

[1주차] Introduction to Convolutional Neural Networks for Visual Recognition

1기 강다연
1기 김연수
1기 나정현


목차

1 Intro

2 History of Computer Vision

3 Image Classification

4 Wrap up



Lecture 1:
Introduction

16

☰

Stanford University CS231n, Spring 2017

Anders Feder

Lecture 1 | Introduction to Convolutional Neural Networks for Visual Recognition • 57:57

Lecture 2 | Image Classification • 59:32

[모든 재생목록 보기](#)

CS231n은 컴퓨터 비전에 관한 수업으로
Neural Network(신경망)과 CNN과 관련된 부분을 중점적으로 공부합니다.

Intro

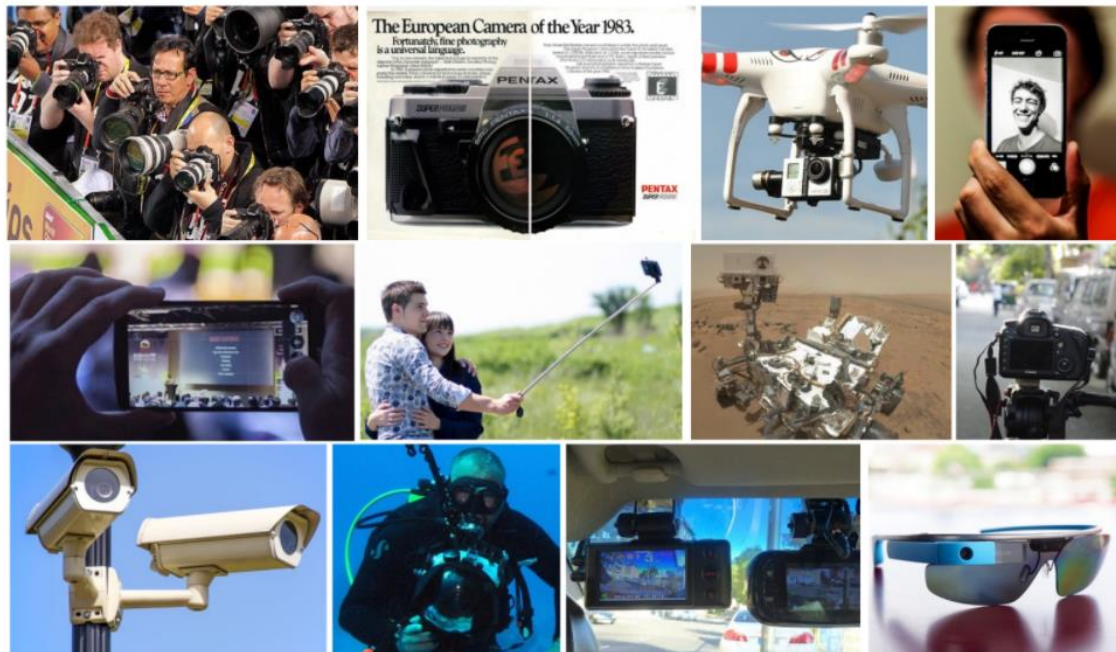
대부분의 데이터가 영상



데이터 가공 및 이해해야 함



하지만 사람이 가공하기에는 한계 존재



History of Computer Vision

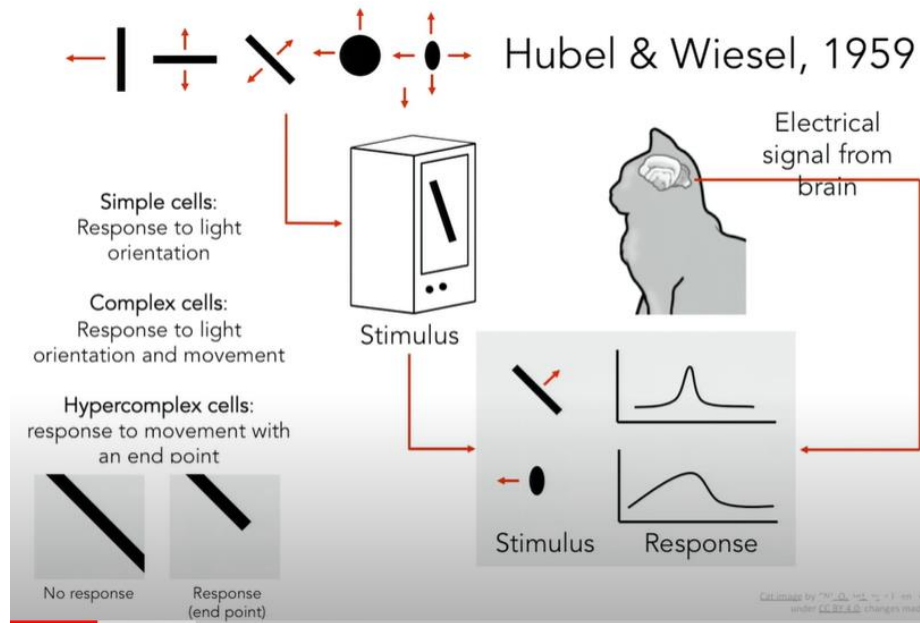
* 어디서 시작됐는가?

진화의 시작은 항상 'vision'

- 지능화된 종에서 가장 큰
sensory system

* 언제 시작됐는가?

* 현재(2017) 어느정도 와있는가?



vision의 매커니즘

* 어떻게 발전했는가?

가장 simple한 것부터 시작 : 방향



object recognition 등

이러한 visual process를 해체하여 하나씩 보면...

=> 간단한 단계를 모아 복잡한 결과를 창출

1. input
2. edge
3. 2+1/2D sketch : 물체를 분리해서
4. 3D model

Input image

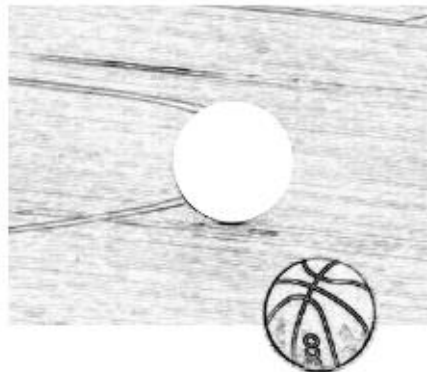


This image is CC0 1.0 public domain

Edge image



2 1/2-D sketch



3-D model



This image is CC0 1.0 public domain

Algorithms and Fields

Supporting vector machine, etc.



Object recognition



- object segmentation : Graph theory algorithm
- Face recognition
- Real-time face detection
- Feature-based object recognition
- Transfer / Match an entire object to entire object with different features

Dataset

Object recognition의 성능 평가를 위해
Benchmark dataset이 필요!

하지만... 시각 데이터는

- 복잡
- 고차원의 input
- 여러 hyper parameter 및 parameter의 조정이 필요
- 일반화하기 어려움

- PASCAL
- IMAGENET
 - 거의 모든 시각 데이터를 포함
 - object recognition 알고리즘이 발전하는데 가장 큰 역할을 함

👉 어떻게 생성되었는가?

: Data - WordNet - 분류/ 정리/ 라벨링

2012:

‘deep learning’ starts

SIFT Algorithm

1990~2010년 : 특징 기반 객체인식 알고리즘 



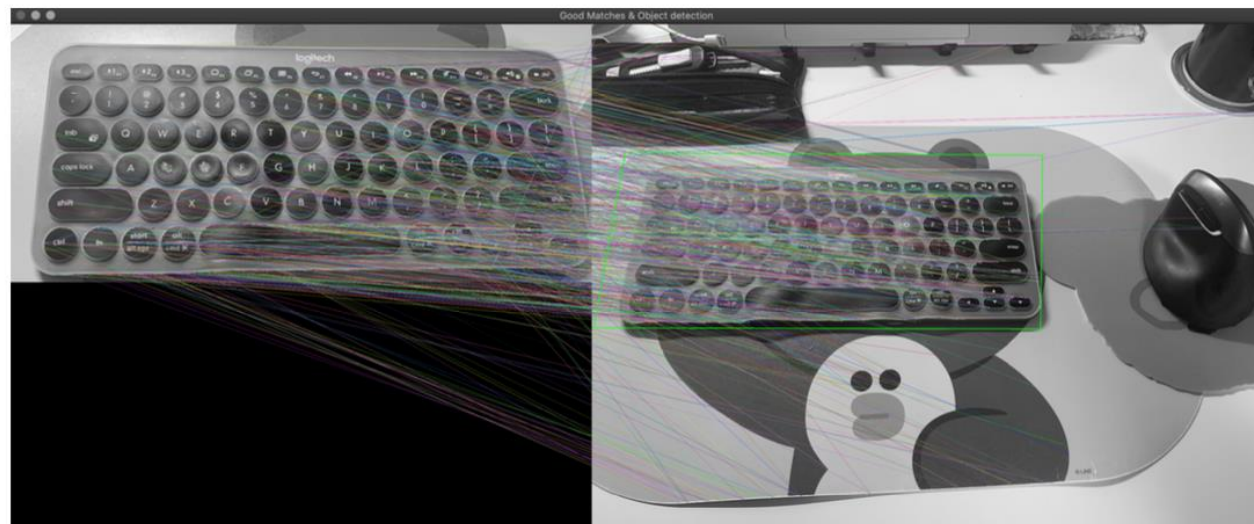
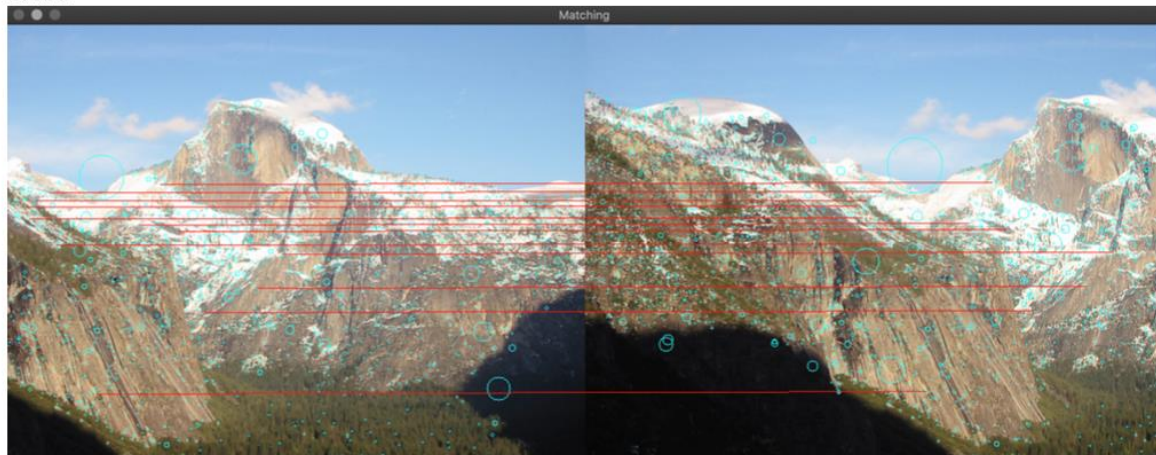
image is public domain



image is CC BY-SA 3.0

카메라 앵글, 조도 등의
특징들을 매칭해서 식별

Case3



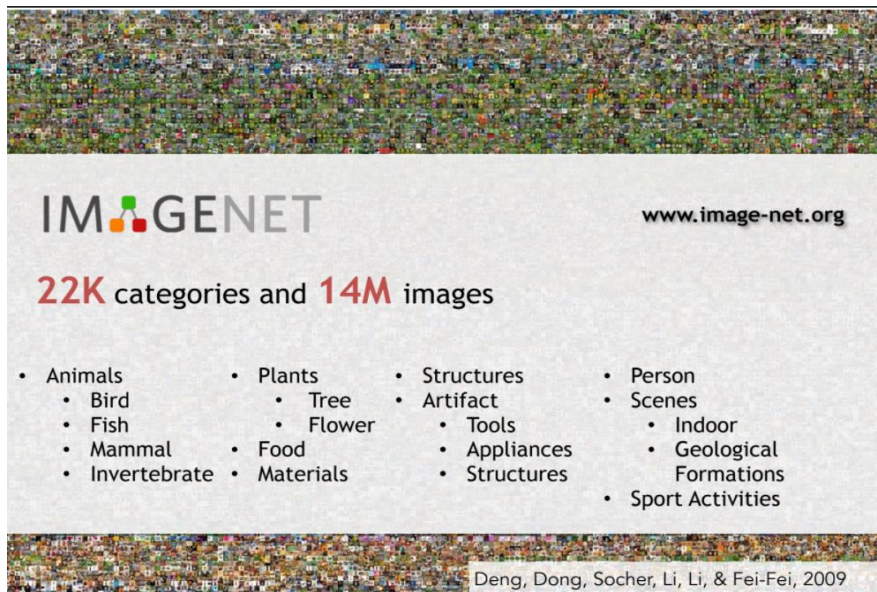
ImageNet_Image Classification

- 2000년대 초,
CV 분야에서 풀어야 할 문제 정의

- SVM, Adaboost
- training data set 부족
- 시각 데이터가 매우 복잡



overfitting 줄이기
+
세상의 모든 객체를 인식 해보자!



www.image-net.org

22K categories and **14M** images

- Animals
 - Bird
 - Fish
 - Mammal
 - Invertebrate
- Plants
 - Tree
 - Flower
 - Food
 - Materials
- Structures
 - Artifact
 - Tools
 - Appliances
 - Structures
- Person
 - Scenes
 - Indoor
 - Geological Formations
 - Sport Activities

Deng, Dong, Socher, Li, Li, & Fei-Fei, 2009

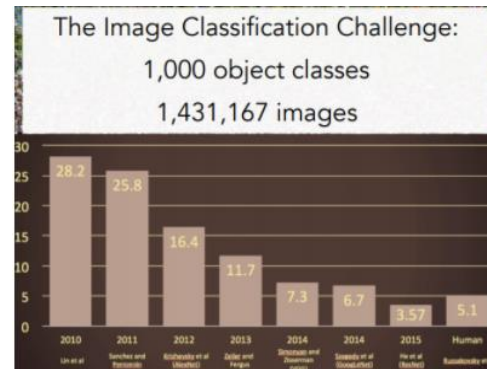


Image Classification 대회에서
CNN 기반 AlexNet 제안

-> 이를 계기로 CNN을 변형한 연구 ↑

Wrap up

* 적용 분야

- Medical diagnosis
- 로보틱스
- 자율주행 자동차

* CV 분야의 목표

- Build machine to see like humans
- 이미지에 담긴 story를 깊게 이해할 수 있게!



PT = 500ms

Some kind of game or fight. Two groups of two men? The man on the left is throwing something. Outdoors seemed like because i have an impression of grass and maybe lines on the grass? That would be why I think perhaps a game, rough game though, more like rugby than football because they pairs weren't in pads and helmets, though I did get the impression of similar clothing. maybe some trees? in the background. (Subject: SM)

1주차 과제

1. 2주차 과제를 하기 위한 setup하기

<https://cs231n.github.io/assignments2020/assignment1/> 의 파일을 받아 구글드라이브에 옮긴 다음
get_datasets.sh 실행한 뒤 캡처해서 인증해서 제출 해주세요!

```
from google.colab import drive

drive.mount('/content/drive', force_remount=True)

# enter the foldername in your Drive where you have saved the unzipped
# 'cs231n' folder containing the '.py', 'classifiers' and 'datasets'
# folders.
# e.g. 'cs231n/assignments/assignment1/cs231n/'
FOLDERNAME = 'cs231n/assignment/assignment1/cs231n/'

assert FOLDERNAME is not None, "[!] Enter the foldername."

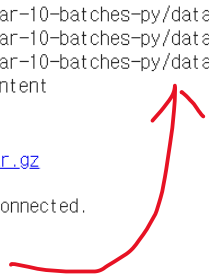
%cd drive/My Drive
%cp -r $FOLDERNAME ../../
%cd ../../
%cd cs231n/datasets/
!bash get_datasets.sh
%cd ../../
```

```
Mounted at /content/drive
/content/drive/My Drive
/content
/content/cs231n/datasets
--2021-03-22 02:46:34-- http://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz
Resolving www.cs.toronto.edu (www.cs.toronto.edu)... 128.100.3.30
Connecting to www.cs.toronto.edu (www.cs.toronto.edu)[128.100.3.30]:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 170498071 (163M) [application/x-gzip]
Saving to: 'cifar-10-python.tar.gz'
```

```
cifar-10-python.tar 100%[=====>] 162.60M 69.1MB/s in 2.4s

2021-03-22 02:46:37 (69.1 MB/s) - 'cifar-10-python.tar.gz' saved [170498071/170498071]

cifar-10-batches-py/
cifar-10-batches-py/data_batch_4
cifar-10-batches-py/readme.html
cifar-10-batches-py/test_batch
cifar-10-batches-py/data_batch_3
cifar-10-batches-py/batches.meta
cifar-10-batches-py/data_batch_2
cifar-10-batches-py/data_batch_5
cifar-10-batches-py/data_batch_1
/content
```



2. Python-numpy tutorial 실습

<https://cs231n.github.io/python-numpy-tutorial/> 실습해서 제출해주세요!

Python

Python is a high-level, dynamically typed multiparadigm programming language. Python code is often said to be almost like pseudocode, since it allows you to express very powerful ideas in very few lines of code while being very readable. As an example, here is an implementation of the classic quicksort algorithm in Python:

```
def quicksort(arr):
    if len(arr) <= 1:
        return arr
    pivot = arr[len(arr) // 2]
    left = [x for x in arr if x < pivot]
    middle = [x for x in arr if x == pivot]
    right = [x for x in arr if x > pivot]
    return quicksort(left) + middle + quicksort(right)

print(quicksort([3,6,8,10,1,2,1]))
# Prints "[1, 1, 2, 3, 6, 8, 10]"
```


1주차 과제

자세한 내용은 Euron -AI-2021 repo의 Week_1 README 파일을 참고해주세요!


Git checkout Week_1

Git pull upstream Week_1

(Is했을 때 README.md
파일이 있는 지 확인 해주세요!)

Add/commit/push 해서 본인 레포에
가져가시면 됩니다!

EURON 1기 - AI팀

주차	내용	발표자	발표자료
1	cs231n 1주차	강다연(통계), 김연수, 나정현	

Requirements

! Local Environment (Jupyter Notebook) 가 아닌 [Google Colab](#) 을 이용해주세요. (미리 설치하실 것은 따로 없으며, Assignment 절차를 따라주시면 됩니다.)

Software Setup

This year, the recommended way to work on assignments is through [Google Colaboratory](#). However, if you already own GPU-backed hardware and would prefer to work locally, we provide you with instructions for setting up a virtual environment.

- [Working remotely on Google Colaboratory](#)
- [Working locally on your machine](#)
 - [Anaconda virtual environment](#)
 - [Python venv](#)
 - [Installing packages](#)

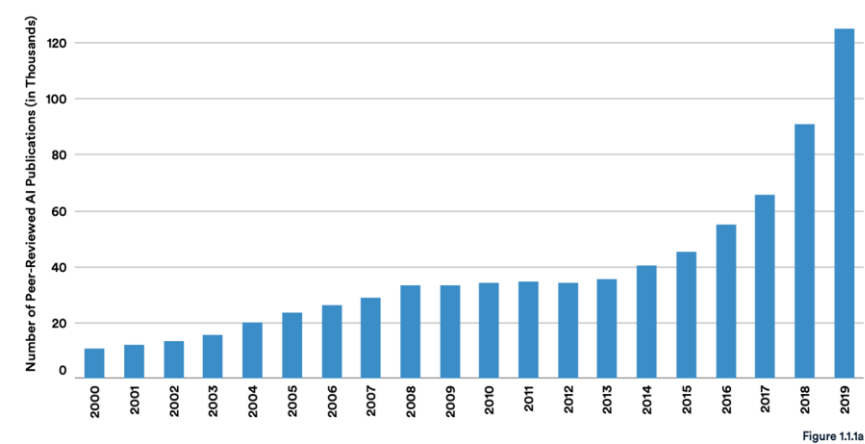
감사합니다

Q&A

요즘도?

NUMBER of PEER-REVIEWED AI PUBLICATIONS, 2000-19

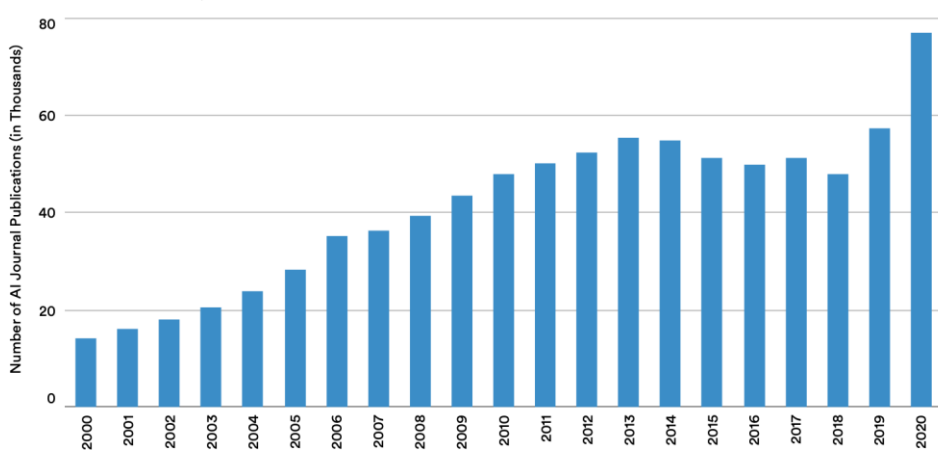
Source: Elsevier/Scopus, 2020 | Chart: 2021 AI Index Report



1 Regions in this chapter are classified according to the World Bank analytical grouping.

NUMBER of AI JOURNAL PUBLICATIONS, 2000-20

Source: Microsoft Academic Graph, 2020 | Chart: 2021 AI Index Report



percentage points in 2020, higher than the average of U.S. percentage points in the past five years (Figure 1.1.7b).

The 2021 AI Index

- Stanford Institute for Human-Centered Artificial Intelligence

NUMBER of AI CONFERENCE PUBLICATIONS, 2000-20

Source: Microsoft Academic Graph, 2020 | Chart: 2021 AI Index Report

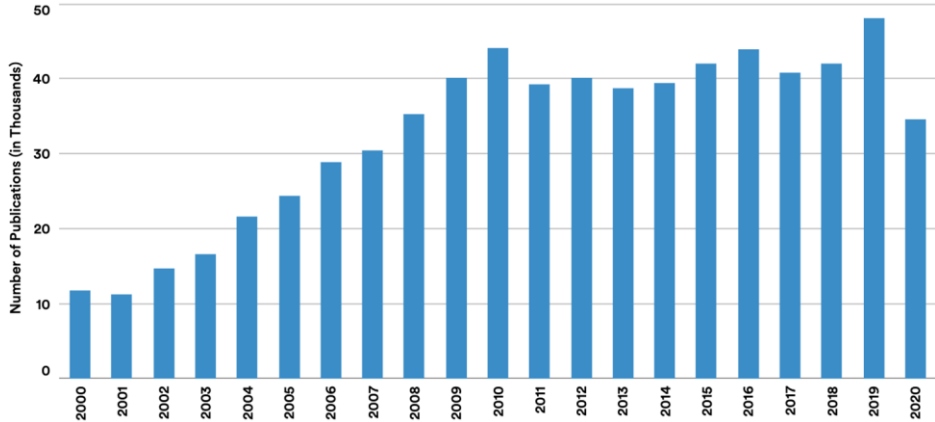


Figure 1.1.11a

NUMBER of AI-RELATED PUBLICATIONS on ARXIV, 2015-20

Source: arXiv, 2020 | Chart: 2021 AI Index Report

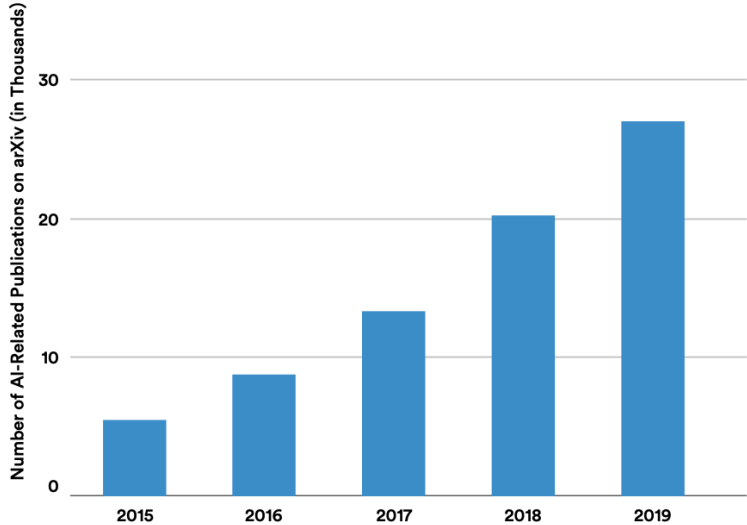


Figure 1.1.16

ATTENDANCE at LARGE AI CONFERENCES, 2010-20

Source: Conference Data | Chart: 2021 AI Index Report

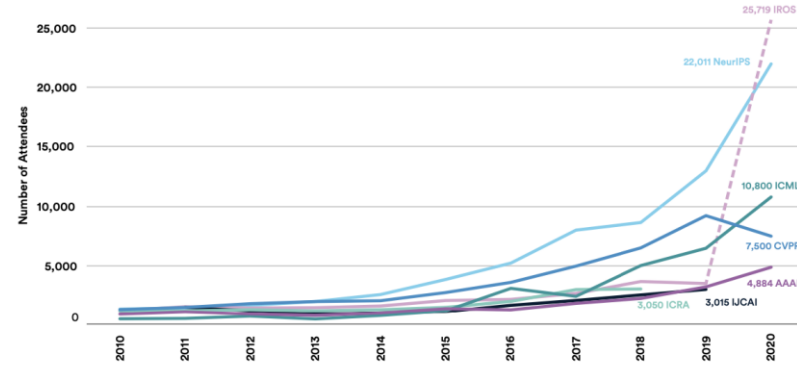


Figure 1.2.1

ATTENDANCE at SMALL AI CONFERENCES, 2010-20

Source: Conference Data | Chart: 2021 AI Index Report

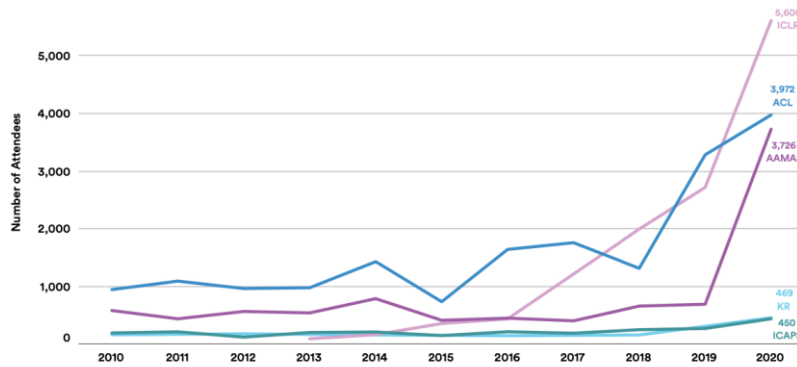


Figure 1.2.2

Example : Object Detection Research



Task

- **Vision** : Image Classification, Object Detection, Generation, Human Pose Estimation, Deepfake Detection, Semantic Segmentation, Activity Recognition
- **Language** : Machine Translation, Classification, Generation, QA, Summarization, NER
- **Multimodal** : VQA, Image Captioning, Image-text matching, Text-to-Image
- **Speech** : Speech Recognition, Voice Synthesis, Voice Conversion
- **Recommendation**
- **Meta Learning**
- **Reinforcement Learning**
- **Graph Neural Network**
- **Domain Adaptation**

Task

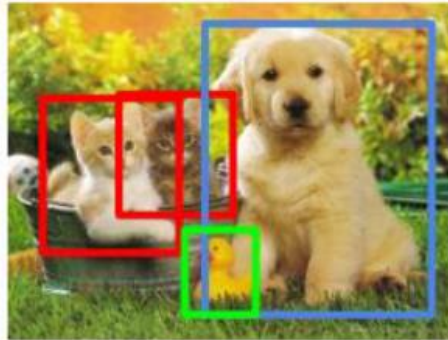
- **Vision** : Image Classification, Object Detection, Generation, Human Pose Estimation, Deepfake Detection, Semantic Segmentation, Activity Recognition
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- **Multimodal** : VQA, Image Captioning, Image-text matching, Text-to-Image
- **Speech** : Speech Recognition, Voice Synthesis, Voice Conversion
- **Recommendation**
- **Meta Learning**
- **Reinforcement Learning**
- **Graph Neural Network**
- **Domain Adaptation**

Classification



CAT

Object Detection



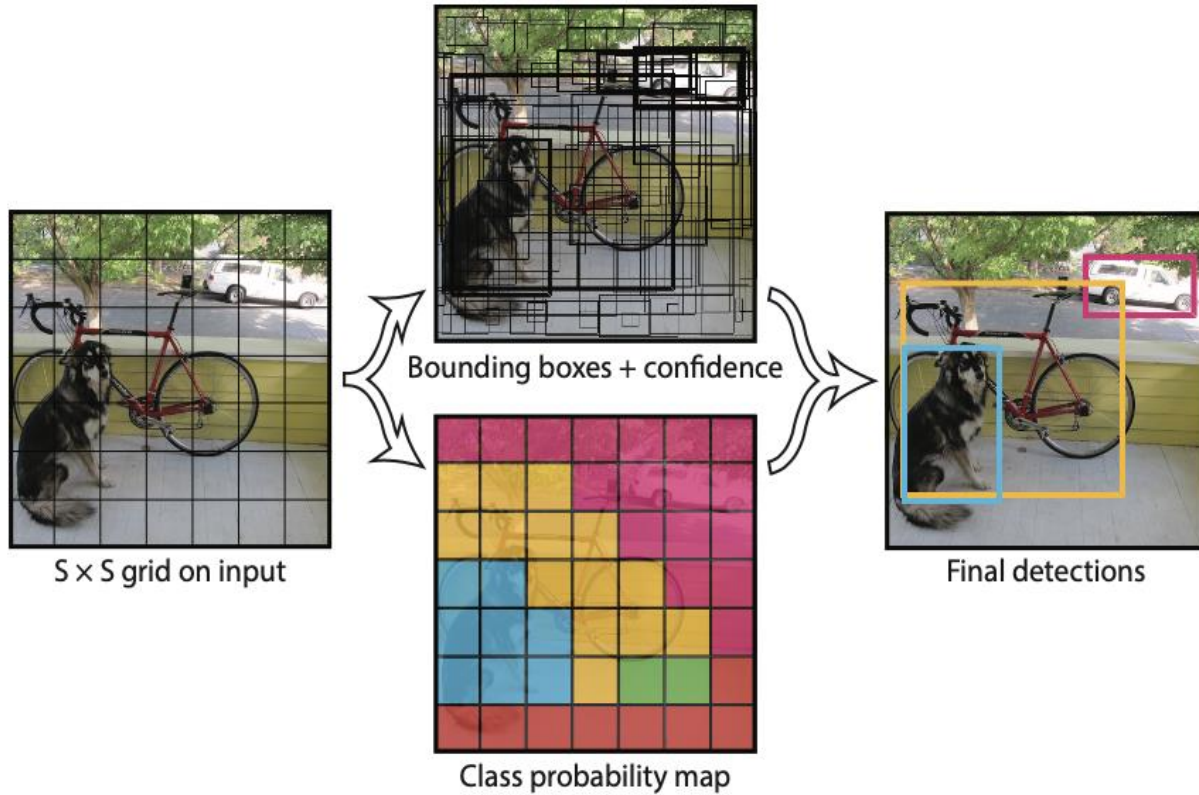
CAT, DOG, DUCK

Instance Segmentation

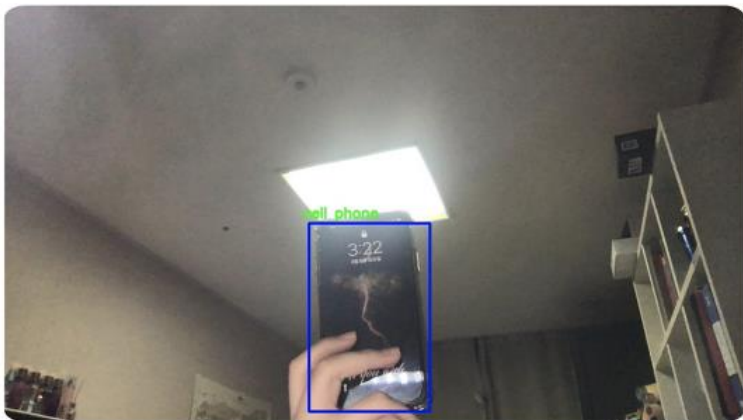


CAT, DOG, DUCK

<https://hoya012.github.io/blog/Tutorials-of-Object-Detection-Using-Deep-Learning-what-is-object-detection/>



🖥 Video Streaming 🖥

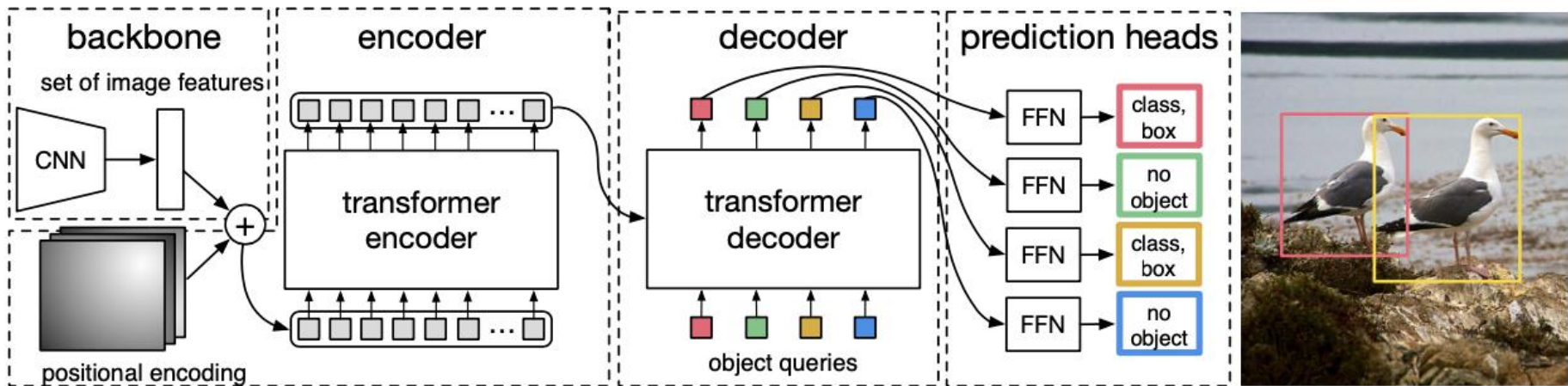


🤔 현재 predict label 🤔

예측을 시작하려면 Enter키  를 눌러주세요.

cell phone

DETR



Vision Transformer(ViT)

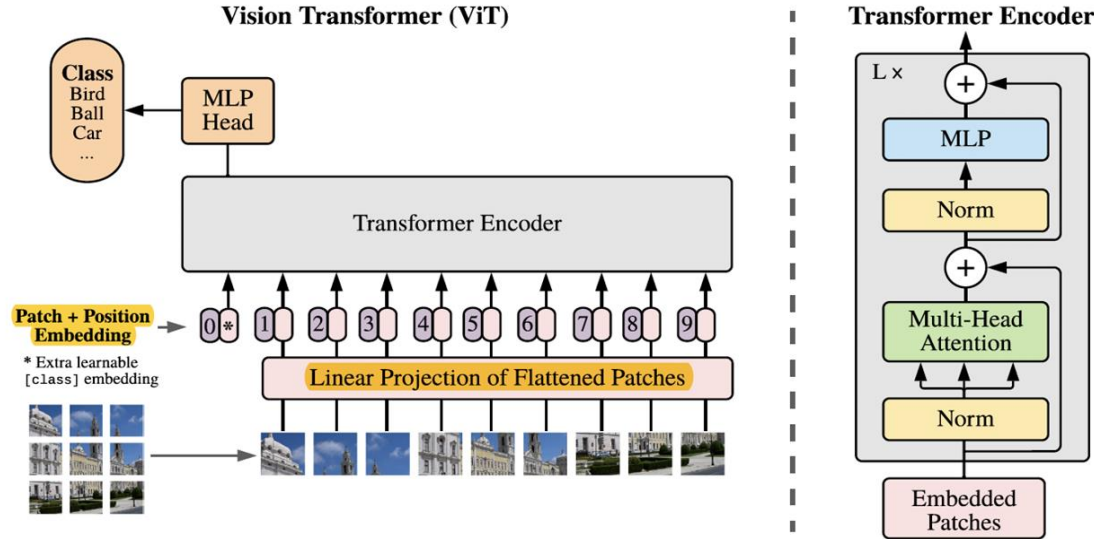


Figure 1: Model overview. We split an image into fixed-size patches, linearly embed each of them, add position embeddings, and feed the resulting sequence of vectors to a standard Transformer encoder. In order to perform classification, we use the standard approach of adding an extra learnable “classification token” to the sequence. The illustration of the Transformer encoder was inspired by Vaswani et al. (2017).

StarGAN

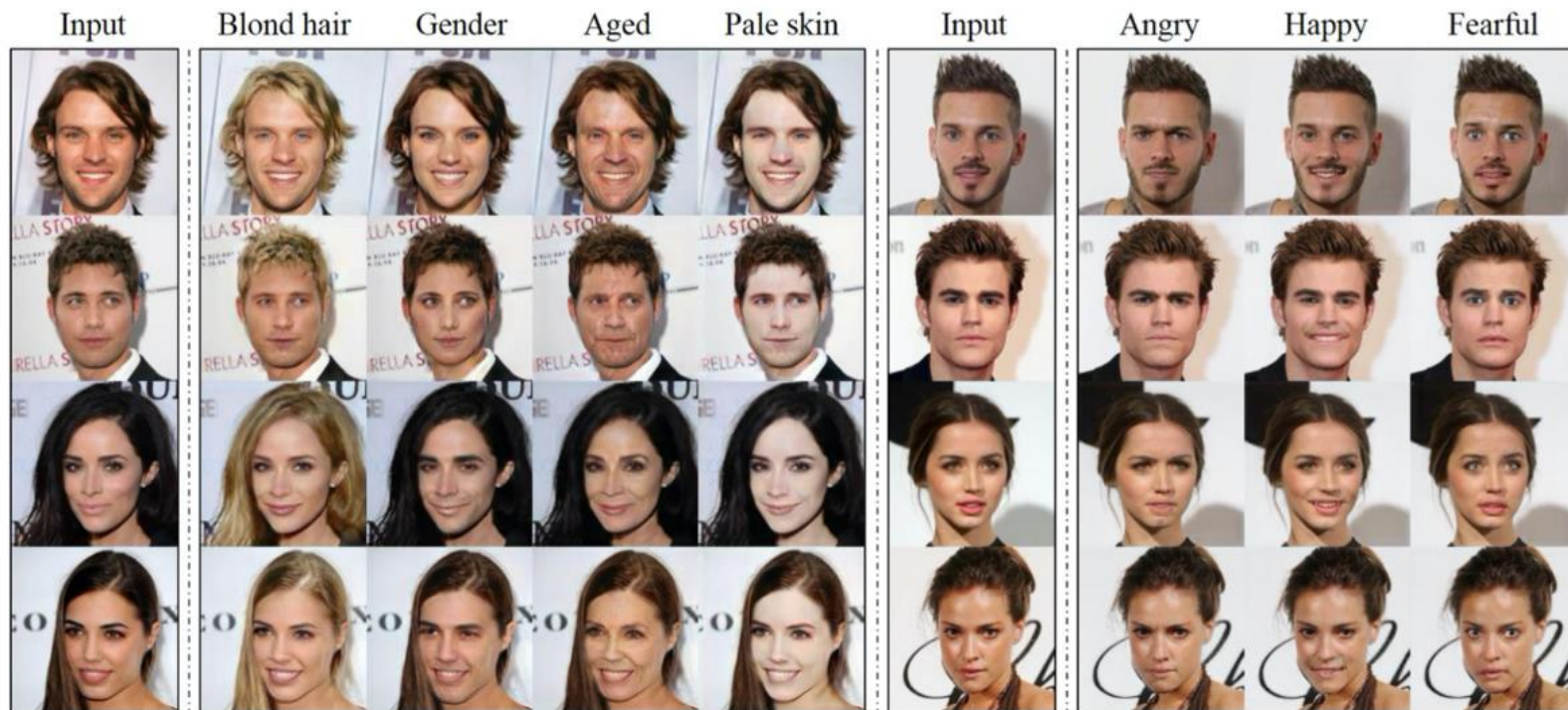


Figure 1. Multi-domain image-to-image translation results on the CelebA dataset via transferring knowledge learned from the RaFD dataset. The first and sixth columns show input images while the remaining columns are images generated by StarGAN. Note that the images are generated by a single generator network, and facial expression labels such as angry, happy, and fearful are from RaFD, not CelebA.

Style Transfer

Content image



+

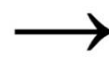
Style image



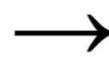
Output image



+

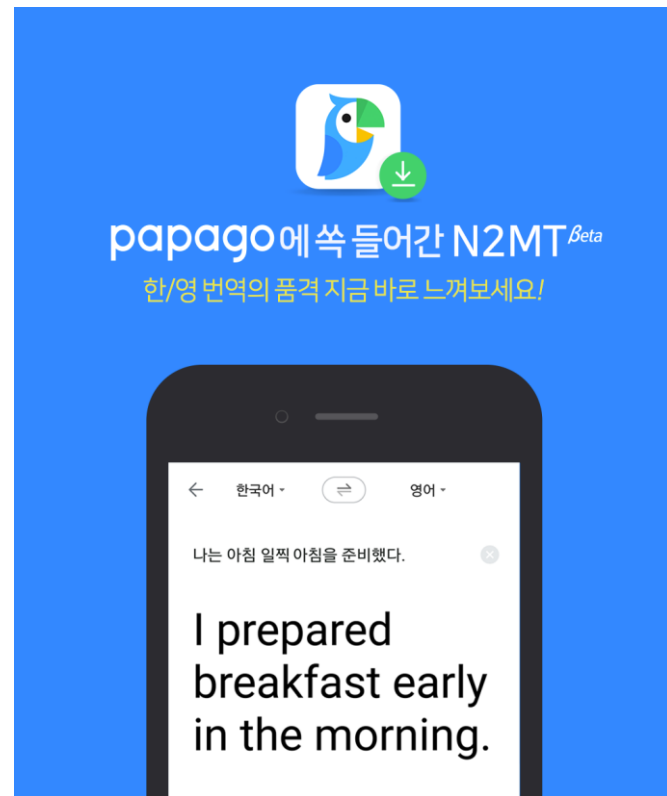
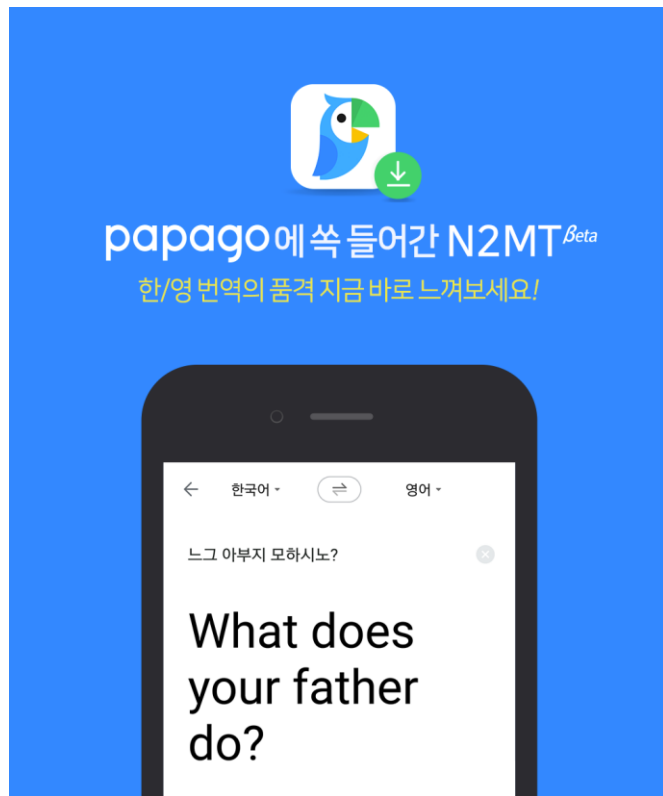


+





Machine Translation



Text Summarization

Input Article

Marseille, France (CNN) The French prosecutor leading an investigation into the crash of Germanwings Flight 9525 insisted Wednesday that he was not aware of any video footage from on board the plane. Marseille prosecutor Brice Robin told CNN that "so far no videos were used in the crash investigation." He added, "A person who has such a video needs to immediately give it to the investigators." Robin's comments follow claims by two magazines, German daily Bild and French Paris Match, of a cell phone video showing the harrowing final seconds from on board Germanwings Flight 9525 as it crashed into the French Alps. All 150 on board were killed. Paris Match and Bild reported that the video was recovered from a phone at the wreckage site. ...

Text Summarization Models

Abstractive summarization

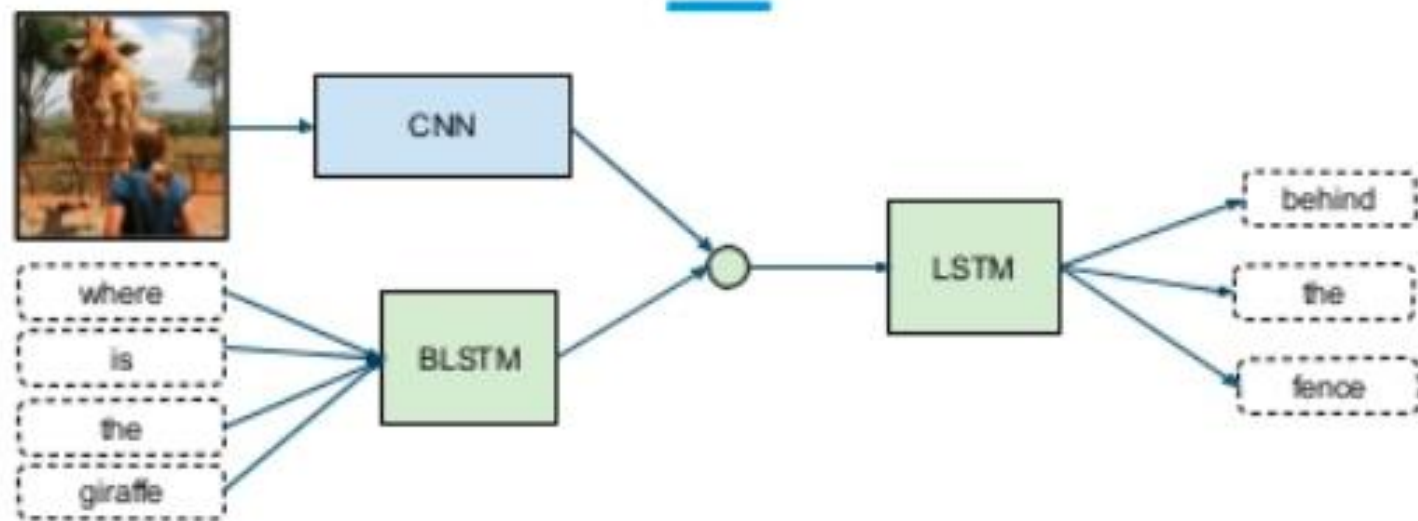
Extractive summarization

Generated summary

Prosecutor : " So far no videos were used in the crash investigation "

Extractive summary

marseille prosecutor brice robin told cnn that " so far no videos were used in the crash investigation . " robin \s comments follow claims by two magazines , german daily bild and french paris match , of a cell phone video showing the harrowing final seconds from on board germanwings flight 9525 as it crashed into the french alps . paris match and bild reported that the video was recovered from a phone at the wreckage site .



Visual Question Answering (VQA)



Q: Does this foundation have any sunscreen?

A: yes



Q: What is this?

A: 10 euros



Q: What color is this?

A: green



Q: Please can you tell me what this item is?

A: butternut squash red pepper soup



Q: Is it sunny outside?

A: yes



Q: Is this air conditioner on fan, dehumidifier, or air conditioning?

A: air conditioning



Q: What type of pills are these?

A: unsuitable image



Q: What type of soup is this?

A: unsuitable image



Q: Who is this mail for?

A: unanswerable



Q: When is the expiration date?

A: unanswerable



Q: What is this?

A: unanswerable



Q: Can you please tell me what the oven temperature is set to?

A: unanswerable

Visual Question Answering (VQA)



Q: Does this foundation have any sunscreen?
A: yes



Q: What is this?
A: 10 euros



Q: What color is
A: green



Q: What type of soup is this?
A: unsuitable image



Q: What is this?
A: 10 euros



Q: What color is
A: green



Q: What type of pills are these?
A: unsuitable image



Q: What type of soup is this?
A: unsuitable image



Q: Who is this man?
A: unanswerable

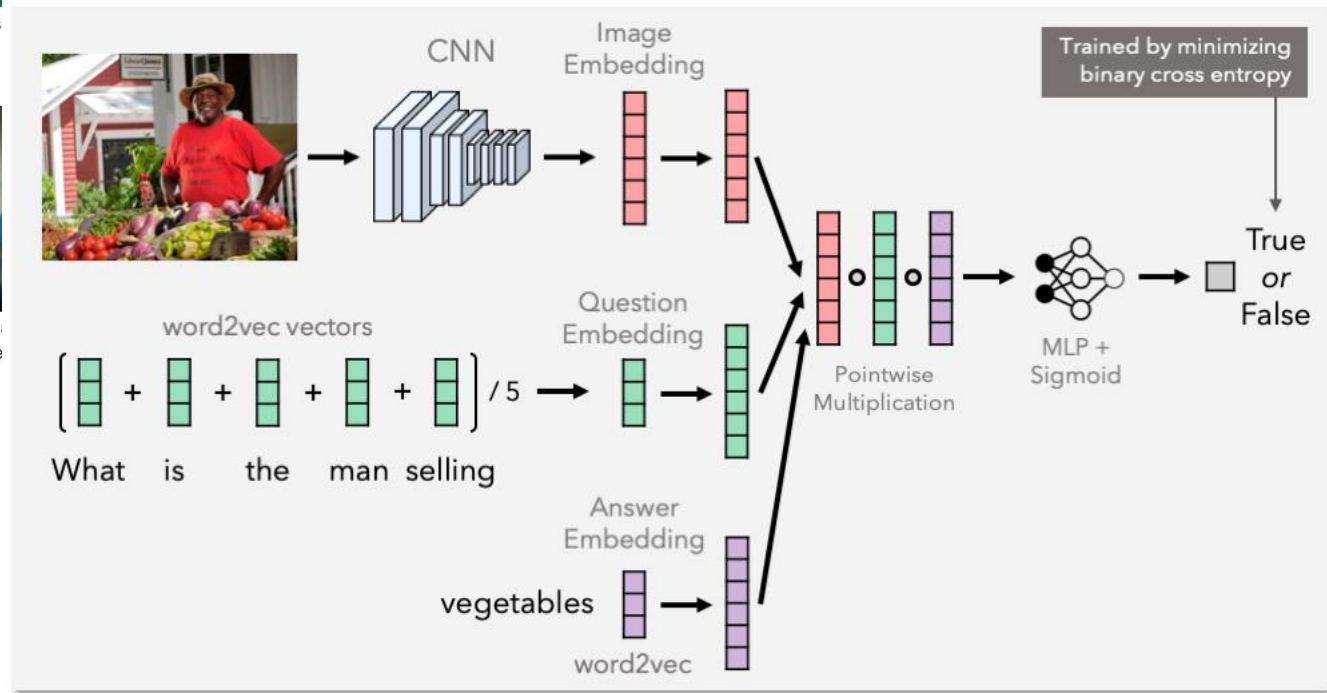


Image Captioning

A young boy is playing basketball.



Two dogs play in the grass.



A dog swims in the water.



A little girl in a pink shirt is swinging.



A group of people walking down a street.



A group of women dressed in formal attire.



Two children play in the water.



A dog jumps over a hurdle.



Text to Image Generation – Dall e

TEXT PROMPT

an illustration of a baby daikon radish in a tutu walking a dog

AI-GENERATED IMAGES



[Edit prompt or view more images ↕](#)

TEXT PROMPT

an armchair in the shape of an avocado [...]

AI-GENERATED IMAGES



[Edit prompt or view more images ↕](#)

TEXT PROMPT

a store front that has the word 'openai' written on it [...]

AI-GENERATED IMAGES



[Edit prompt or view more images ↕](#)

Speech Synthesis

CLOVA Speech Synthesis(CSS)

입력한 텍스트를 자연스러운 목소리로 재생해주는 음성 합성 API입니다

Korean ▾

이용 신청하기

비즈니스 문의

CLOVA Voice

HDTS와 NES 기술로 만든 CLOVA Voice를 체험해보세요

- ☒ 아라
- ☐ 아라(기쁨)
- ☐ 아라(슬픔)
- ☐ 민상
- ☐ 다인(여아)
- ☐ 유인나
- ☐ 오상진

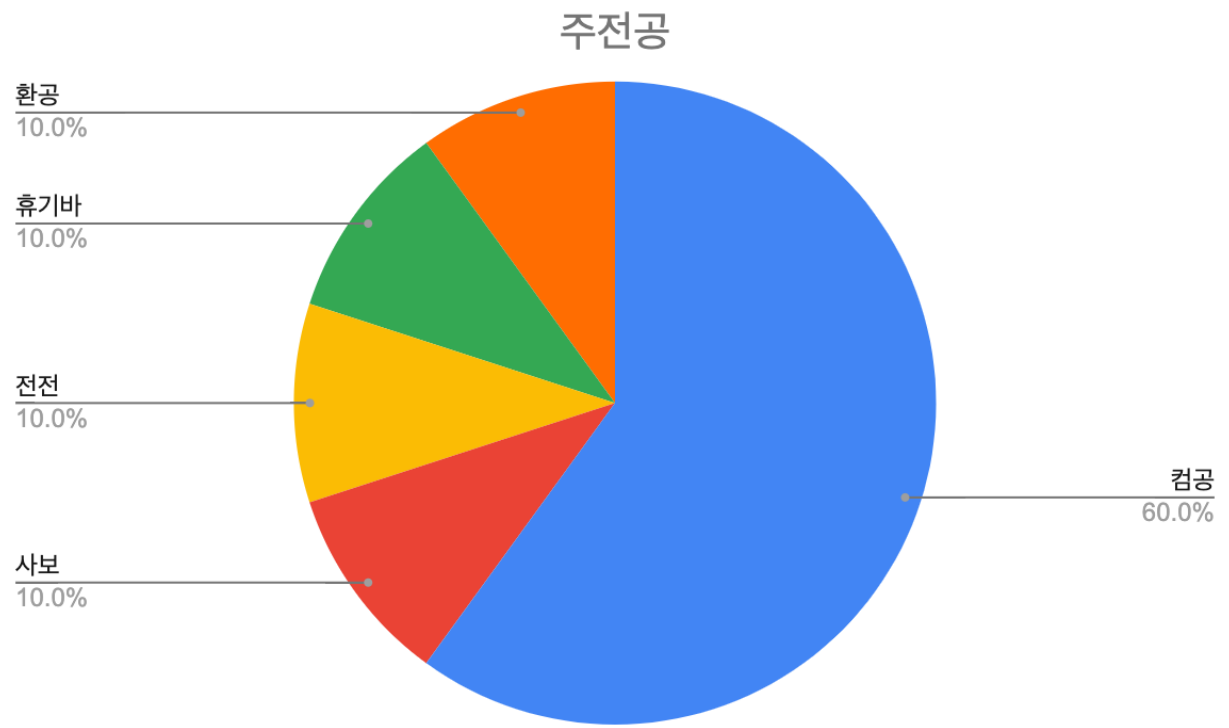


백남준은 미디어 아트의 개척자로서 다양한 테크놀로지를 이용하여 실험적이고 창의적으로 작업했다.

문장 바꾸기

▶ 들어보기

시팀 벳들의 (주)전공 조사



Survey Result

Programming [0-5]			
Python	Numpy	Tensorflow	Pytorch
3.45	2.64	1.91	1.64
중급	초급		

Machine Learning [0-3]							
kNN	SVM	Tree	Ensemble	SGD	CNN	RNN	Transformer
1.27	1.18	1.36	1.27	1.27	1.91	1.36	1.00

CNN 빼고는 ㅏ.ㅏ