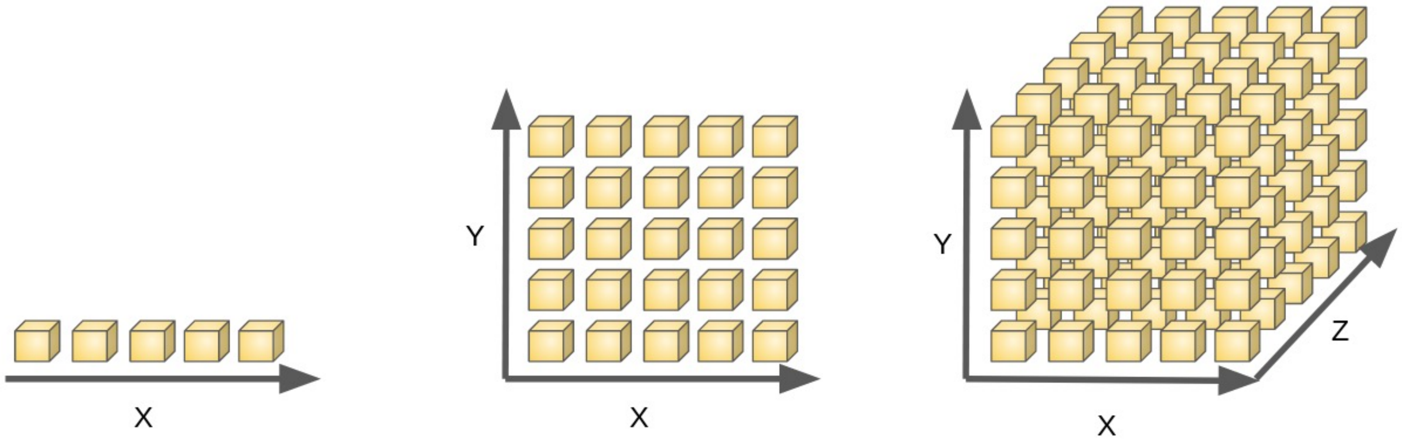
Introduction To Deep Learning

Curse of Dimensionality

Pure Data Space(Pixel Space or Byte Space) is Too big.



512*512*3 = 786432
30**786432 = ?

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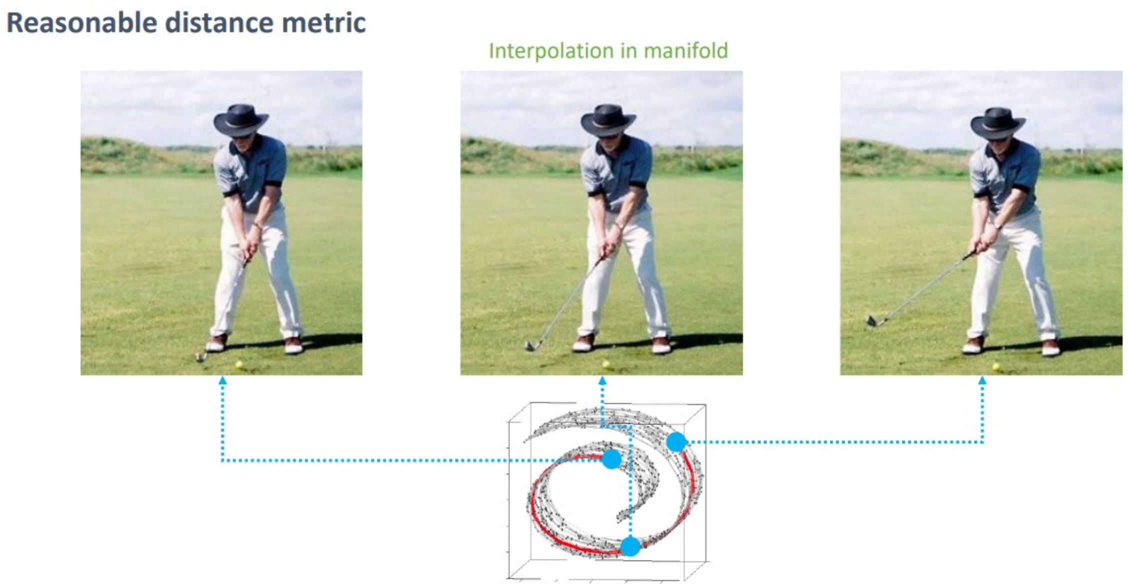
Introduction To Deep Learning

Curse of Dimensionality

Meaningful Data Space is Too small than pure data space.



Introduction To Deep Learning

Goal

In unstructured data, pure data Space is Too big
➔ But, meaningful data Space is Too small than Pure data space
➔ If we can model meaningful data space, we can model unstructured data
➔ How? We can use some assumption

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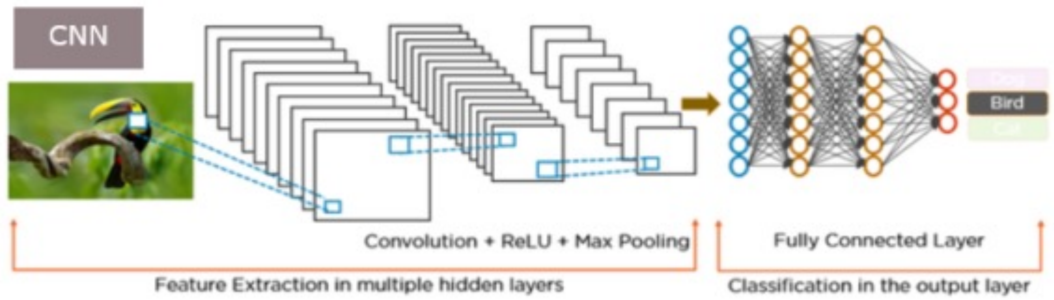
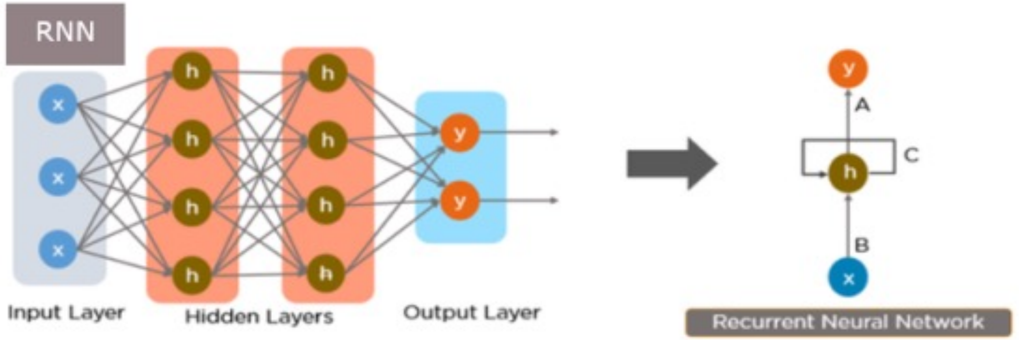
Introduction To Deep Learning

Inductive Bias

Convolutional Neural Network



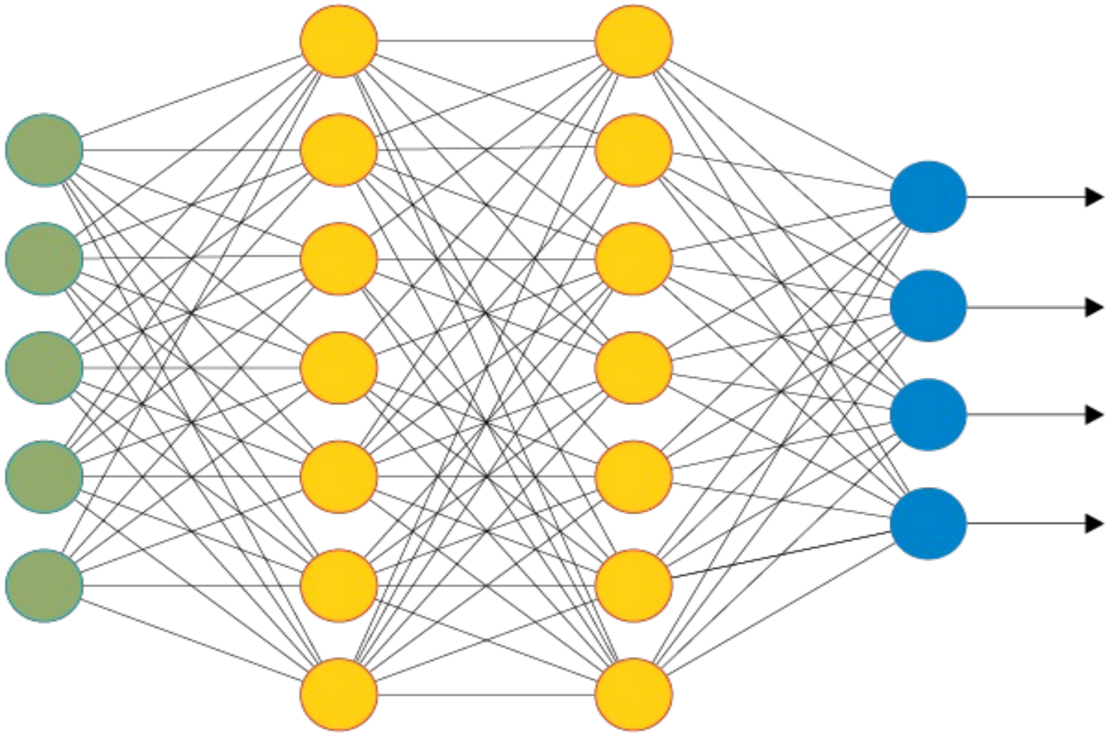
Recurrent Neural Network



Introduction To Deep Learning

Pure Data 2 Meaningful Vector

Vector in Pixel Space
512*512*3 dim Vector



Q11.
정보량의 관점에서 입력 데이터가 정보량이 많을까, 출력 데이터가 정보량이 많을까?

Vector in Meaningful Space
512 dim Vector
(Manifold Axis)

Q12.
데이터가 무한한 상황을 가정하고, 그냥 CNN 없이 학습하면 잘 될까? 분포를 메울만큼 데이터가 없어서 모델링이 잘 안된 것이라면

We can model unstructured data with deep learning

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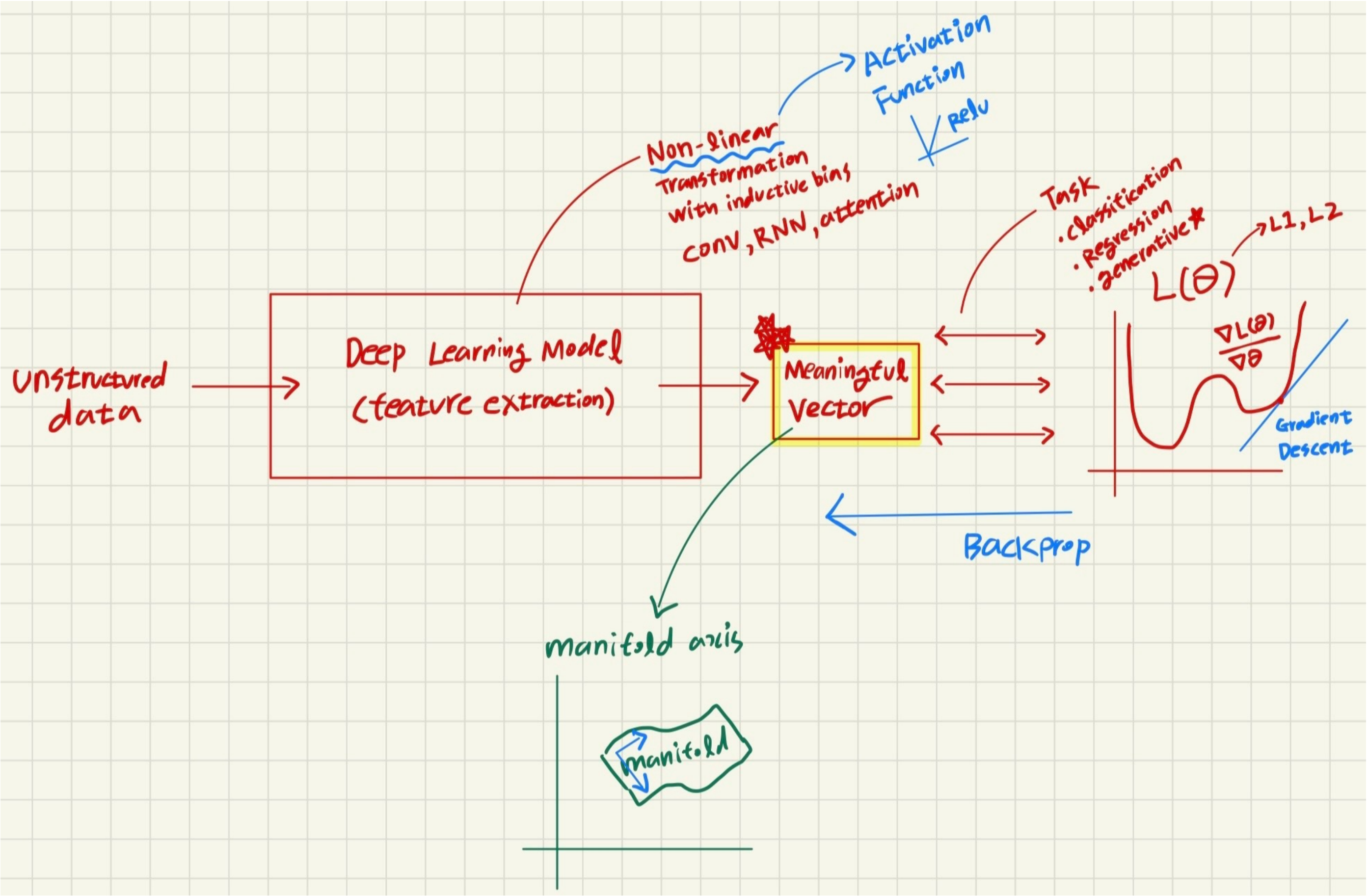
Introduction To Deep Learning

Deep Learning Summary



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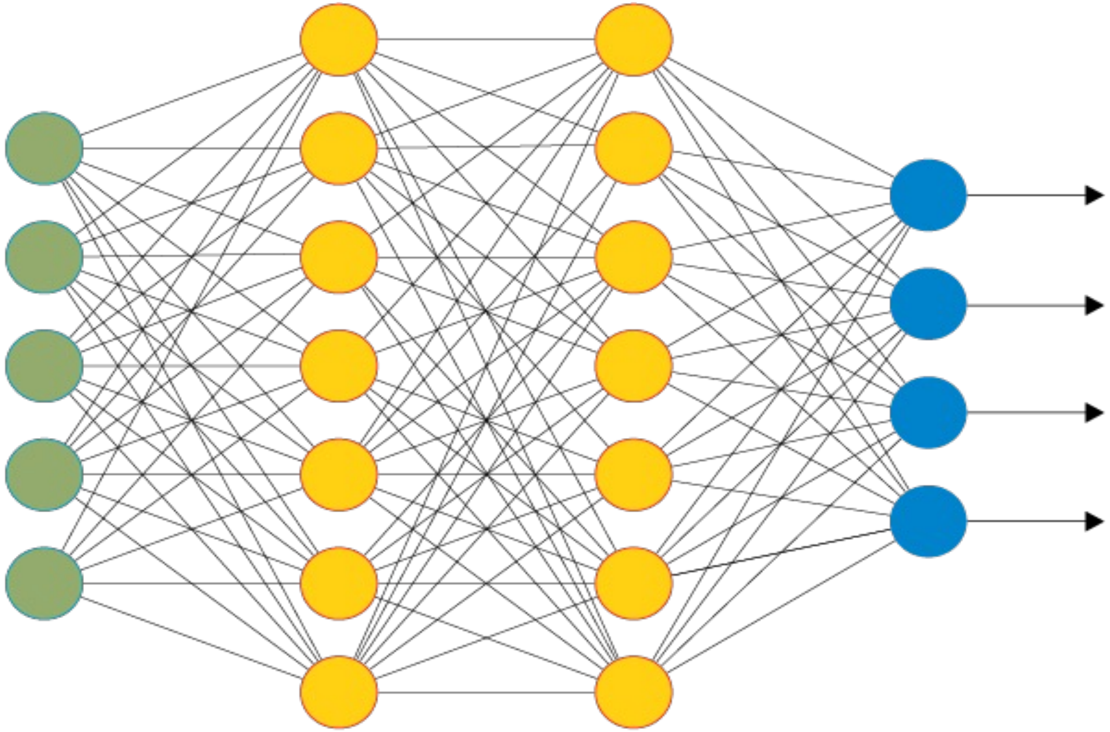
Introduction to Natural Language Processing

What is NLP

Natural Language



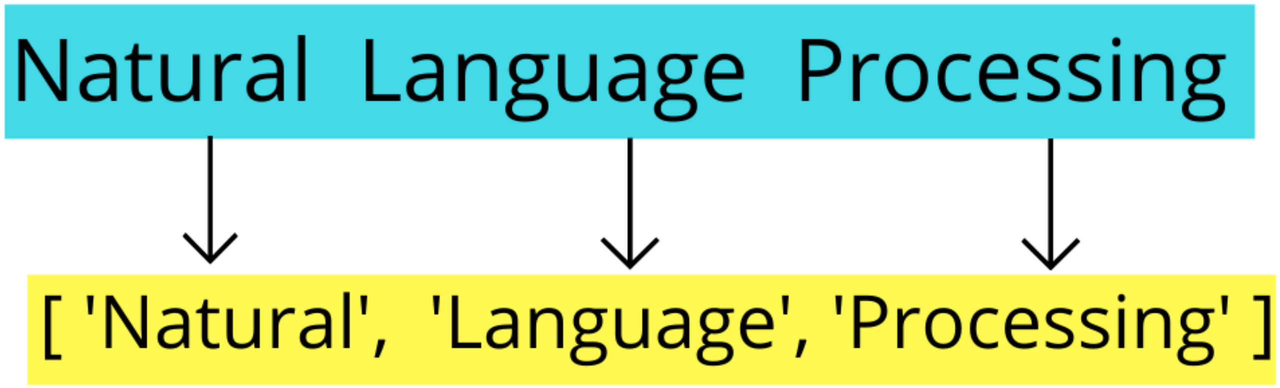
Meaningful Vector

1. How can we get Meaningful Vector
2. Application Using Meaningful Vector

Introduction to Natural Language Processing

How can we get Meaningful Vector

1. Tokenization



How can we get Meaningful Vector

2. One hot Encoding

Color
Red
Green
Blue

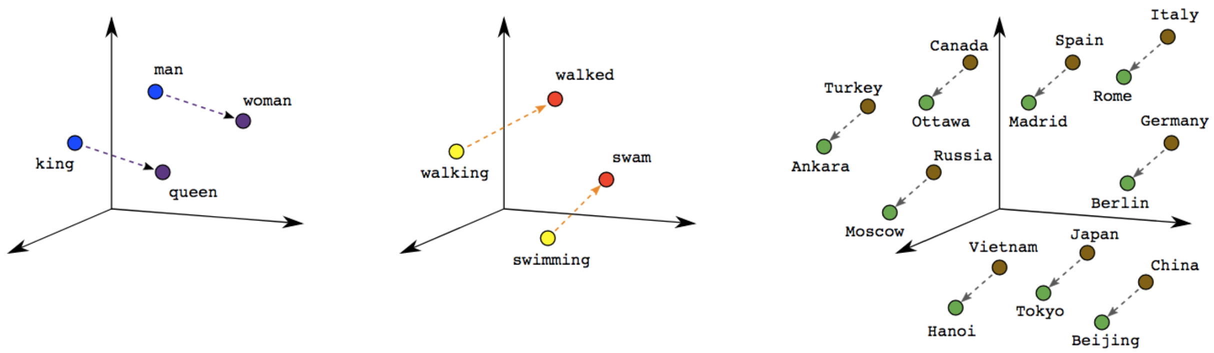
One-hot encoding

d1	d2	d3
1	0	0
0	1	0
0	0	1

Introduction to Natural Language Processing

How can we get Meaningful Vector

3. Word Embedding

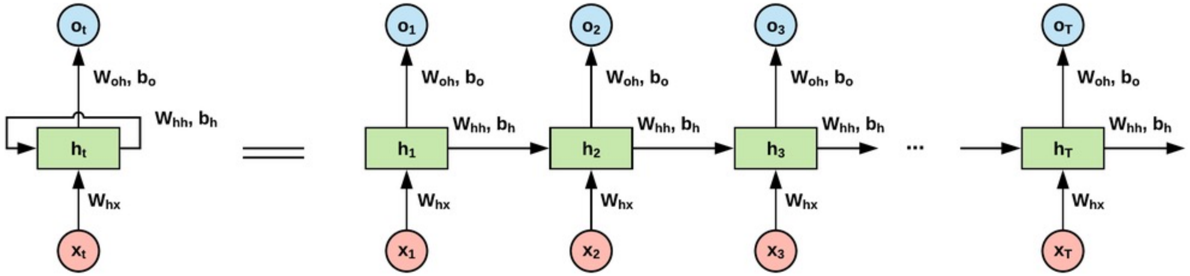


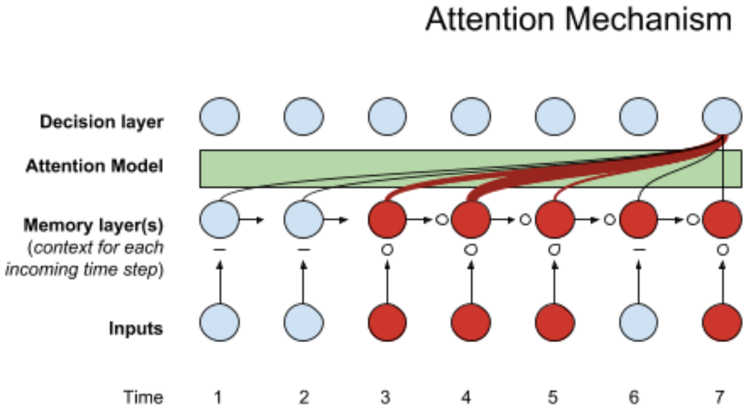
Male-Female Verb Tense Country-Capital

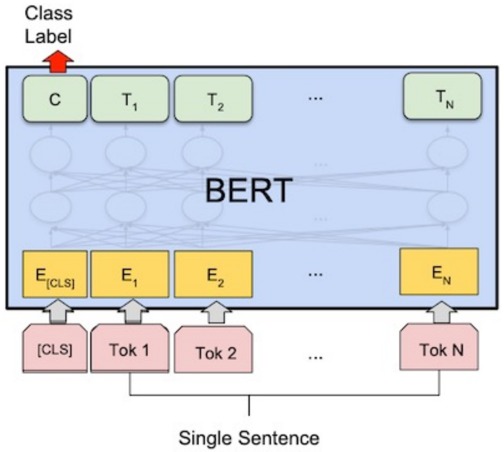
Introduction to Natural Language Processing

How can we get Meaningful Vector

4. Text Embedding







Introduction to Natural Language Processing

Application Using Meaningful Vector

1. Sentiment Analysis

Sentiment Analysis is the task of classifying the polarity of a given text. For instance, a text-based tweet can be categorized into either "positive", "negative", or "neutral". Given the text and accompanying labels, a model can be trained to predict the correct sentiment.

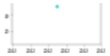
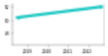
Trend	Dataset	Best Model	Paper	Code	Compare
	SST-2 Binary classification	T5-11B			See all
	IMDb	XLNet			See all
	SST-5 Fine-grained classification	Heinsen Routing + RoBERTa Large			See all
	Yelp Binary classification	XLNet			See all
	MR	VLAWE			See all
	Yelp Fine-grained classification	XLNet			See all
	User and product information	MA-BERT			See all

Introduction to Natural Language Processing

Application Using Meaningful Vector

2. Text Retrieval

Text retrieval in deep learning refers to the process of retrieving relevant textual documents or passages from a large corpus in response to a query or search input. This task is fundamental in various natural language processing (NLP) applications such as information retrieval, question answering, and document summarization.

Trend	Dataset	Best Model	Paper	Code	Compare
	MTEB	SGPT-5.8B-msmarco			See all
	Image-Chat	PaCE			See all
	RSICD	GeoRSCLIP-FT			See all

Introduction to Natural Language Processing

Application Using Meaningful Vector

3. Text Generation

Text Generation is the task of generating text with the goal of appearing indistinguishable to human-written text. This task if more formally known as "natural language generation" in the literature.

T	Model	Average	ARC	HellaSwag	MMLU	TruthfulQA
	abacusai/Smaug-72B-v0.1	80.48	76.02	89.27	77.15	76.67
	ibivibiv/alpaca-dragon-72b-v1	79.3	73.89	88.16	77.4	72.69
	moreh/MoMo-72B-lora-1.8.7-DPO	78.55	70.82	85.96	77.13	74.71
	cloudyu/TomGrc_FusionNet_34Bx2_MoE_v0.1_DPO_f16	77.91	74.06	86.74	76.65	72.24
	cloudyu/TomGrc_FusionNet_34Bx2_MoE_v0.1_full_linear_DPO	77.52	74.06	86.67	76.69	71.32
	zhengr/MixTAO-7Bx2-MoE-v8.1	77.5	73.81	89.22	64.92	78.57
	yunconglong/Truthful_DPO_TomGrc_FusionNet_7Bx2_MoE_13B	77.44	74.91	89.3	64.67	78.02

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Introduction to Natural Language Processing

Application Using Meaningful Vector

4. Text to Img Generation (Unimodal)

Text-to-Image Generation is a task in computer vision and natural language processing where the goal is to generate an image that corresponds to a given textual description. This involves converting the text input into a meaningful representation, such as a feature vector, and then using this representation to generate an image that matches the description.

Trend	Dataset	Best Model	Paper	Code	Compare
	MS COCO	Parti Finetuned			See all
	CUB	TLDM			See all
	Multi-Modal-CelebA-HQ	Swinv2-Imagen			See all
	Oxford 102 Flowers	VQ-Diffusion-F			See all

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Introduction to Natural Language Processing

Our Paper Review Curriculum

3/19 <Word Embedding>
Word2Vec : Efficient Estimation of Word Representations in Vector Space (2013)
GloVe : Global Vectors for Word Representation (2014)
ELMo : Deep contextualized word representations (2018)

3/26 <Text Embedding>
RNN : Recurrent neural network based language model (2010)
LSTM : Long Short Term Memory Recurrent Neural Network Architectures for Large Scale Acoustic Modeling (2014)
GRU : Learning Phrase Representation using RNN Encoder-Decoder for Statistical Machine Translation (2014)

4/9 <Text Embedding>
Seq2Seq : Sequence to Sequence Learning with Neural Networks (2014)
Attention : Neural Machine Translation by Jointly Learning to Align and Translate (2015)
Transformer : Attention is All You Need (2017)

4/30 <Text Embedding>
BERT Pretraining of Deep Bidirectional Transformers for Language Understanding (2018)
RoBERTa : RoBERTa: A Robustly Optimized BERT Pretraining Approach (2019)
ALBERT: A Lite BERT for Self-supervised Learning of Language Representations (2019)

5/7 <Text Regression/Classification>
MTEB: Massive Text Embedding Benchmark
XLNet: Generalized Autoregressive Pretraining for Language Understanding

5/21 <Text Generation>
GPT-1 : Improving Language Understanding by Generative Pre-Training (2018)
GPT-2 : Language Models are Unsupervised Multitask Learners (2018)
GPT-3 : Language Models are Few-Shot Learners (2020)

5/28<Document Retrieval>
Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks
Self-RAG: Learning to Retrieve, Generate, and Critique through Self-Reflection
Self-Knowledge Guided Retrieval Augmentation for Large Language Models

6/4 <LLM>
LLaMA: Open and Efficient Foundation Language Models (2023)
Mistral 7B

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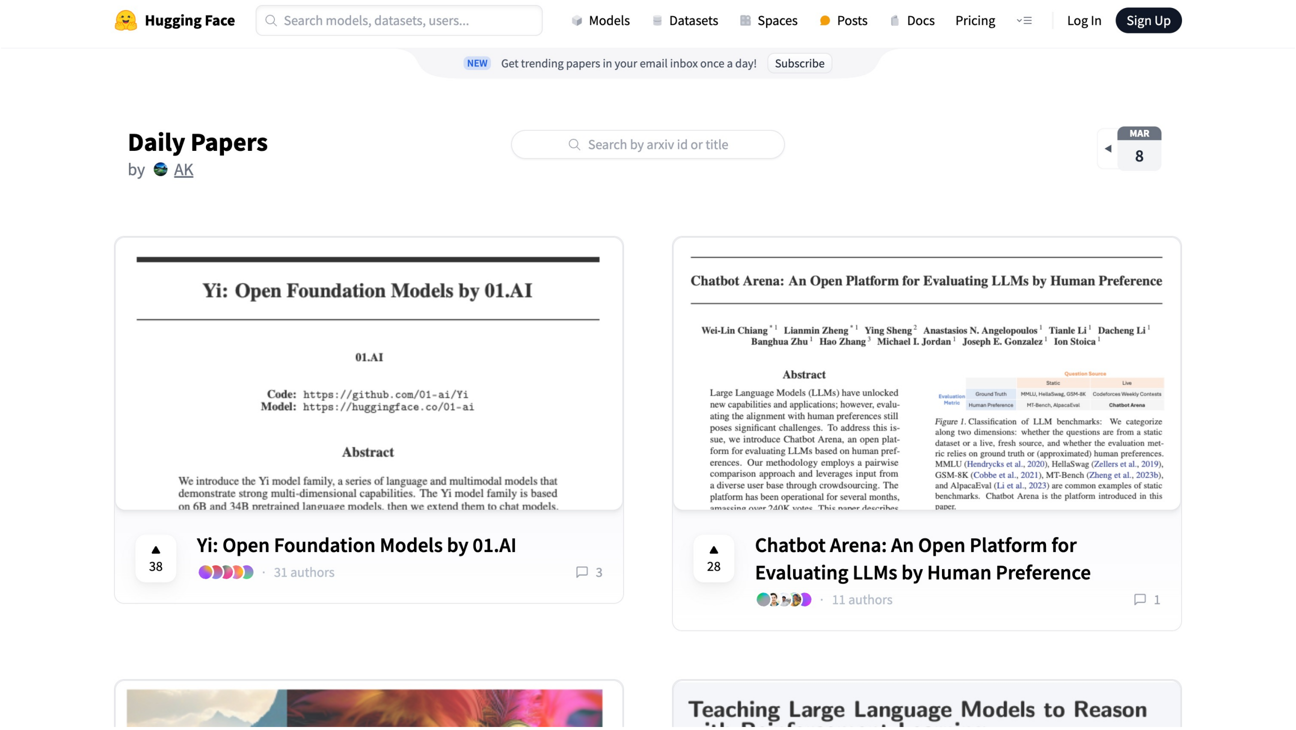
Tip For Study

Research Follow Up

[1. Hugging Face Daily Papers]



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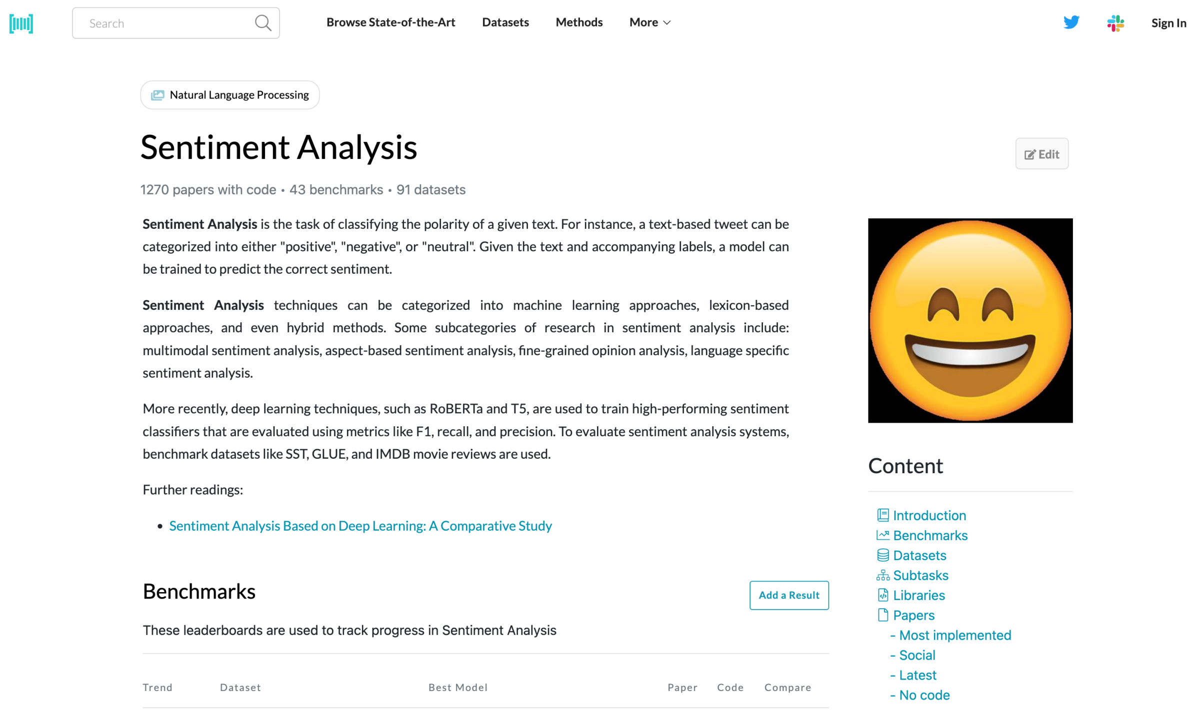
Tip For Study

Research Follow Up

2. Papers with Code



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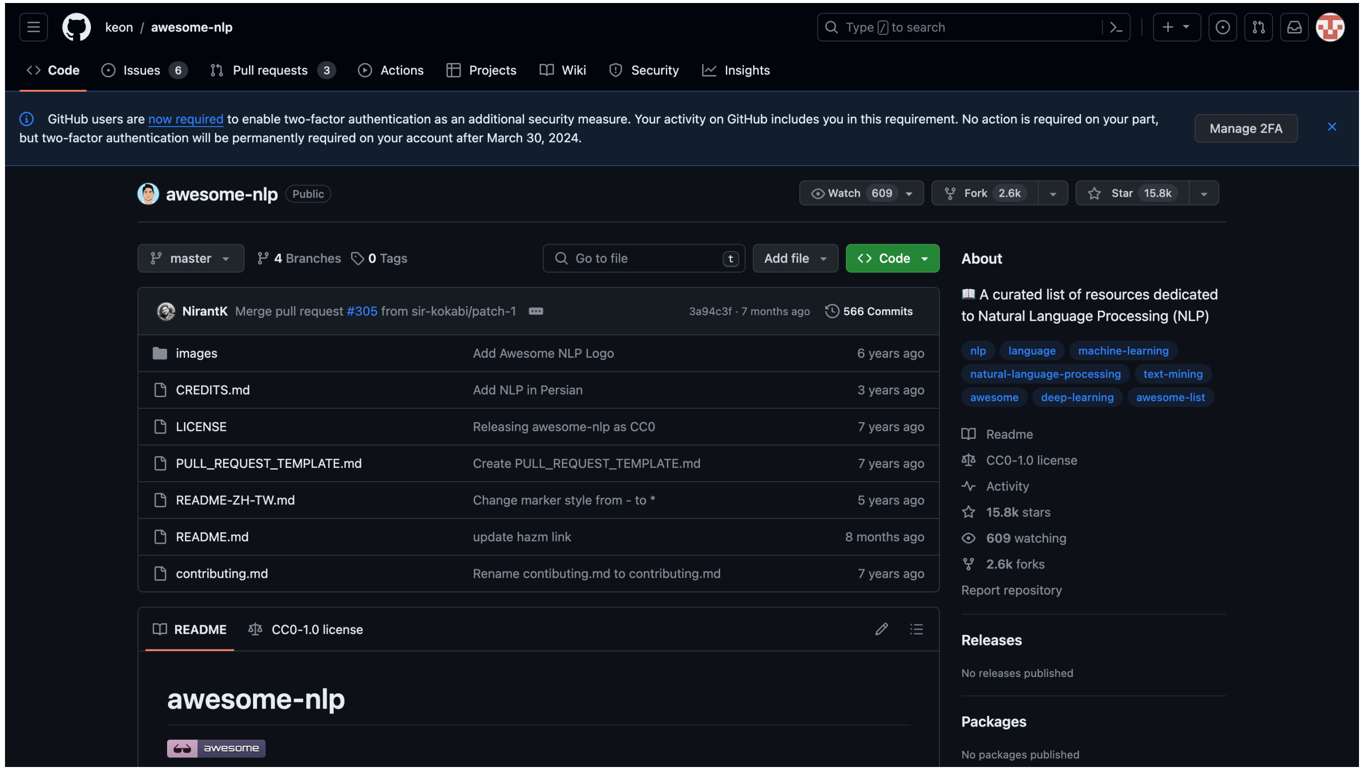
Tip For Study

Research Follow Up

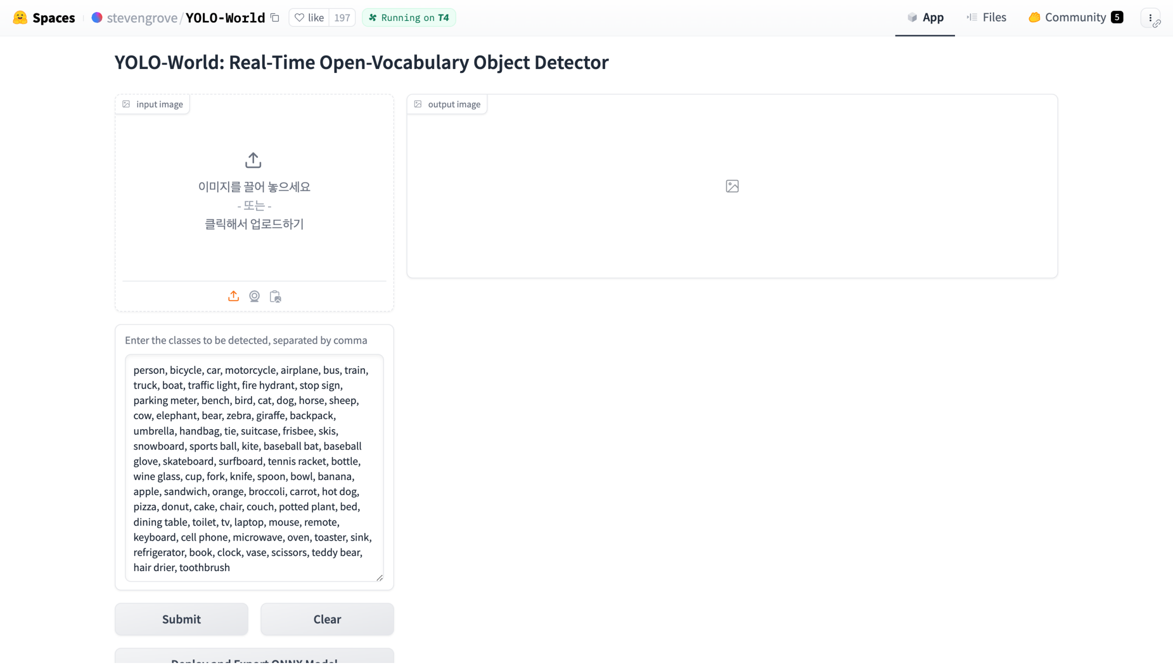
3. Github Awesome 000



Tip For Study

Code Demo

4. Hugging Face Gradio Demo

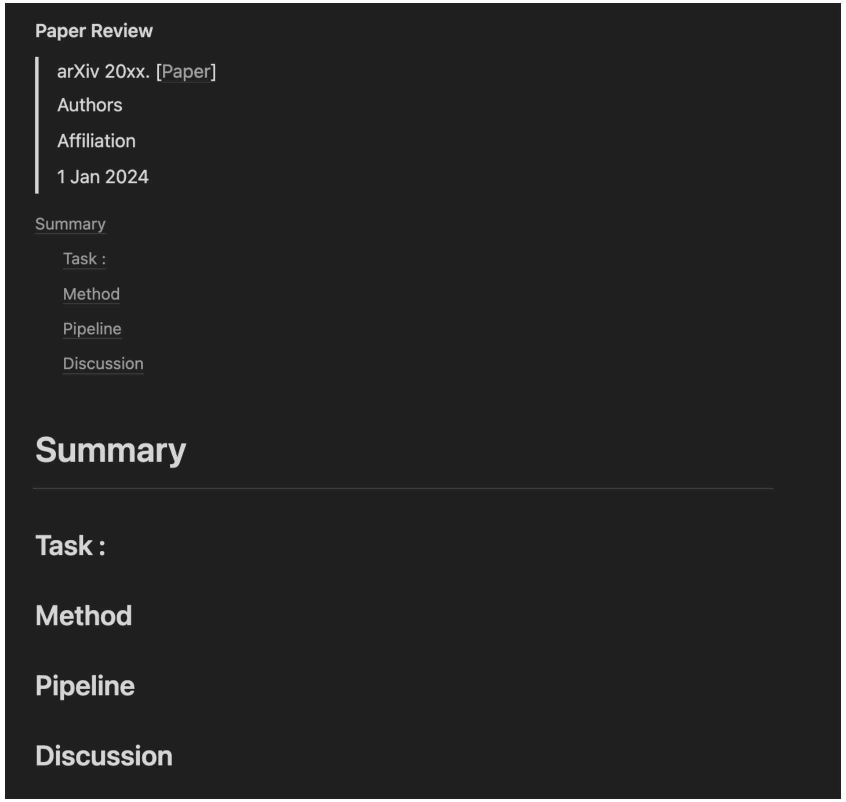


TRAIN AND TEST

Tip For Study

Paper Review

5. Notion



TRAIN AND TEST