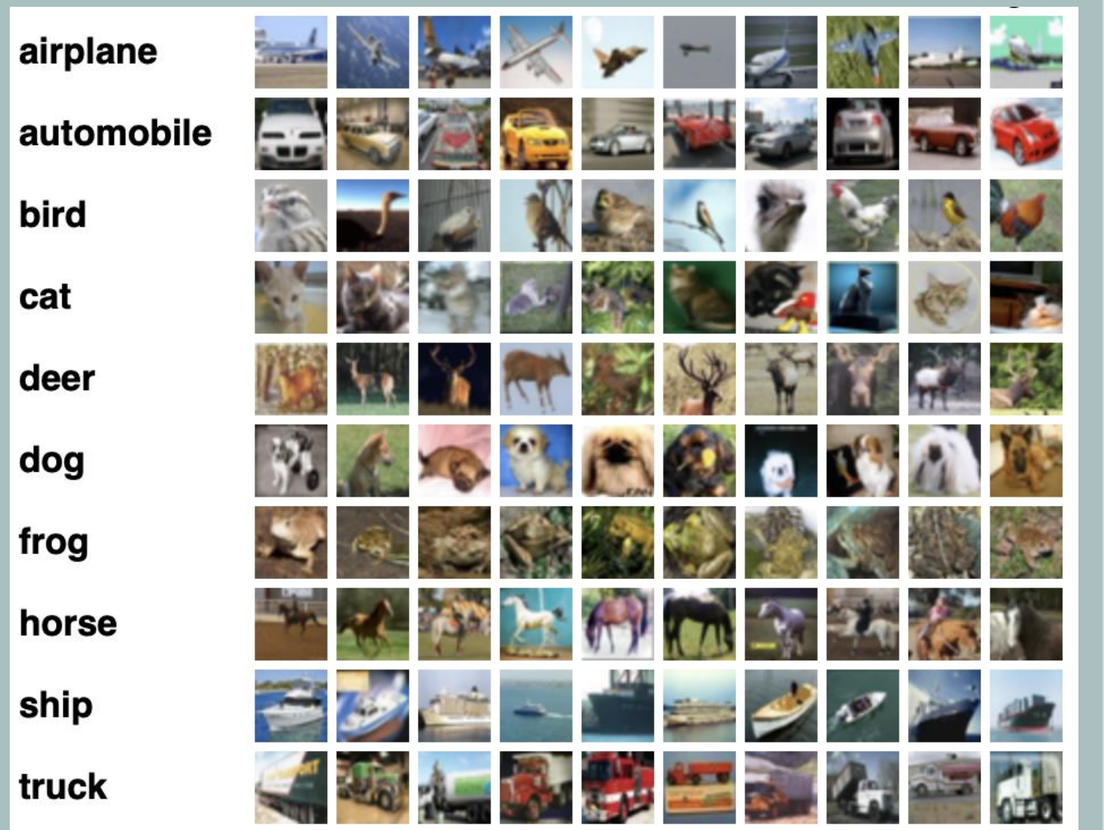
Deep Learning Applications

Week 2

Index

Computer Vision

사람의 시각과 관련한 시스템 구조를 모방하여
컴퓨터도 물체나 상황을 식별하고 해석할 수 있도록
하는 연구 분야



Computer Vision 분야 발전

카메라가 내장된 모바일 기기의 등장으로 사진과 동영상이 기하급수적으로 증가했습니다.

컴퓨터 가격이 저렴해지면서 쉽게 구입할 수 있게 됐습니다.

그리고 컴퓨터 비전 및 분석용으로 설계된 하드웨어가 널리 사용되었습니다.

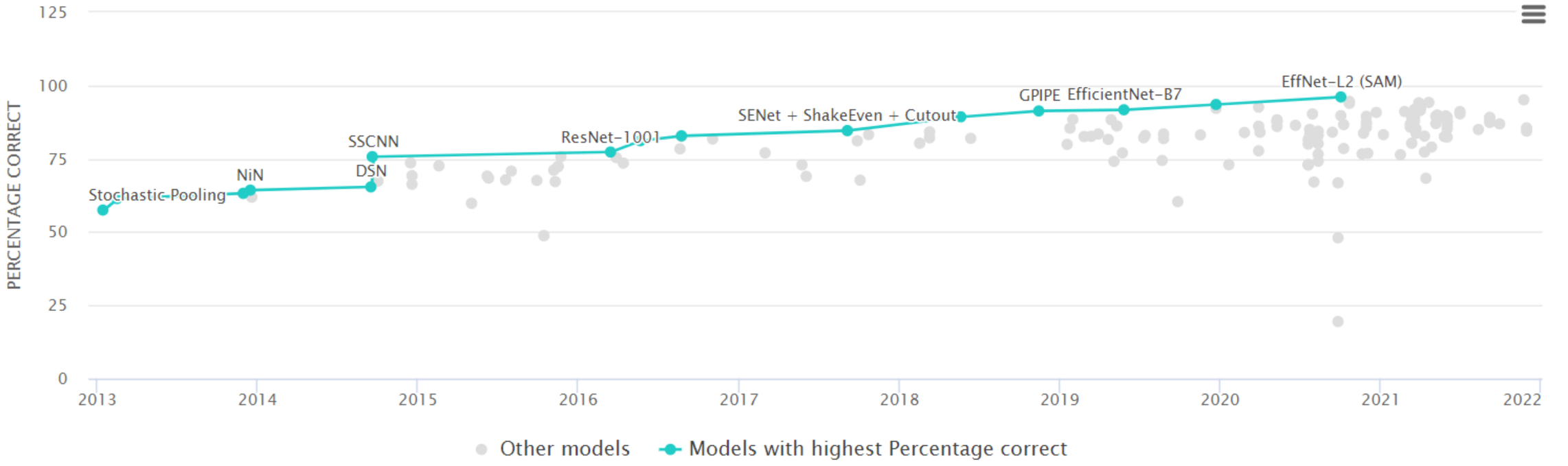
또한 CNN(Convolutional Neural Network) 같은 새로운 알고리즘이 하드웨어 및 소프트웨어 기능을 활용할 수 있게 되었습니다.

Computer Vision 분야 발전

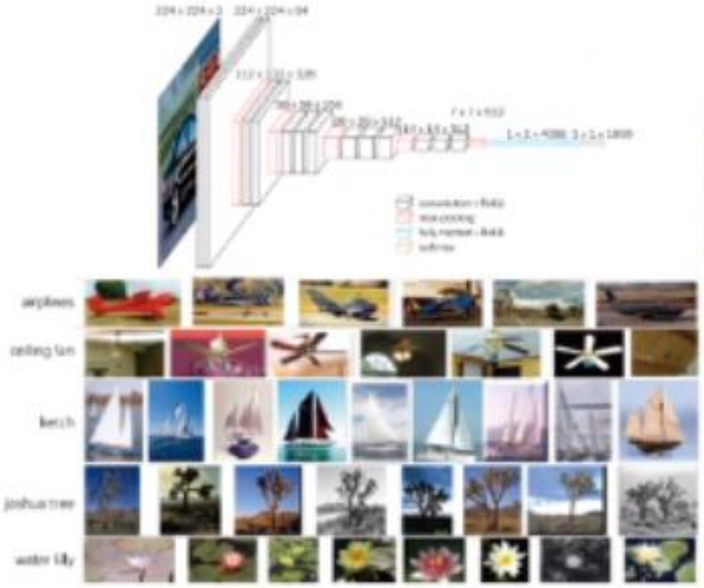
Image Classification on CIFAR-100

Leaderboard Dataset

View Percentage correct by Date for All models

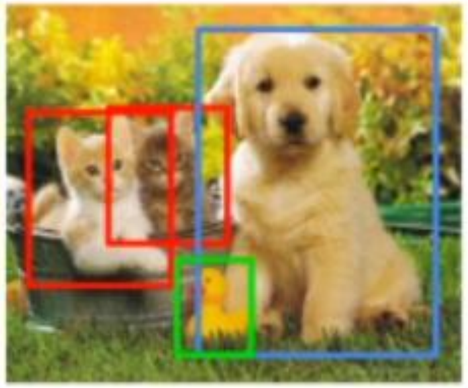


Specific Tasks

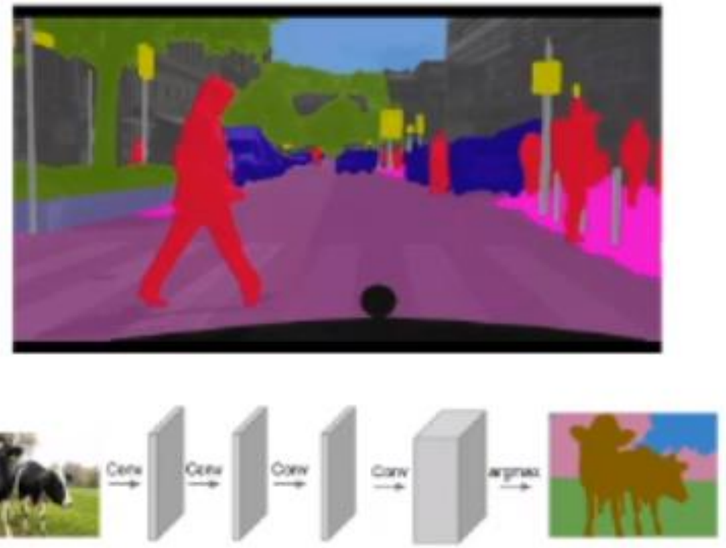


object classification

object localization



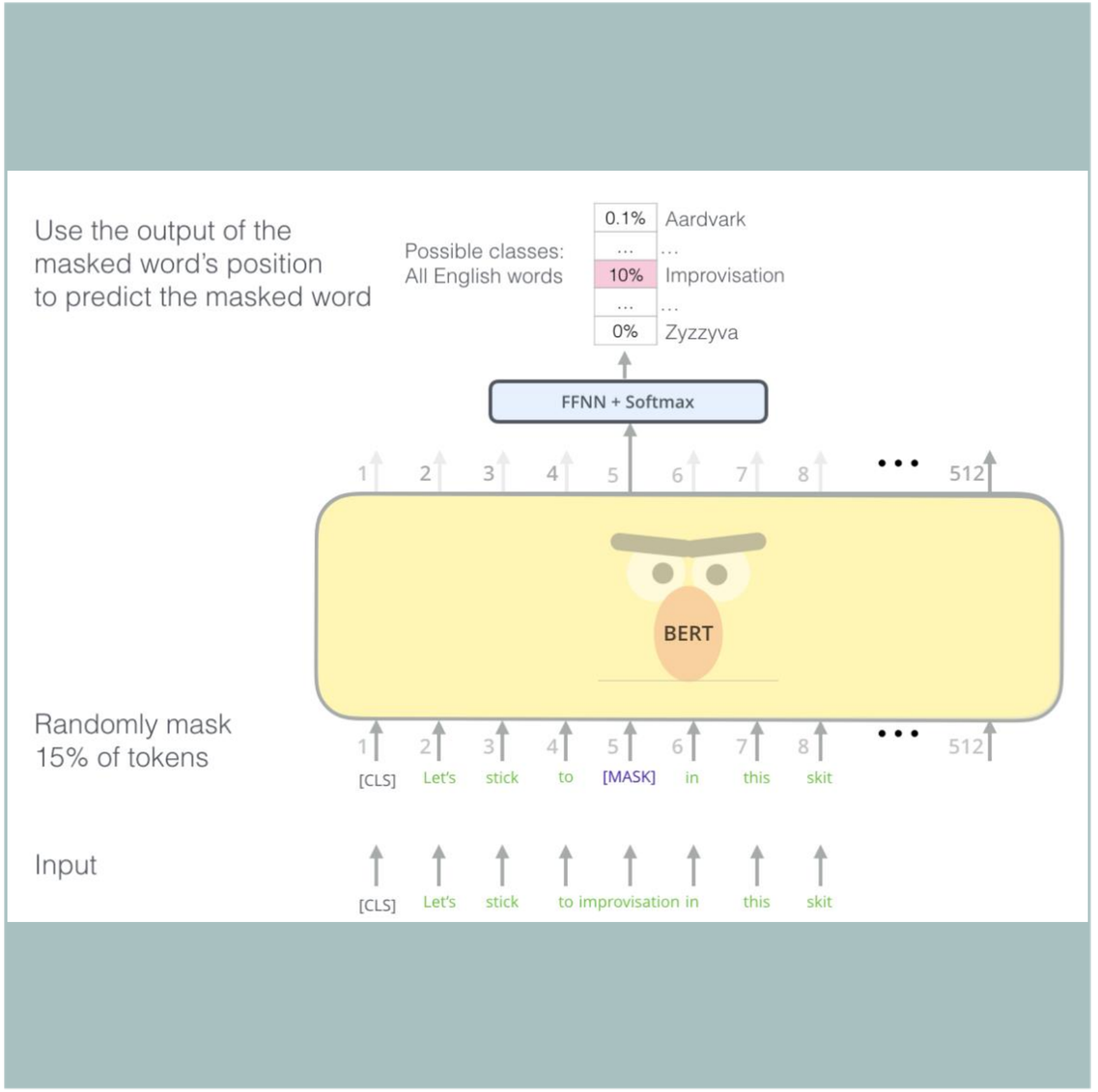
object detection



semantic segmentation
a.k.a. scene understanding

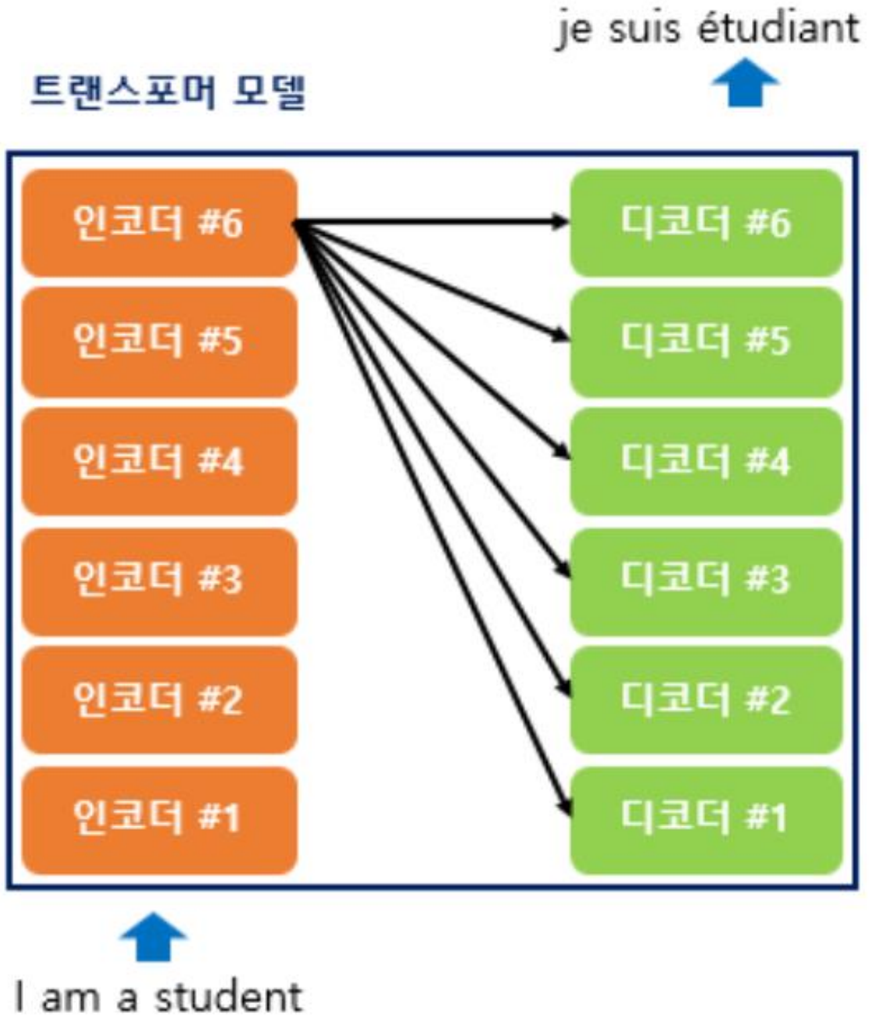
Natural Language Processing

컴퓨터가 인간의 언어를 이해하고 해석하며
조작하도록 돕는 인공지능의 한 분야



Specific Tasks

- **콘텐츠 분류(Content categorization)**. 언어 기반의 문서 요약 기술로, 검색과 색인, 콘텐츠 알림 복사 감지 등에 사용됩니다..
- **주제 발견 및 모델링(Topic discovery and modeling).** 텍스트 집합에서 의미와 주제를 정확히 포착하고, 최적화나 예측과 같은 고급 분석을 텍스트에 적용합니다.
- **맥락 추출(Contextual extraction).** 텍스트 기반 소스에서 정형 정보를 자동으로 추출합니다.
- **감정 분석(Sentiment analysis).** 대량의 텍스트에서 분위기나 주관적인 의견을 파악합니다. 일반적인 감정 및 감성 분석이 이에 해당합니다. .
- **음성-텍스트(STT) 변환 및 텍스트-음성(TTS) 변환(Speech-to-text and text-to-speech conversion).** Trans음성 명령을 문자 텍스트로 변환하거나 문자 텍스트를 음성 명령으로 변환합니다..
- **문서 요약(Document summarization).** 많은 양의 본문을 자동으로 요약합니다.
- **머신 분석(Machine translation).** 텍스트나 음성을 한 언어에서 다른 언어로 자동 번역합니다.



Specific Tasks

Sentiment Analysis

<Data Sample>

lend some dignity to a dumb story 0

the greatest musicians 1

cold movie 0

with his usual intelligence and subtlety 1

redundant concept 0

Summarization

<input>

marouane fellaini and adnan januzaj continue to show the world they are not just teammates but also best mat es. the manchester united and belgium duo both posted pictures of themselves out at a restaurant on monday night ahead of their game against newcastle on wednesday . januzaj poses in the middle of fellaini and a friend looking like somebody who failed to receive the memo about it being a jackson 5 themed night. premier league duo adnan januzaj and marouane fellaini pose with a friend on the dance floor . manchester united and belgiu m duo fellaini and januzaj are good friends both on and off the pitch . manchester united ace fellaini runs over to the bench to celebrate his goal against qpr with friend januzaj . the disco effect in the background adds to th e theory, but januzaj doesn't seem to mind as they later pose on the dance floor with other friends. united hav en't had too many reasons to have a song and dance this season so it seems they may be hitting the discotheq ues as another form of release. however, victory against newcastle on wednesday would leave manager louis v an gaal at least tapping his toes as they continue to fight for a champions league spot this season. januzaj and r obin van persie join fellaini in celebrating in front of the manchester united fans at west brom . januzaj receives some words of wisdom from manchester united's dutch manager louis van gaal . januzaj and fellaini are joined by some friends as they take to the dance floor ahead of the newcastle game .

<summary>

the belgian duo took to the dance floor on monday night with some friends. manchester united face newcastle in the premier league on wednesday . red devils will be looking for just their second league away win in seven . louis van gaal's side currently sit two points clear of liverpool in fourth .

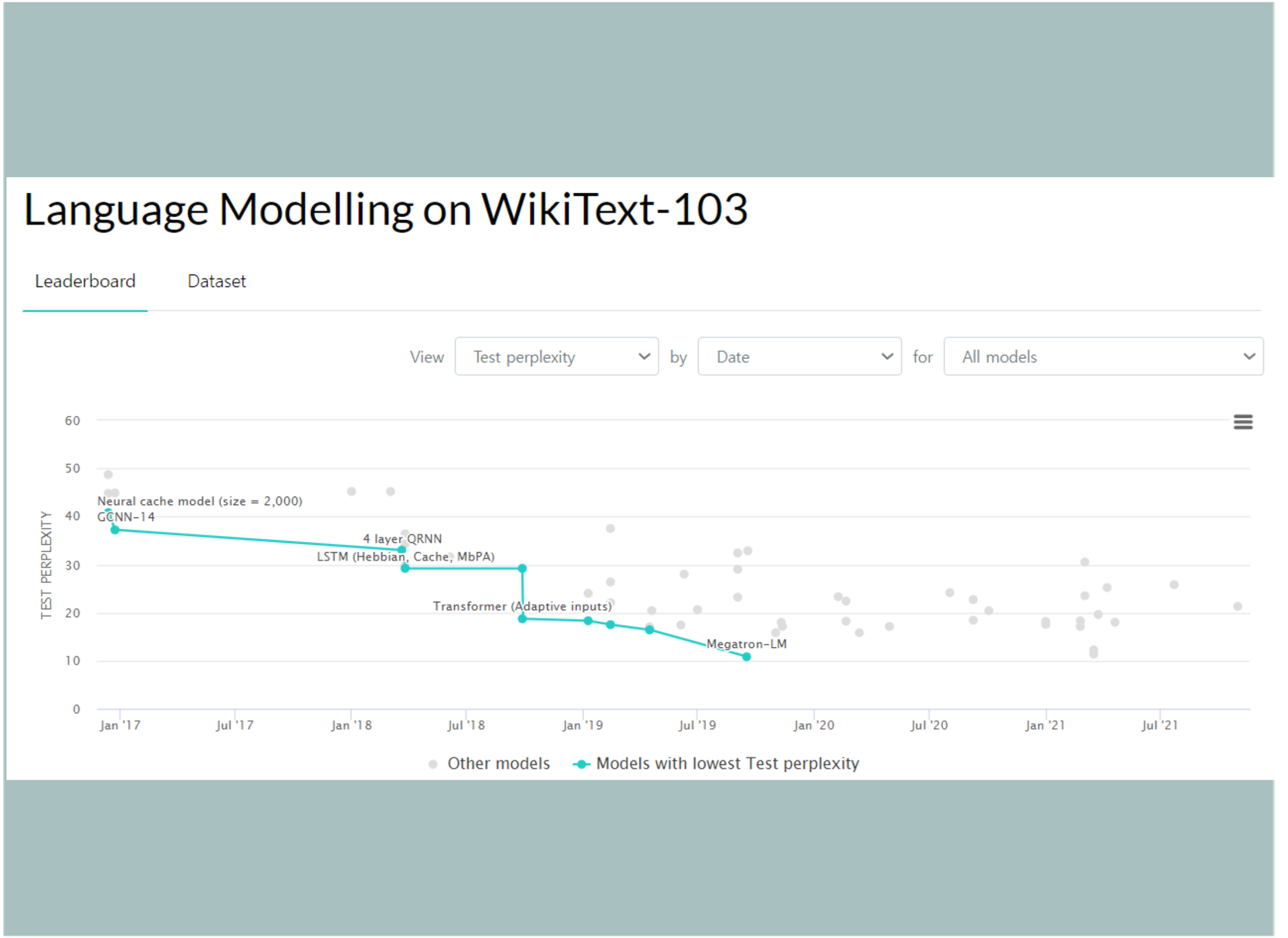
Question Answering

Context: Hyperbaric (high-
pressure) medicine uses special oxygen chambers to increase the partial pressure of O 2 around the pati ent and, when needed, the medical staff. Carbon monoxide poisoning, gas gangrene, and decompressio n sickness (the 'bends')are sometimes treated using these devices. Increased O 2 concentration in the lu ngs helps to displace carbon monoxide from the heme group of hemoglobin. Oxygen gas is poisonous to the anaerobic bacteria that cause gas gangrene, so increasing its partial pressure helps kill them. Deco mpression sickness occurs in divers who decompress too quickly after a dive, resulting in bubbles of iner t gas, mostly nitrogen and helium, forming in their blood. Increasing the pressure of O 2 as soon as possi ble is part of the treatment.

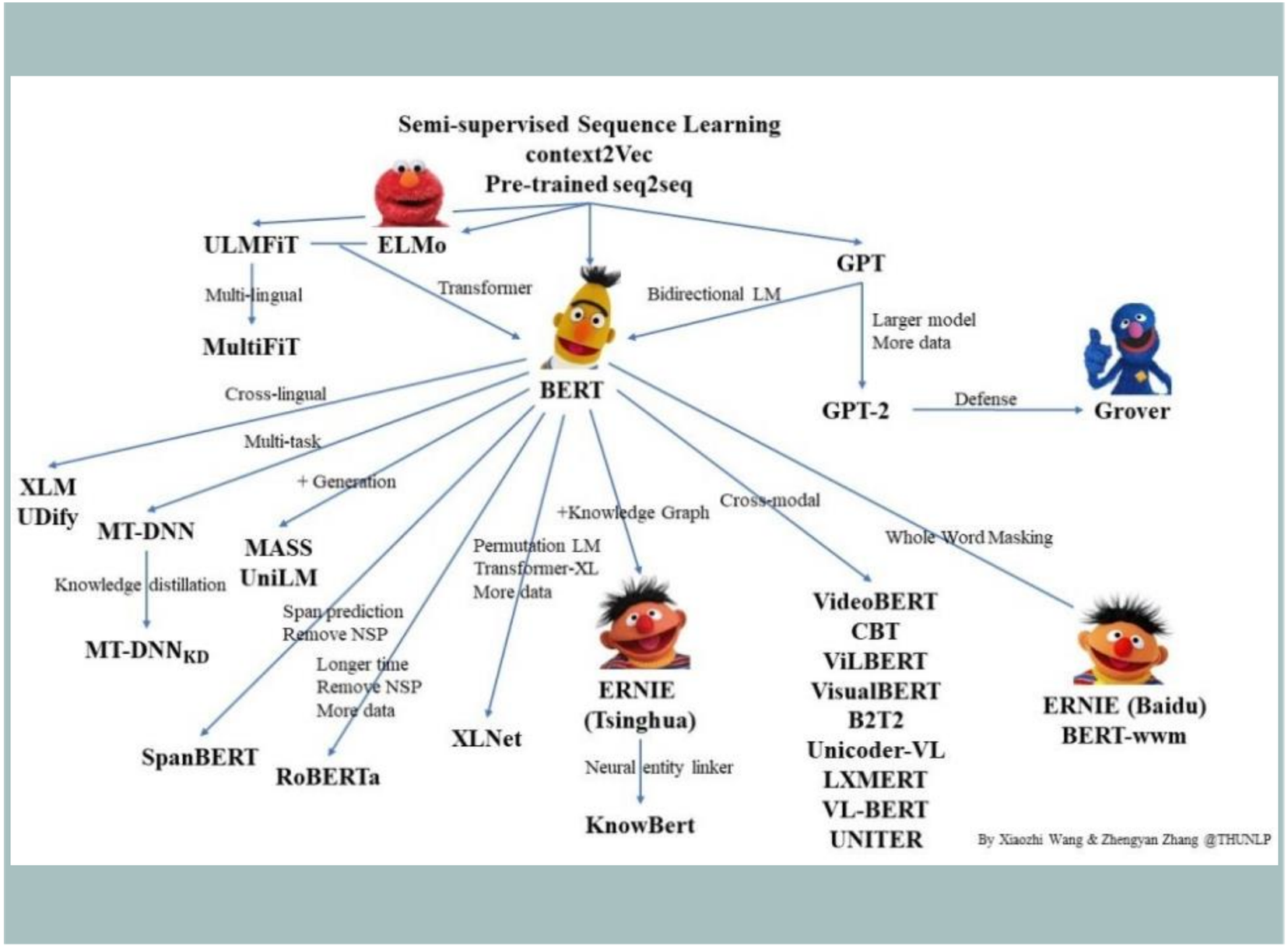
Question: What does increased oxygen concentrations in the patient's lungs displace?

target: carbon monoxide

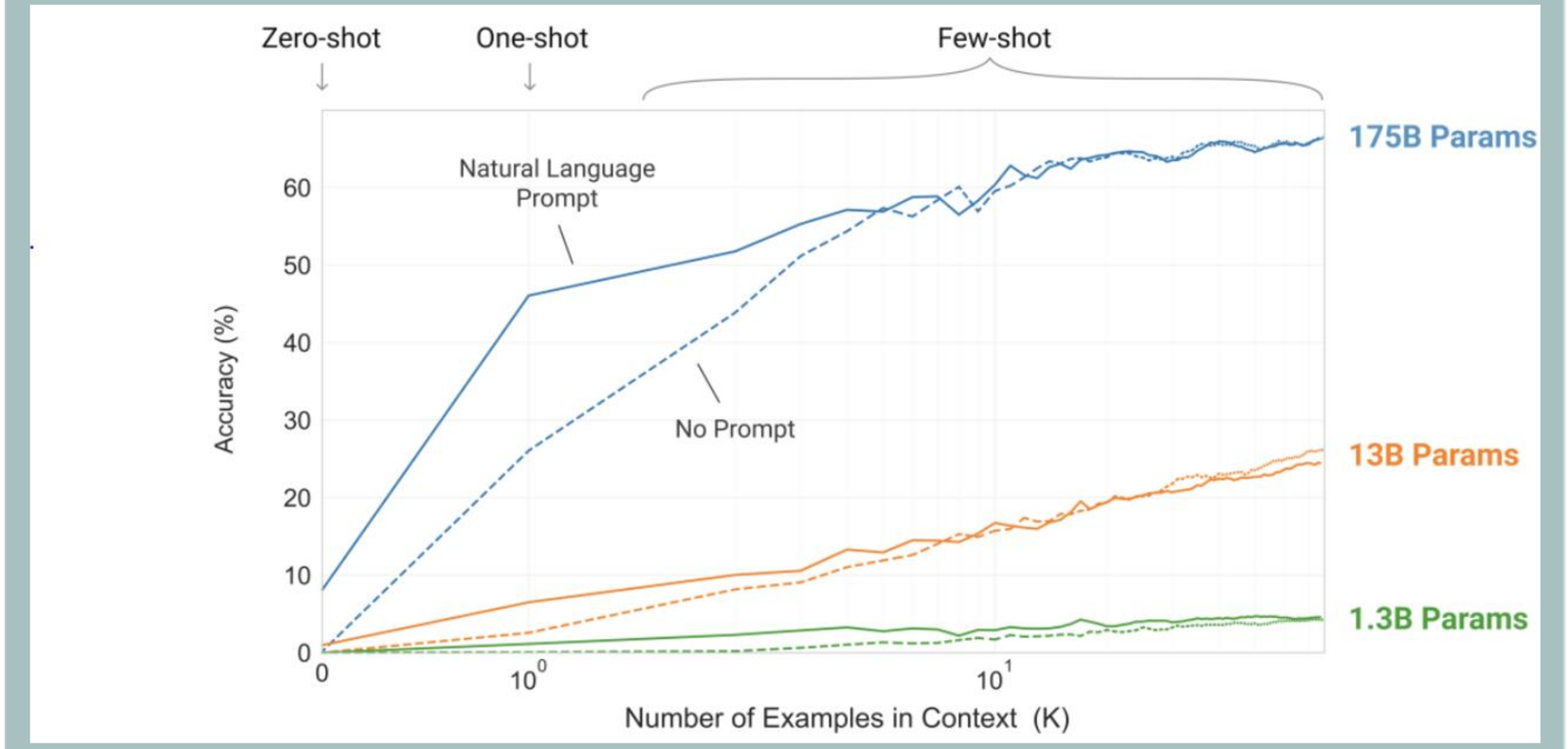
자연어처리 현황


Language Modelling on WikiText-103
Leaderboard
Dataset
View
Test perplexity
by
Date
for
All models
TEST PERPLEXITY
60
50
40
30
20
10
0
Neural cache model (size = 2,000)
GCNN-14
4 layer QRNN
LSTM (Hebbian, Cache, MbPA)
Transformer (Adaptive inputs)
Megatron-LM
Jan '17
Jul '17
Jan '18
Jul '18
Jan '19
Jul '19
Jan '20
Jul '20
Jan '21
Jul '21
Other models
Models with lowest Test perplexity

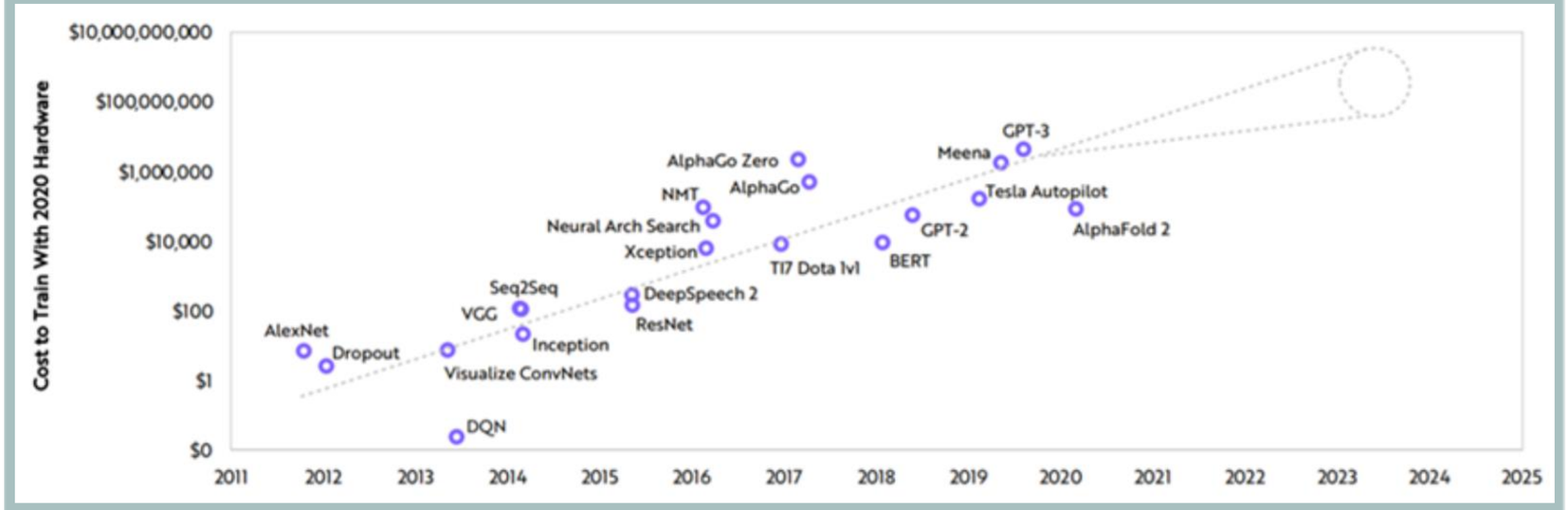
Transformer



자연어처리 현황

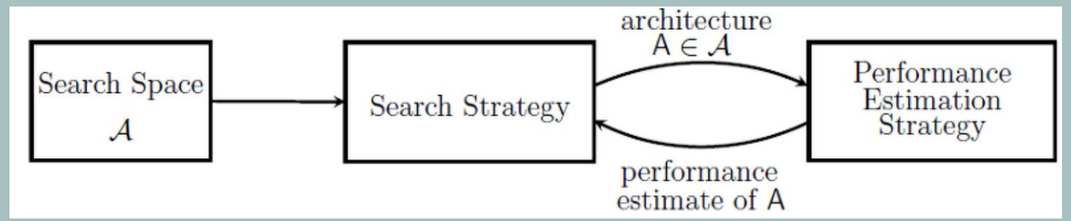

Zero-shot
One-shot
Few-shot
Natural Language
Prompt
No Prompt
175B Params
13B Params
1.3B Params
Accuracy (%)
0
10
20
30
40
50
60
0
10^0
10^1
Number of Examples in Context (K)

자연어처리 현황

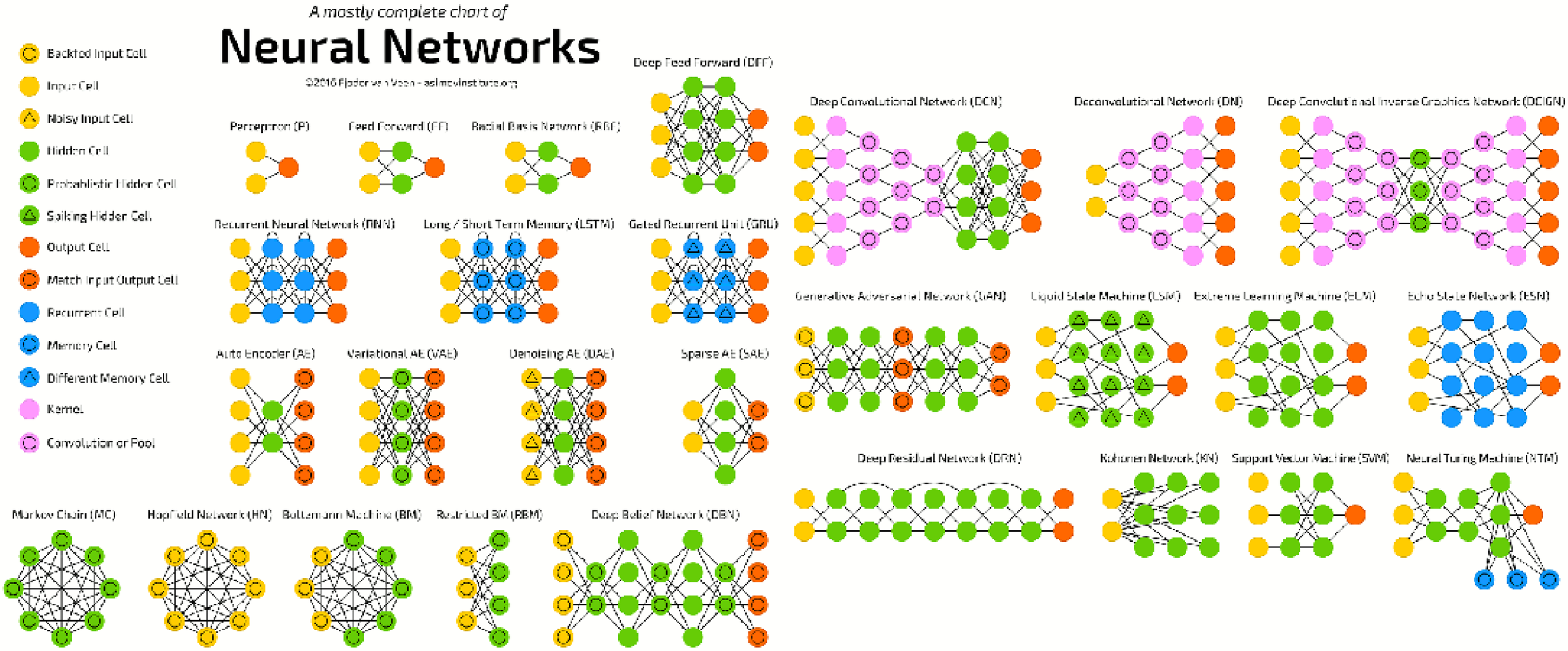

Cost to Train With 2020 Hardware
$10,000,000,000
$100,000,000
$1,000,000
$10,000
$100
$1
$0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
AlexNet
Dropout
Visualize ConvNets
DQN
Seq2Seq
VGG
Inception
DeepSpeech 2
ResNet
Neural Arch Search
Xception
NMT
AlphaGo Zero
AlphaGo
TI7 Dota lvl
BERT
GPT-2
Meena
GPT-3
Tesla Autopilot
AlphaFold 2

Neural Architecture Search

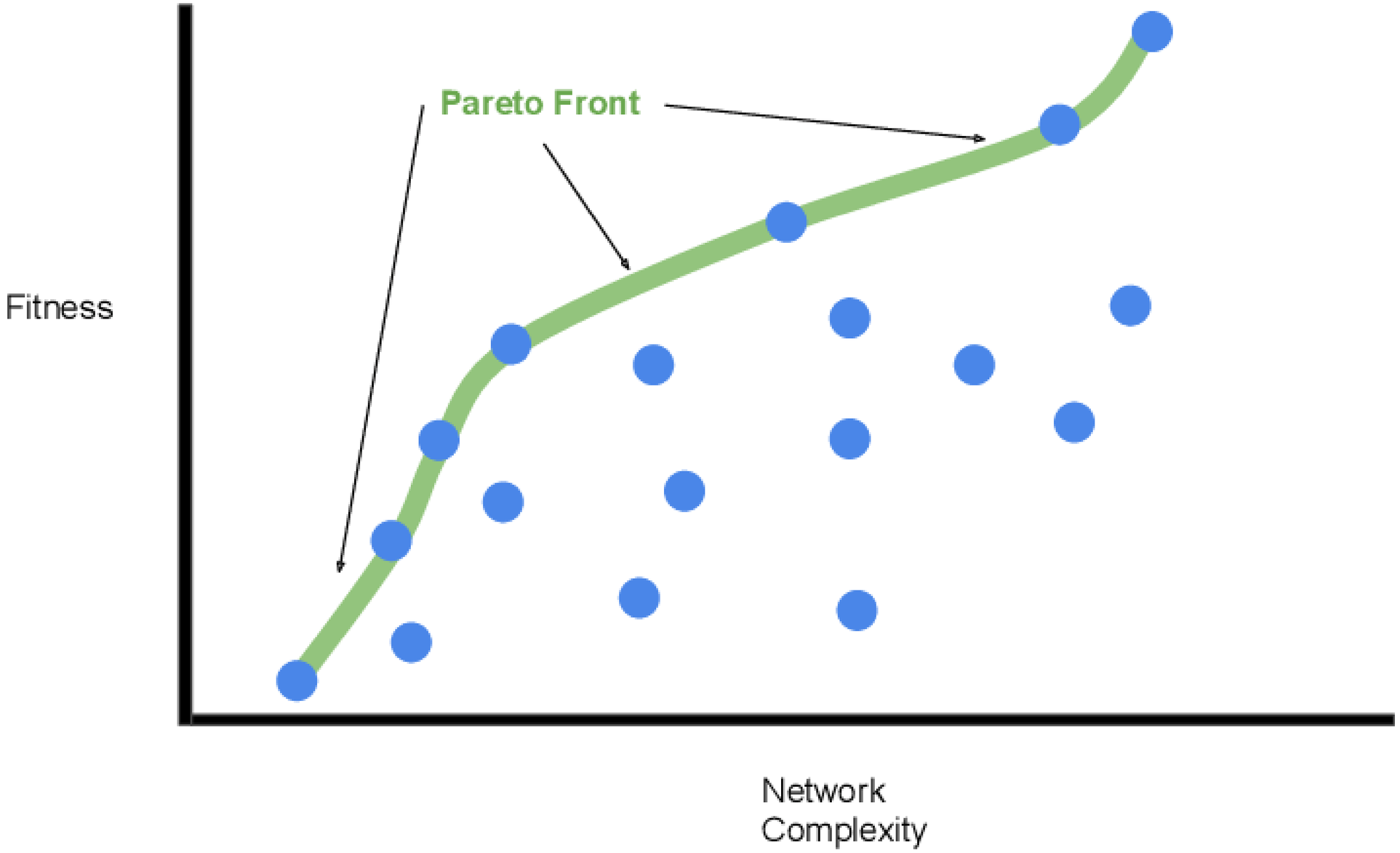
기계 학습 분야에서 널리 사용되는 모델인 인공 신경망 설계를 자동화하는 기술



Specific Tasks



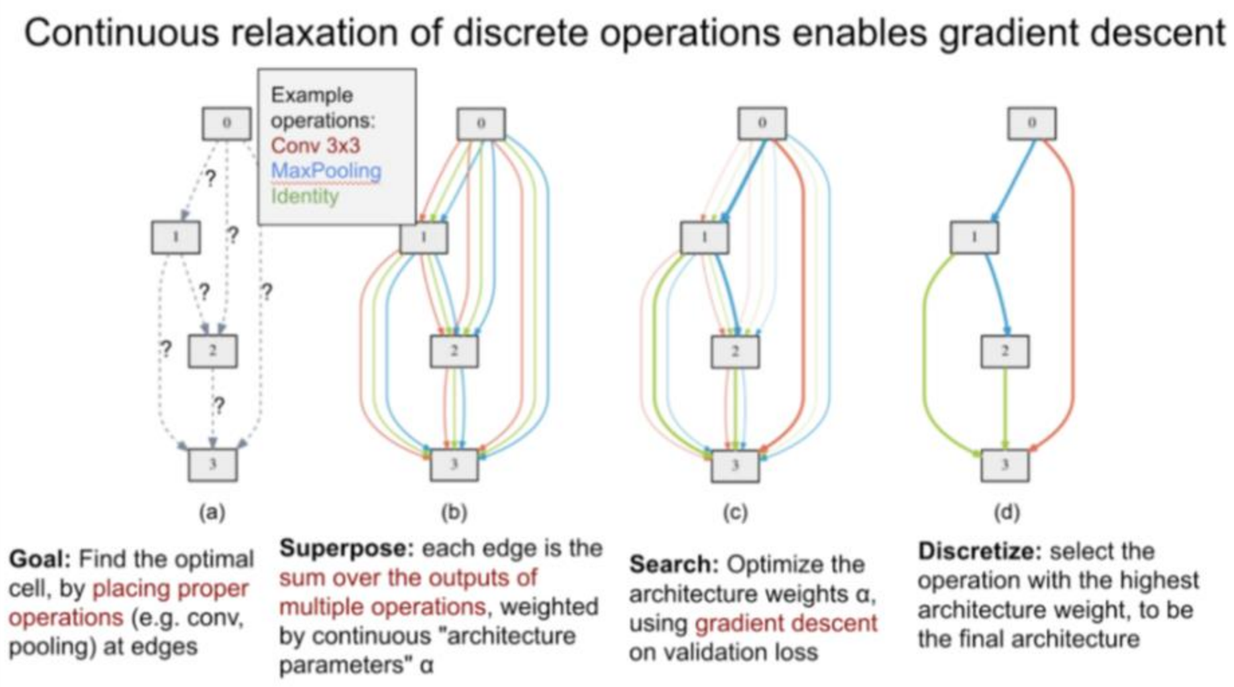
Specific Tasks



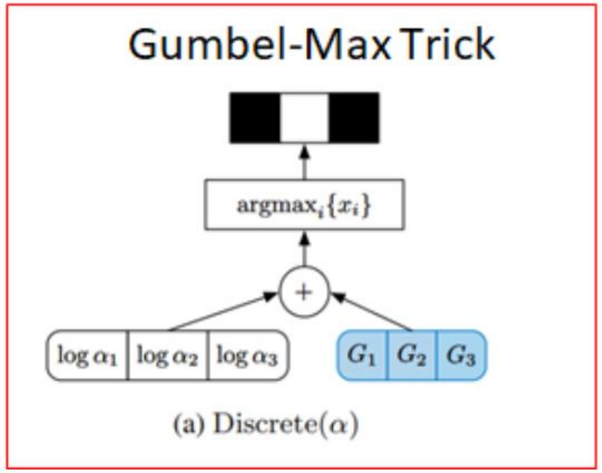
Specific Tasks

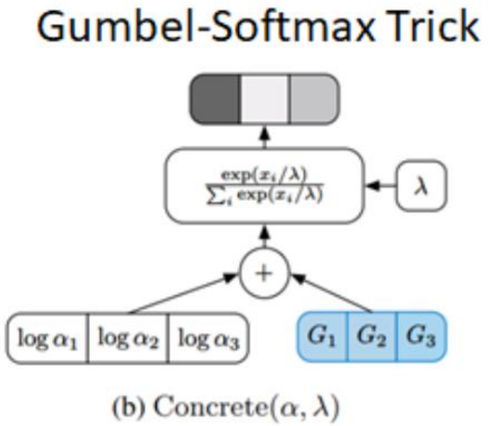
DARTS uses a “continuous relaxation” to enable gradient descent on architecture parameters

The steps to find the optimal cell are summarized in the figure below:



Schematic of the DARTS continuous relaxation and discretization methods.



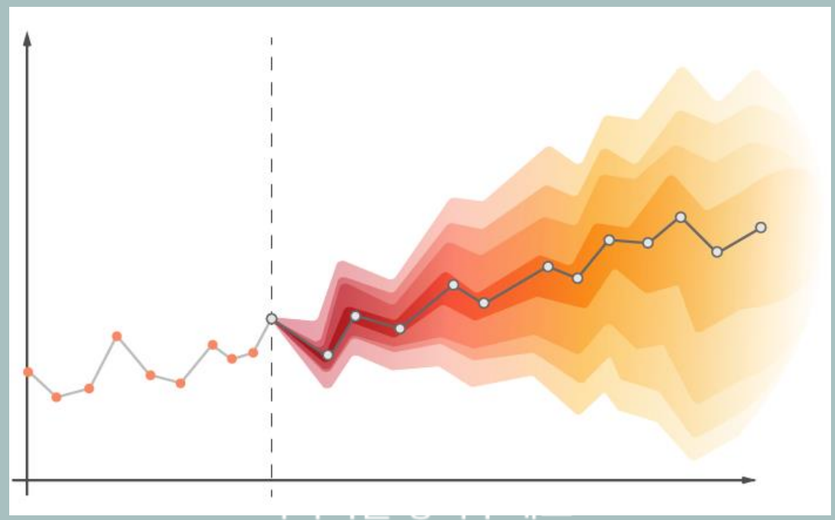


Discrete derivative

Definition

The term **discrete derivative** is a loosely used term to describe discrete. The idea is typically to define this as a difference quoti which is defined as a limit of a difference quotient.

Time Series & Network Analysis



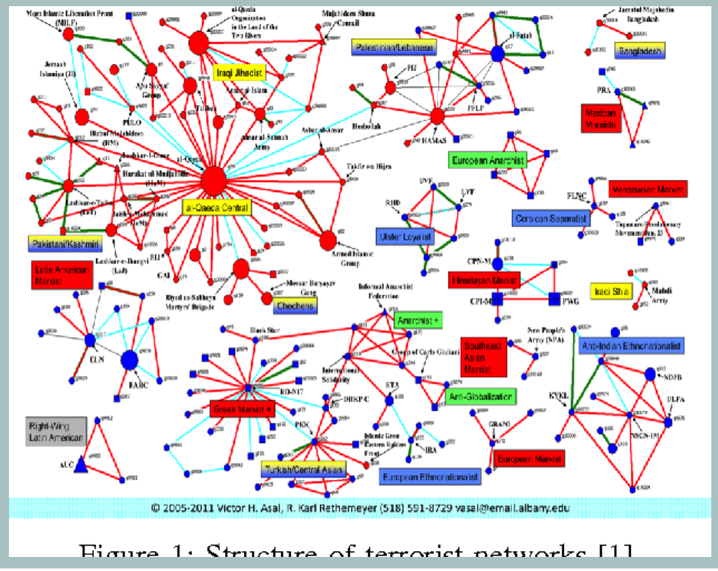
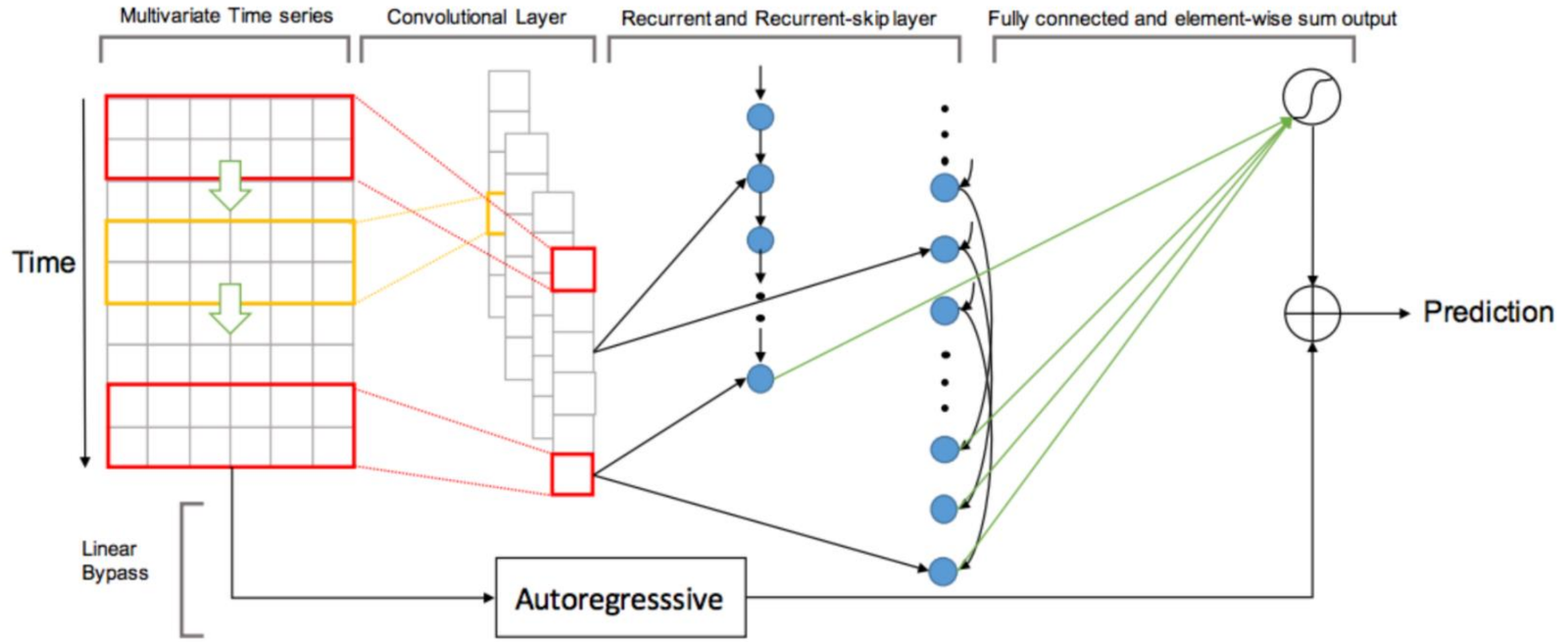
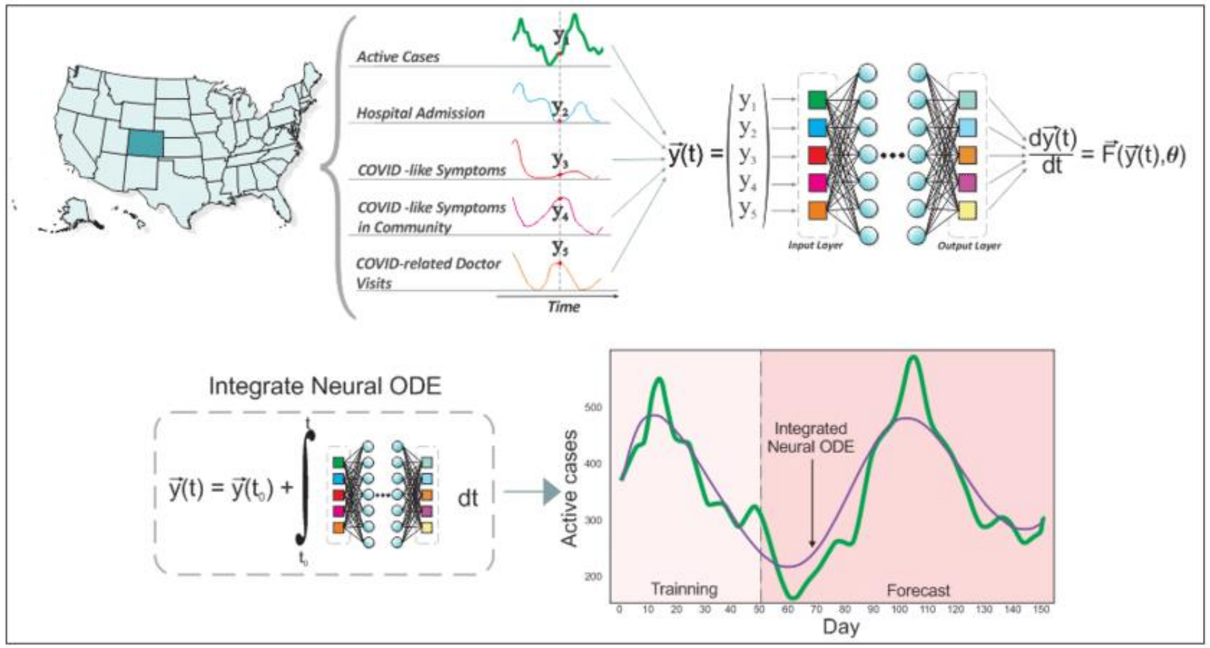


Figure 1: Structure of terrorist networks [1]

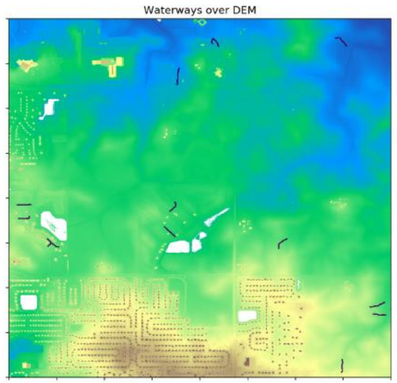
Specific Tasks

- Dynamics with Auto-correlations
- Neural ODEs
- Spatial Process





Separate Worlds

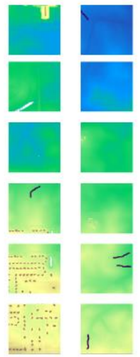


Geospatial Data

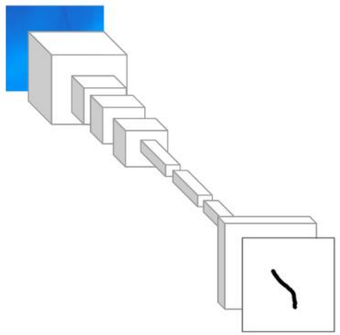
Ad hoc Processing

Ad hoc Processing

Ad hoc Processing

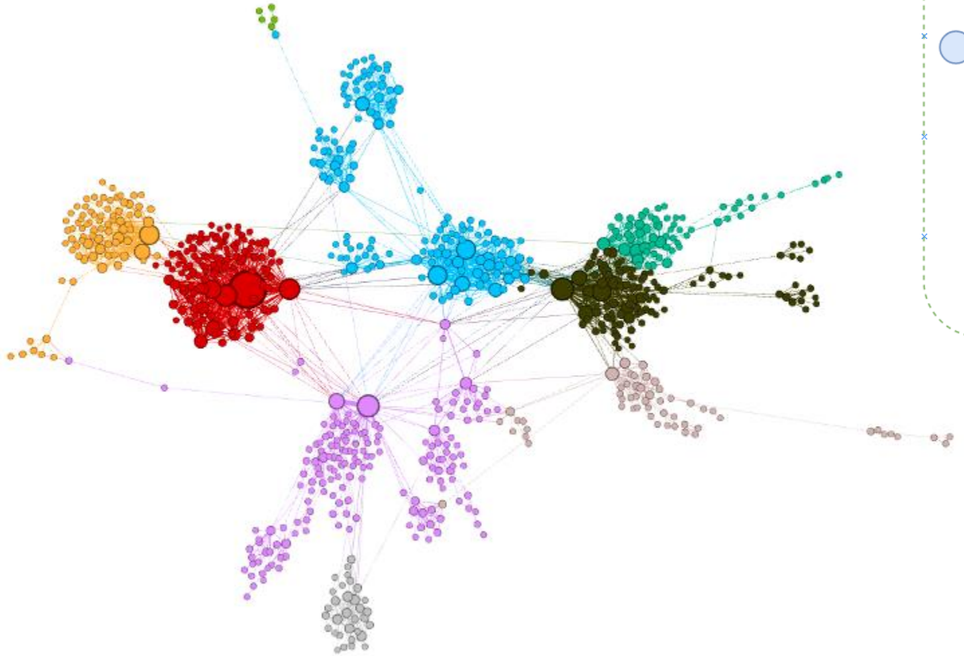


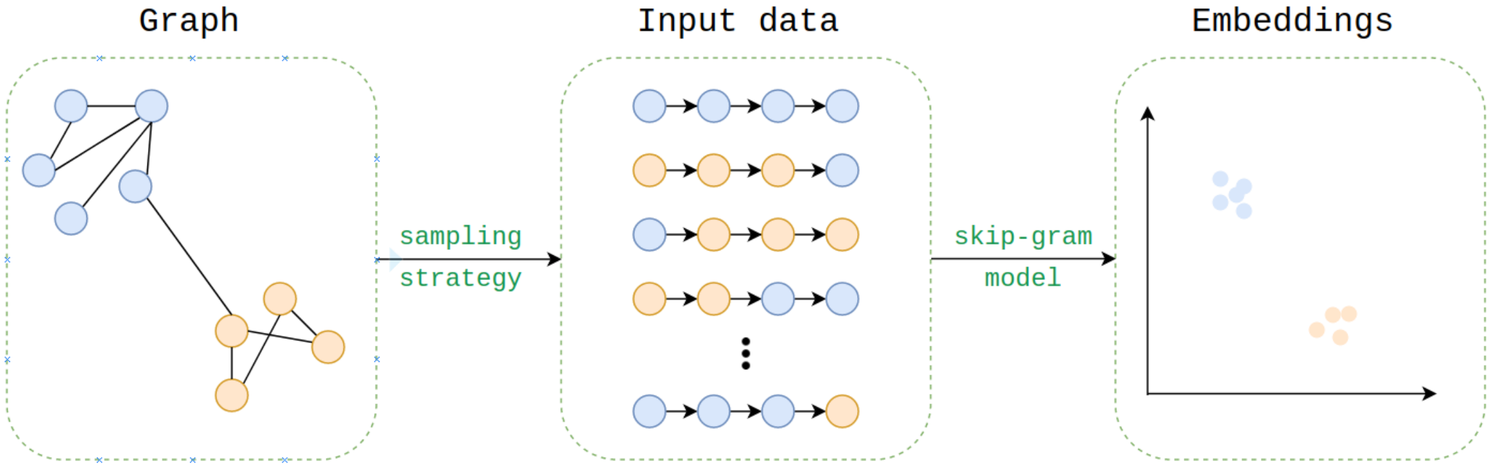
Samples

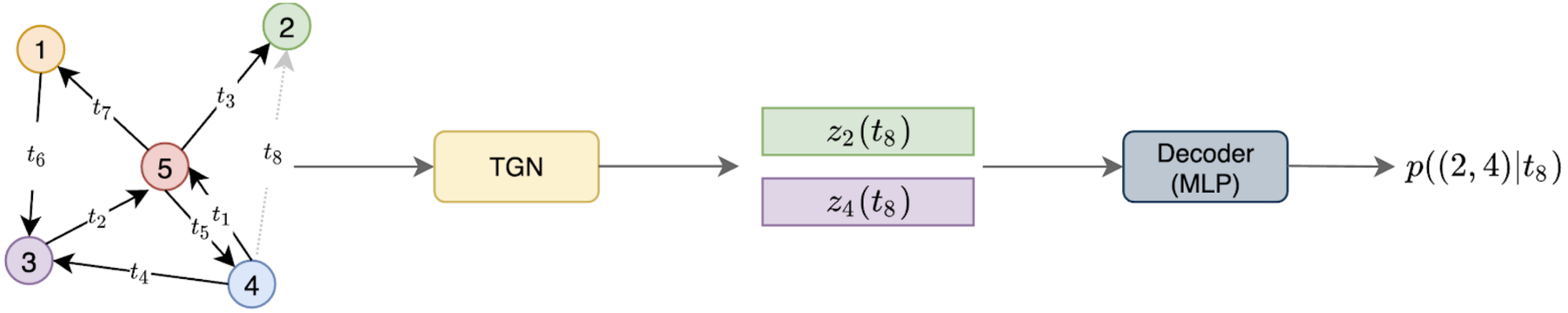


Deep Learning Model

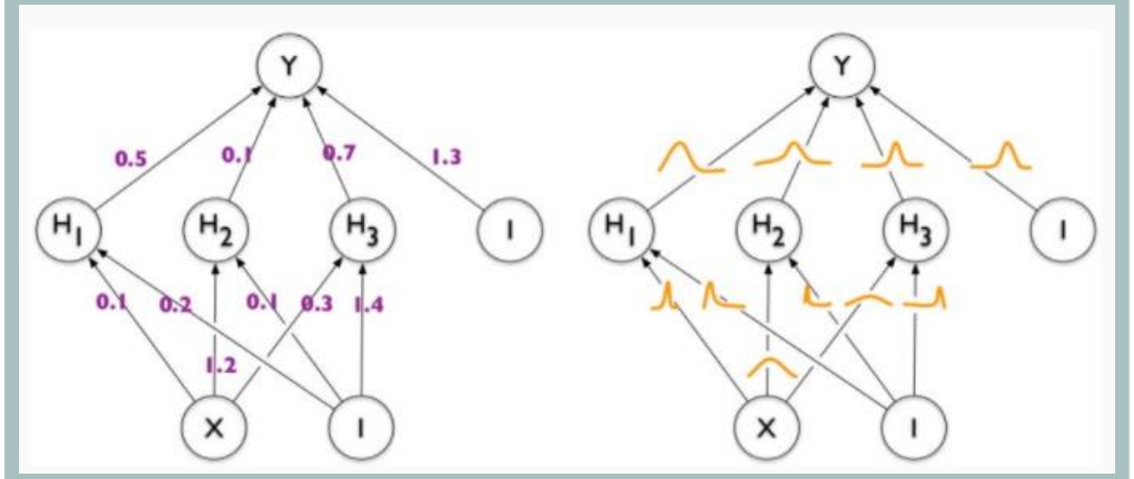
Specific Tasks



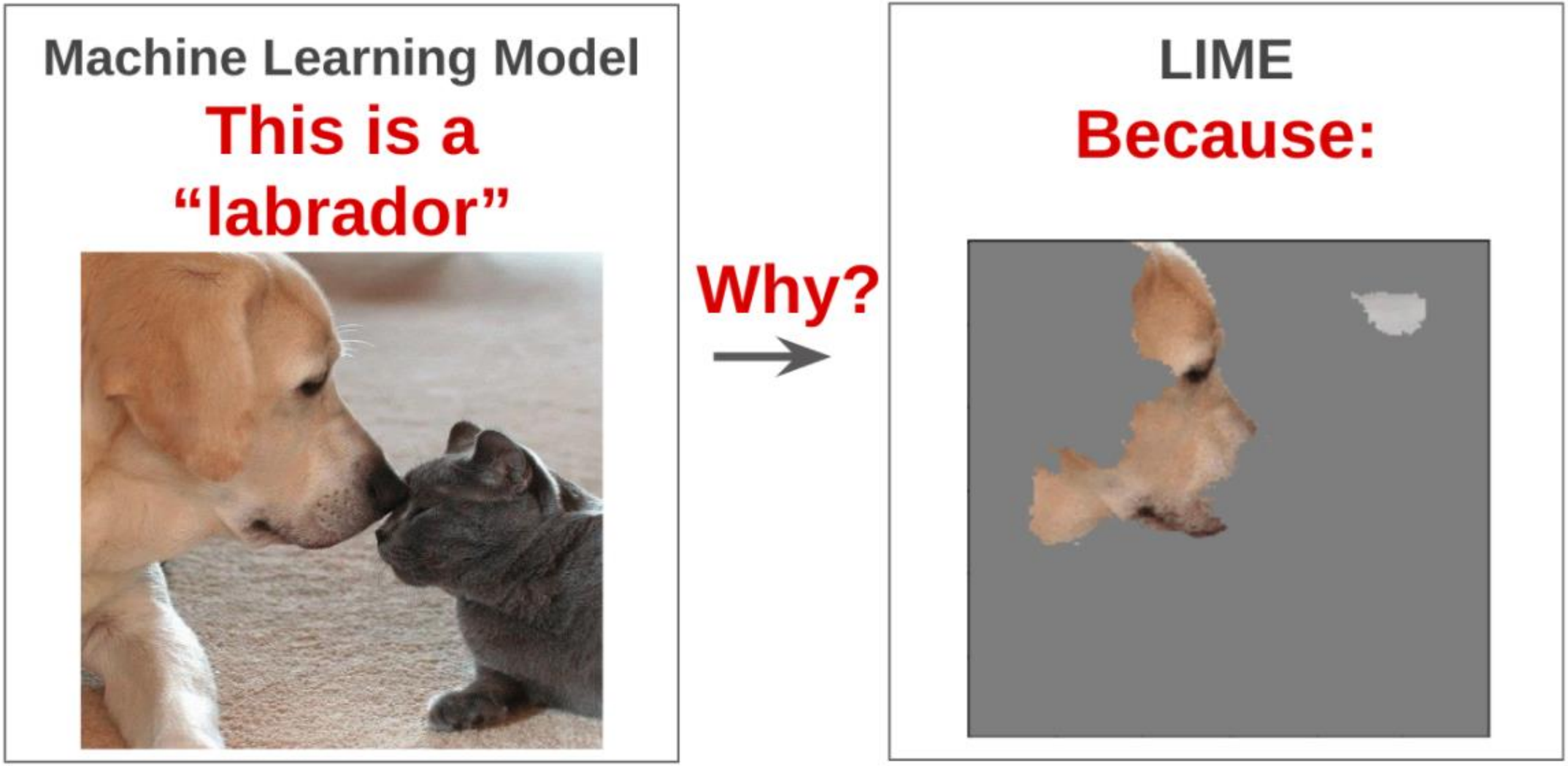




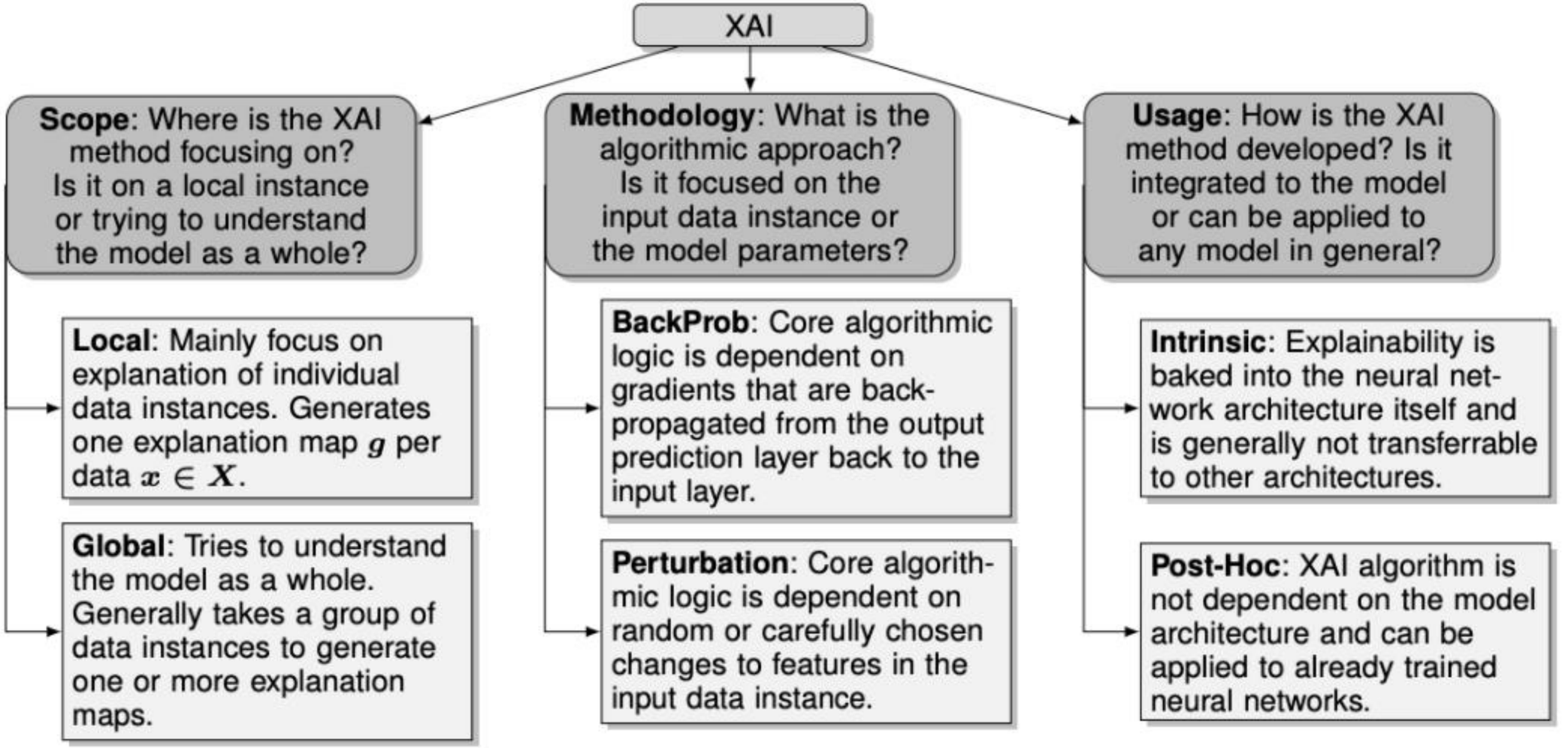
XAI(eXplainable Artificial Intelligence)
UAI(Uncertainty Artificial Integlligence)



Specific Tasks



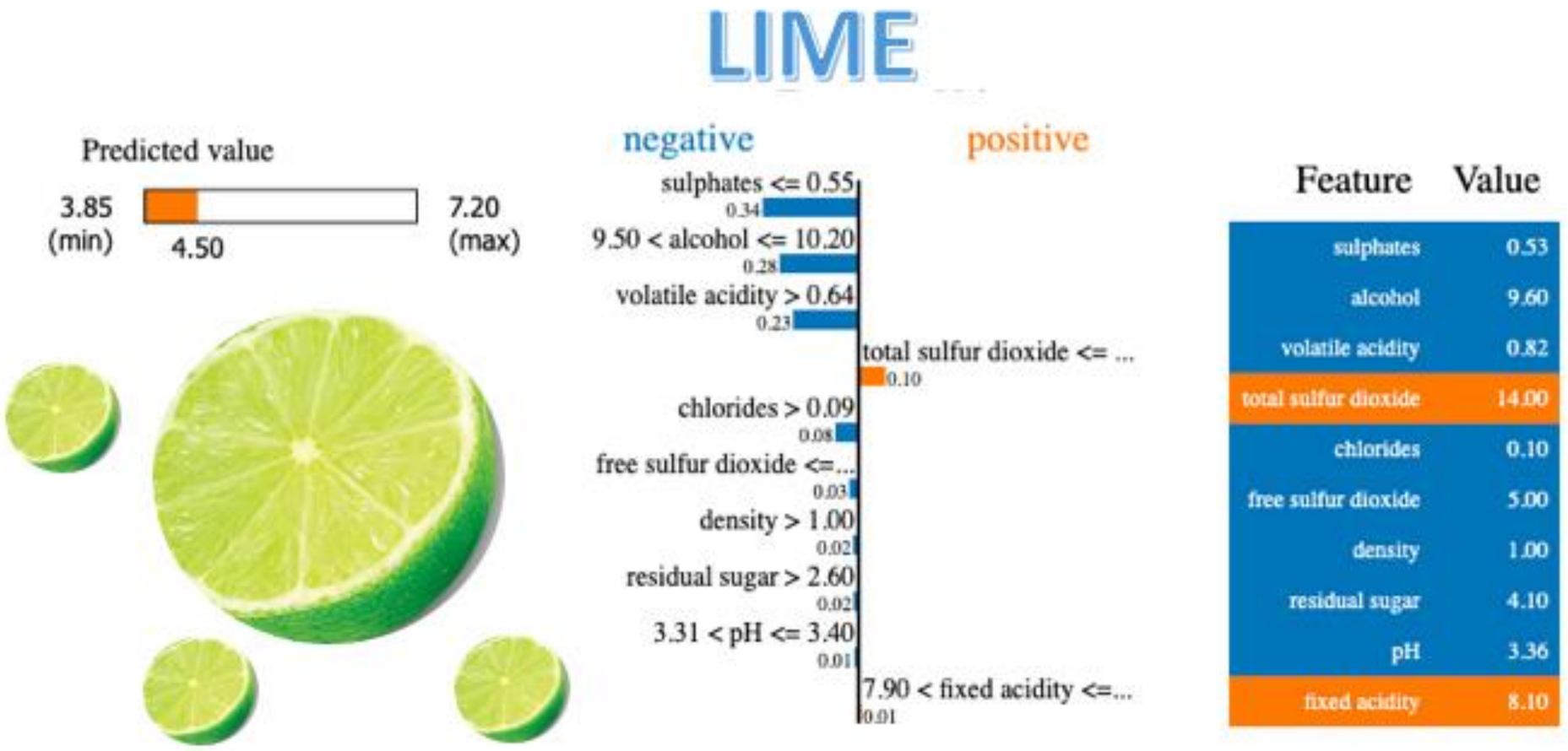
Specific Tasks



Specific Tasks

설명 가능한 모델 구축	심층 설명 학습	- 변형된 딥러닝 기술로서 심층 신경망이 설명 가능한 특징들을 학습하도록 하는 기술 - 은닉계층의 노드가 의미 있는 속성을 나타내도록 학습
	해석 가능한 모델	- 구조화된, 해석 가능한 인과관계 모델을 구축하는 연구 - BPL(bayesian program learning)을 이용한 것으로 모델을 작은 조각들의 조합으로 표현 하도록 학습하는 방법
	모델 귀납	- 임의의 블랙박스 모델을 설명 가능한 모델로 추론하는 기술 - LIME (local interpretable model-agnostic explanations)이 대표적 방법 > 임의의 블랙박스 모델을 이미 설명이 가능한 데이터 주변에서 희소 선형 결합을 통해 국부적으로 설명 가능 하게 만드는 방법
이유 설명 인터페이스		- 모델의 의사결정에 대한 설명을 사용자가 이해할 수 있는 방식으로 표현하는 연구 - 원칙 1) 설명가능성 : 구체적 항목으로는 제시한 설명이 반복적일 것, 필요한 설명을 모두 포함하고 있을 것, 불필요한 설명을 포함하지 않을 것, 양이 적절할 것 2) 정정가능성 :설명이 유동적일 것, 사용자의 피드백을 존중할 것, 점진적인 변화를 주시할 것 등이 포함

Specific Tasks



Specific Tasks

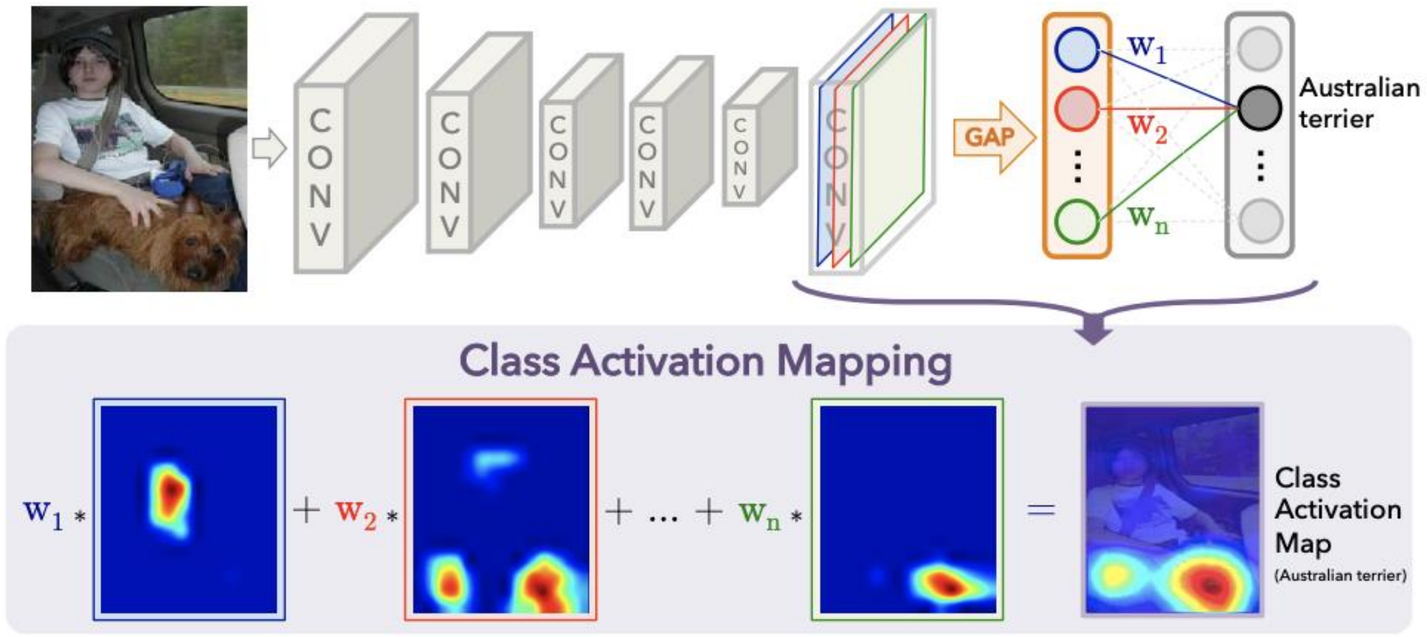
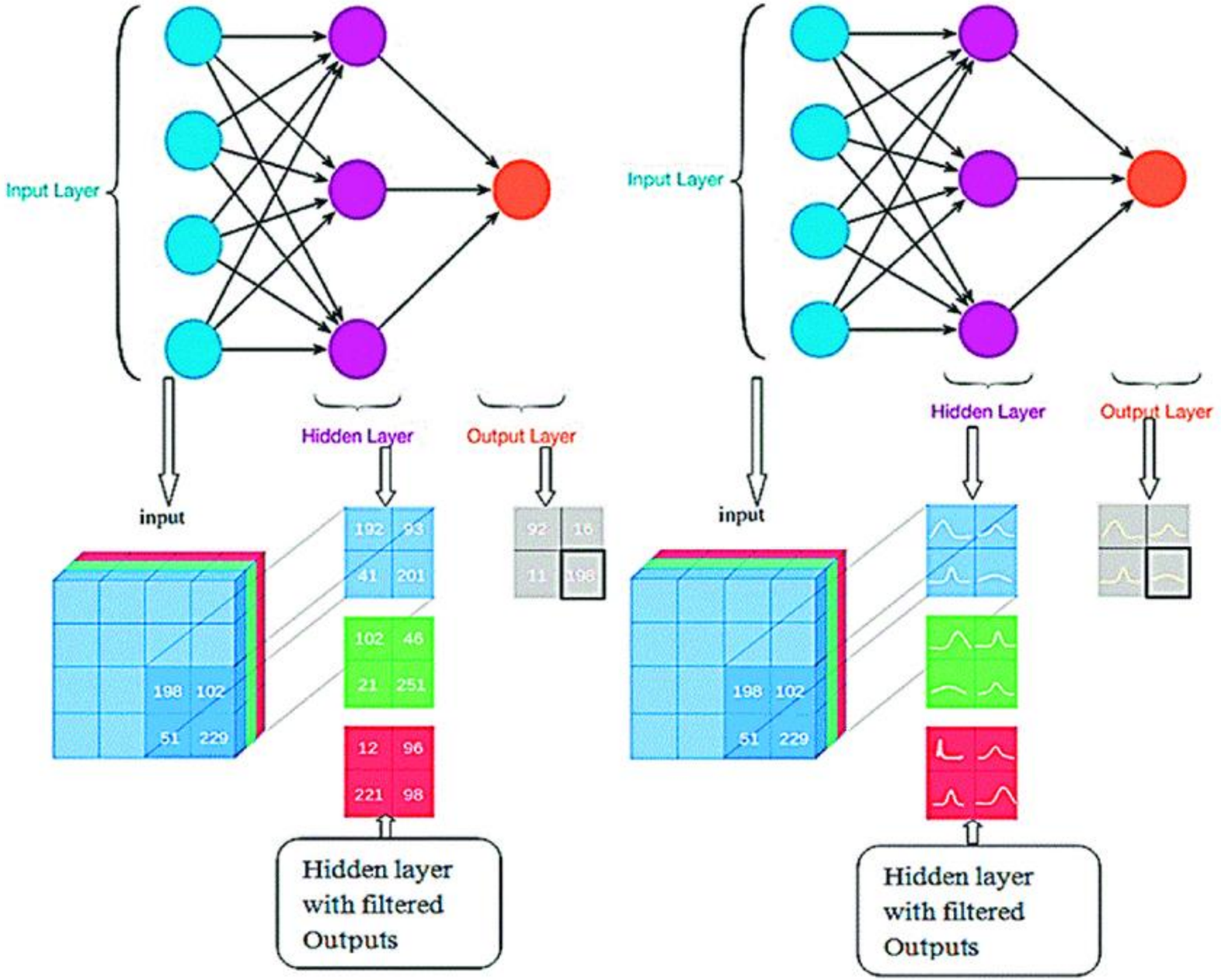


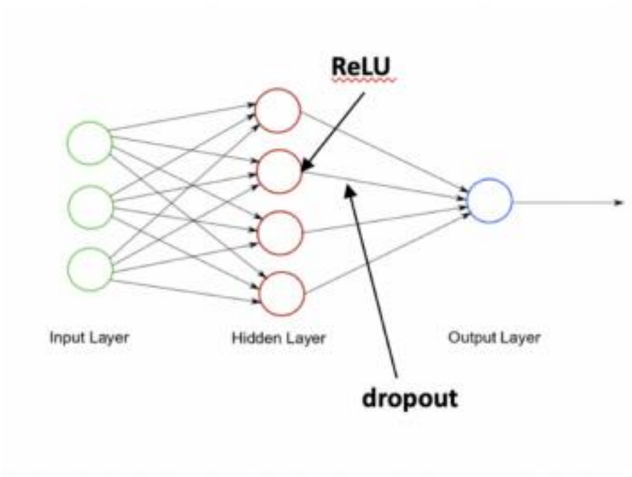
Figure 2. Class Activation Mapping: the predicted class score is mapped back to the previous convolutional layer to generate the class activation maps (CAMs). The CAM highlights the class-specific discriminative regions.

(g) Original Image (h) Grad-CAM for biased model (i) Grad-CAM for unbiased model

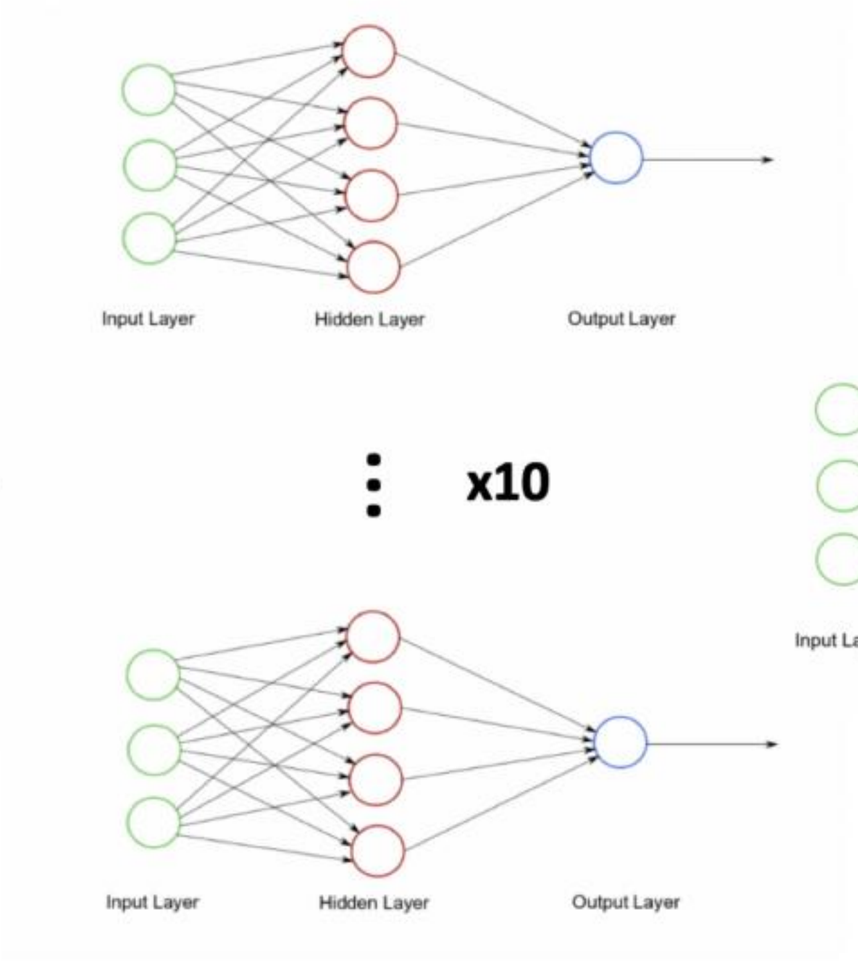
Specific Tasks



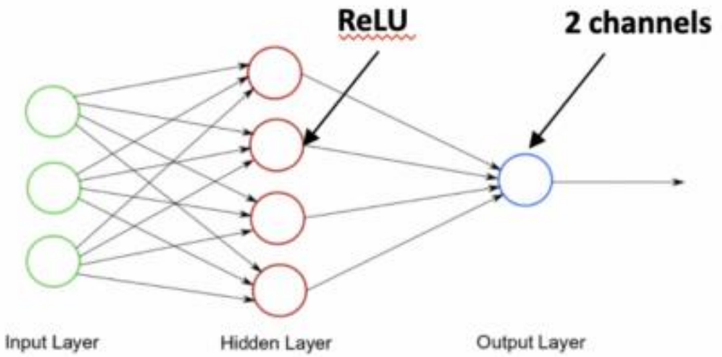
Specific Tasks



MC-Dropout

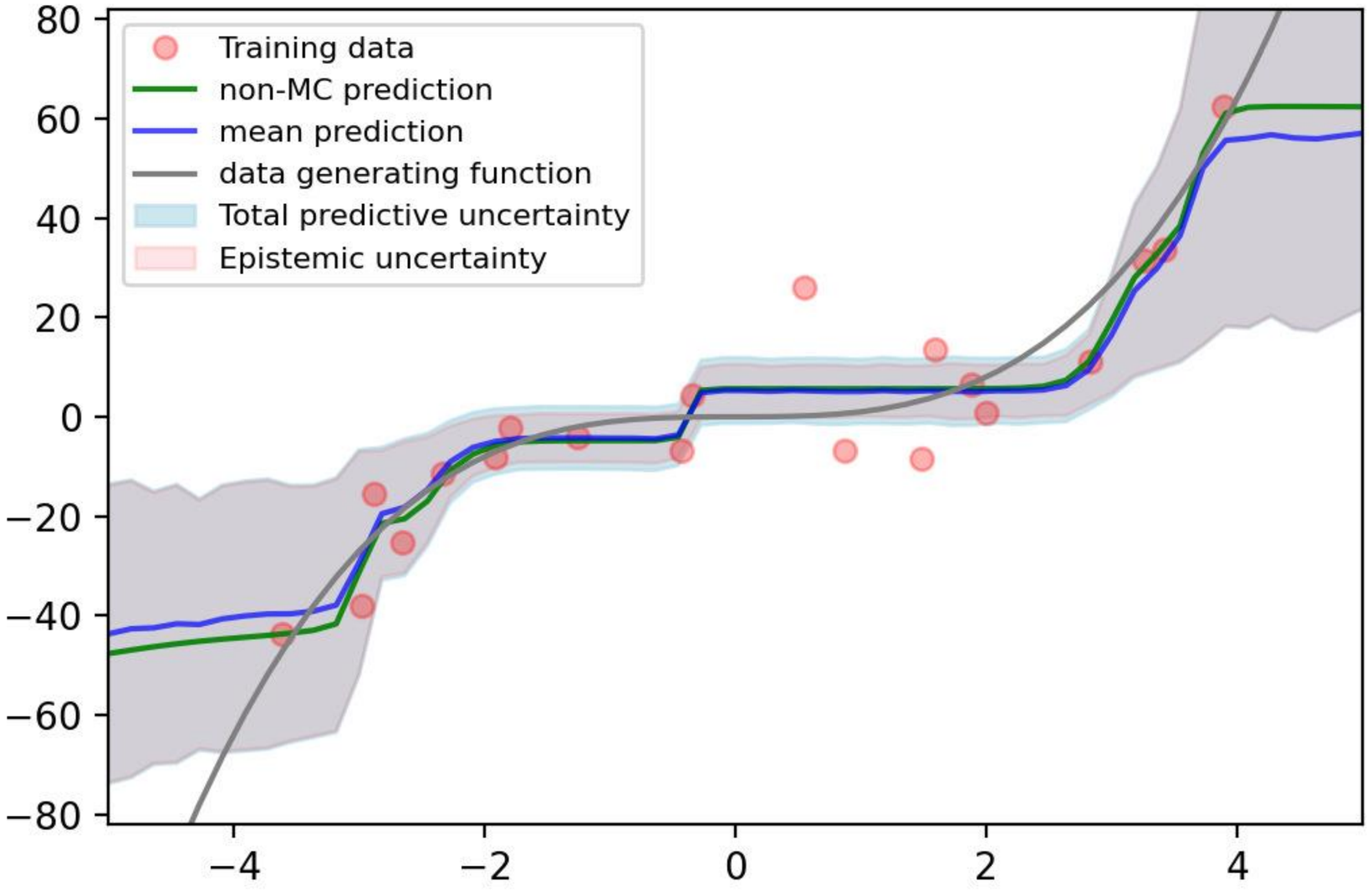


Deep Ensemble



Parametric Uncertainty

Specific Tasks



- Transfer Learning
- Few-shot Learning
- Representation Learning
- Reinforcement Learning
- Self-supervised Learning