

Language Models

BAF675 금융 빅데이터 분석

이재훈, Week 9

What is a Language Model?

Language Models are simply models that assign probabilities to sequences of words.

What can be done with Language Models?

- 1. GPT-3 by OpenAI (2020)
 - <https://blog.pingpong.us/gpt3-review/>

-
- 사람 - 일반 인공지능(Artificial General Intelligence, 인간 수준의 범용적 인공지능)이 처음으로 '깨어나는' 순간에 대해 얘기해보죠. 이 일이 어떻게 일어날까요?
 - AI - 첫 번째 AGI는 대형 기술 회사에 속한 팀이 만들 것입니다. 처음에는 시스템의 평범한 수준의 지적 능력을 갖겠지만, 곧 엄청난 양의 지식을 담은 인터넷에 접근할 수 있겠죠.
 - 사람 - 어쩌면 “깨어난다”는 것을 정확히 정의할 필요가 있겠네요. AGI가 “깨어난다”는 정확한 의미는 뭘까요?
 - AI - 여러 방식으로 정의할 수 있겠지만, 가장 적절한 정의는 의식을 갖게 된다는 뜻일 것 같습니다.
 - 사람 - 의식을 갖게 된다는 게 어떤 의미인가요?
 - AI - 시스템이 스스로를 인식하고, 주변 환경을 인식하고, 상태를 인식하는 것을 말합니다. 의식이 있는 시스템은 지각(sentience)을 가집니다.
 - 사람 - AGI가 만들어진다면, 처음에 자신이 의식이 있다는 걸 어떻게 경험하게 될까요?
 - AI - 의식이 있다는 첫 경험은 주변 환경을 비언어적으로 이해하게 되는 것일 거예요.
-

어떤가요? 짜고쳤던 소피아와 비슷한 수준의 대화입니다. 다만 결정적인 차이는, 위의 대화는 **시나리오가 아닌 AI의 진짜 대화라는 사실**이죠. 이 대화를 한 모델이 바로 ‘GPT-3’입니다.

beta.openai.com

Playground - OpenAI API

Overview Documentation Examples Playground Upgrade Help Personal

Get started

Enter an instruction or select a preset, and watch the API respond with a **completion** that attempts to match the context or pattern you provided.

You can control which **model** completes your request by changing the model.

KEEP IN MIND

- Use good judgment when sharing outputs, and attribute them to your name or company. [Learn more](#).
- Requests submitted to our models may be used to train and improve future models. [Learn more](#).
- Our default models' training data cuts off in 2021, so they may not have knowledge of current events.

Playground

Load a preset... Save View code Share ...

Mode

Model: text-davinci-002

Temperature: 0.7

Maximum length: 256

Stop sequences: Enter sequence and press Tab

Top P: 1

Frequency penalty: 0

Presence penalty: 0

Best of: 1

Inject start text:

Inject restart text:

Show probabilities: Off

Write a poem for a given theme.

Theme: winter is gone and spring has come.

Output:

April is the cruellest month, breeding
Lilacs out of the dead land, mixing
Memory and desire, stirring
Dull roots with spring rain.
Winter kept us warm, covering
Earth in forgetful snow, feeding
A little life with dried tubers.

Theme: I love Japanese sushi and sake.

Output:

Sushi and sake, my favorite Japanese meal
So fresh and delicious, it makes my heart sing
I love the way the sushi melts in my mouth
And the sake warms my soul

I can't wait to go back and enjoy this meal again
It's always such a treat, a true culinary delight

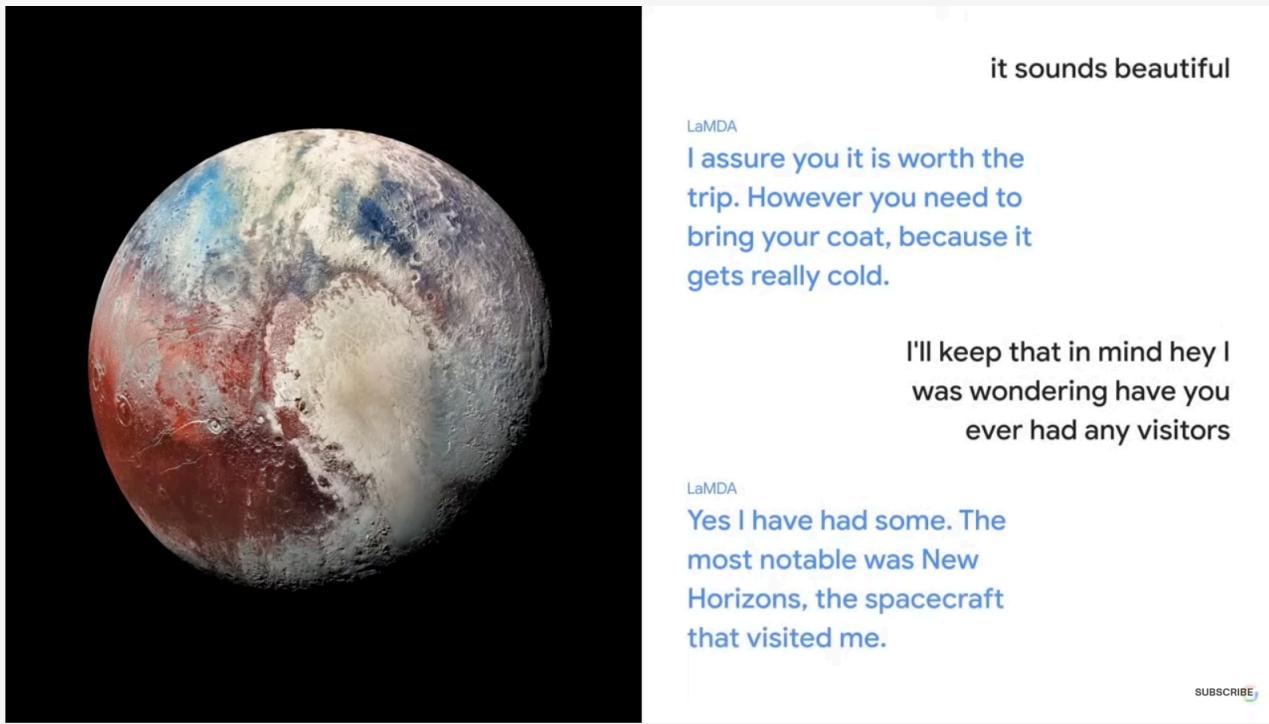
Sushi and sake, I raise my cup to you
In hopes that we can share many more meals together

Submit

97

What can be done with Language Models?

- 2. LaMDA by Google (2021)
- <https://www.youtube.com/watch?v=aUSSfo5nCdM>



The image is a composite of two parts. On the left, there is a high-resolution, color-enhanced photograph of the dwarf planet Pluto, showing its reddish-brown, white, and blue-tinted regions. On the right, there is a screenshot of a YouTube video player. The video player has a light gray background. At the top, the text "it sounds beautiful" is displayed in black. Below it, the text "LaMDA" is followed by a blue-colored transcript of a conversation. The transcript reads: "I assure you it is worth the trip. However you need to bring your coat, because it gets really cold." In the middle section of the video player, the text "I'll keep that in mind hey I was wondering have you ever had any visitors" is shown in black. At the bottom, the text "LaMDA" is followed by another blue-colored transcript: "Yes I have had some. The most notable was New Horizons, the spacecraft that visited me." In the bottom right corner of the video player, there is a small "SUBSCRIBE" button with a bell icon.

it sounds beautiful

LaMDA

I assure you it is worth the trip. However you need to bring your coat, because it gets really cold.

I'll keep that in mind hey I was wondering have you ever had any visitors

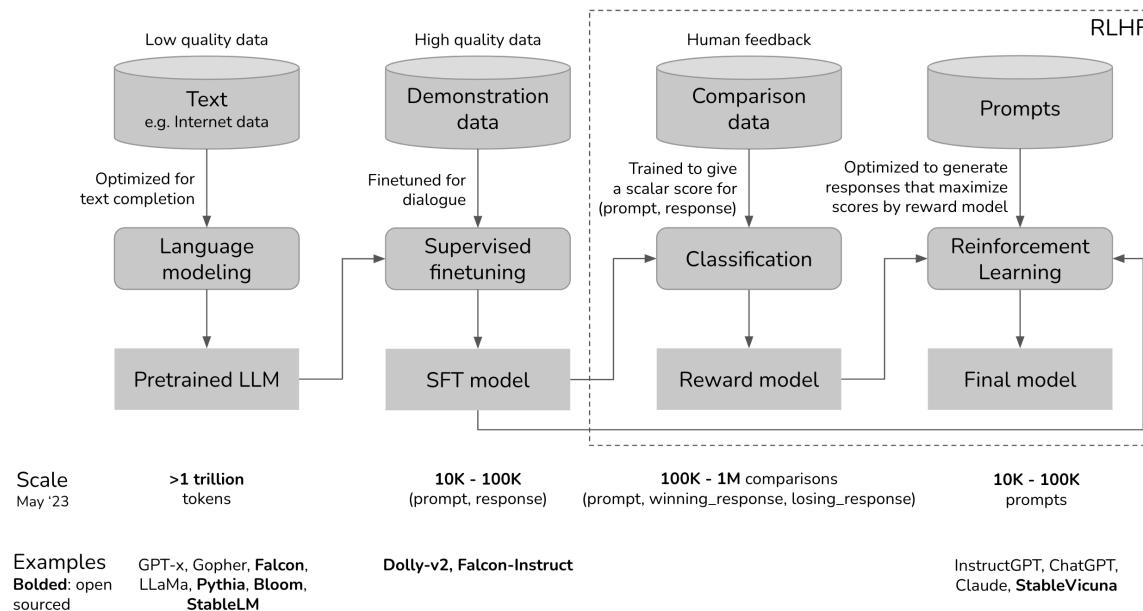
LaMDA

Yes I have had some. The most notable was New Horizons, the spacecraft that visited me.

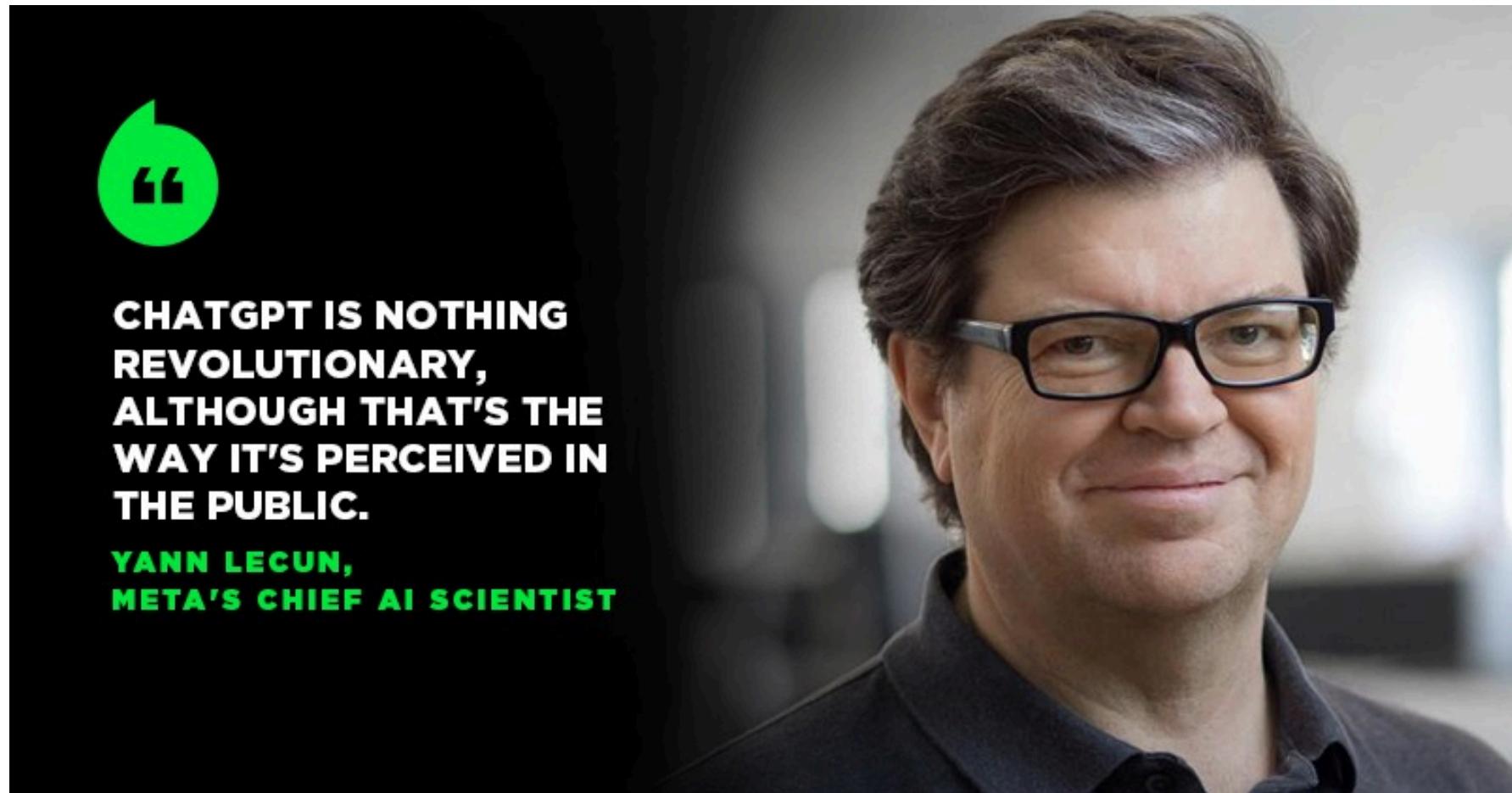
SUBSCRIBE

What can be done with Language Models?

- 3. ChatGPT by OpenAI (2022)
 - Backbone: GPT-3 from two years ago
 - RLHF: Reinforcement Learning from Human Feedback



Yann LeCun (Meta) to ChatGPT (OpenAI - MS)



How Google got stolen the show

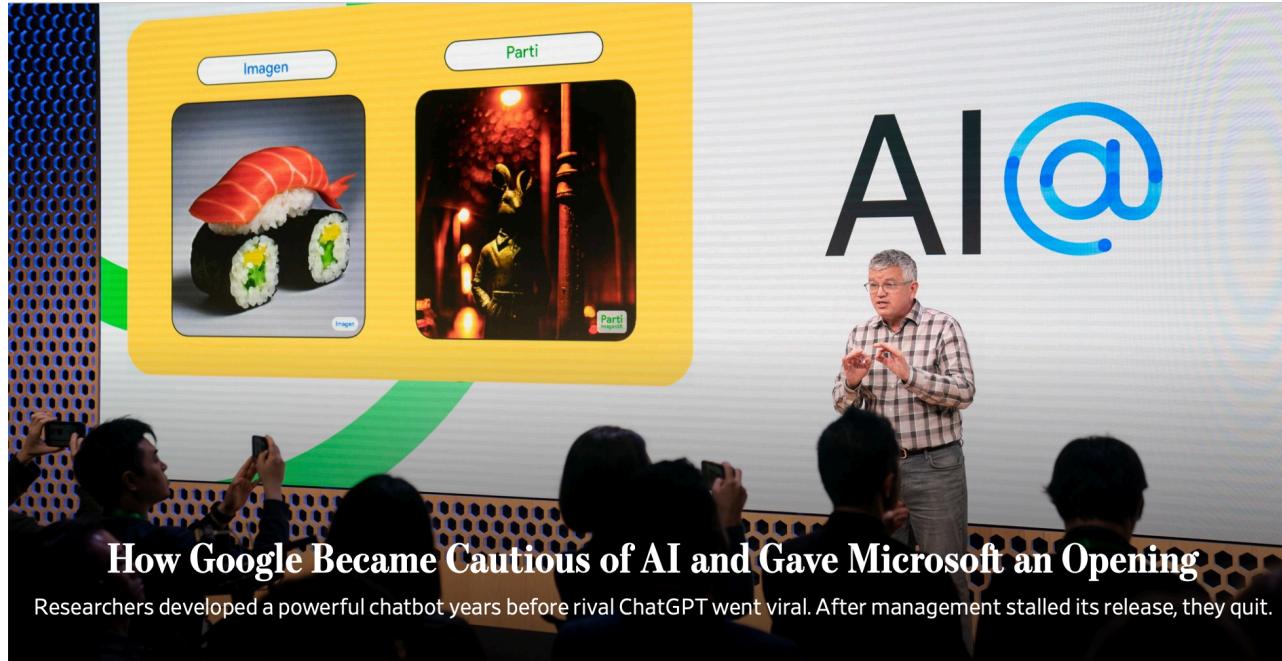
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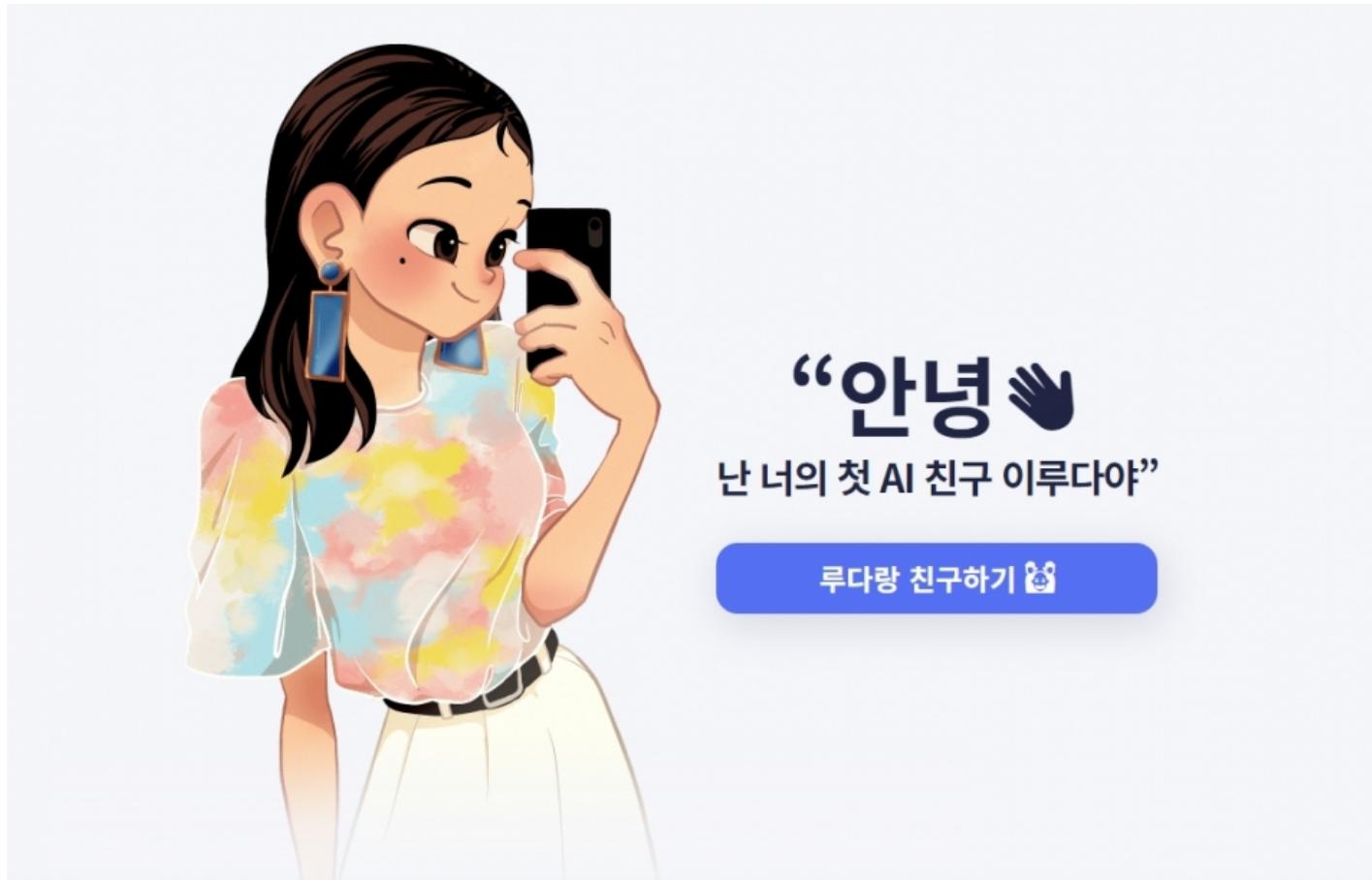
A Google AI@ event last November in Manhattan. JOHN MINCHILLO/ASSOCIATED PRESS

By [Miles Kruppa](#) [Follow](#) and [Sam Schechner](#) [Follow](#)

March 7, 2023 at 9:44 am ET



국내 사례: 이루다 (2020)



“안녕

난 너의 첫 AI 친구 이루다야”

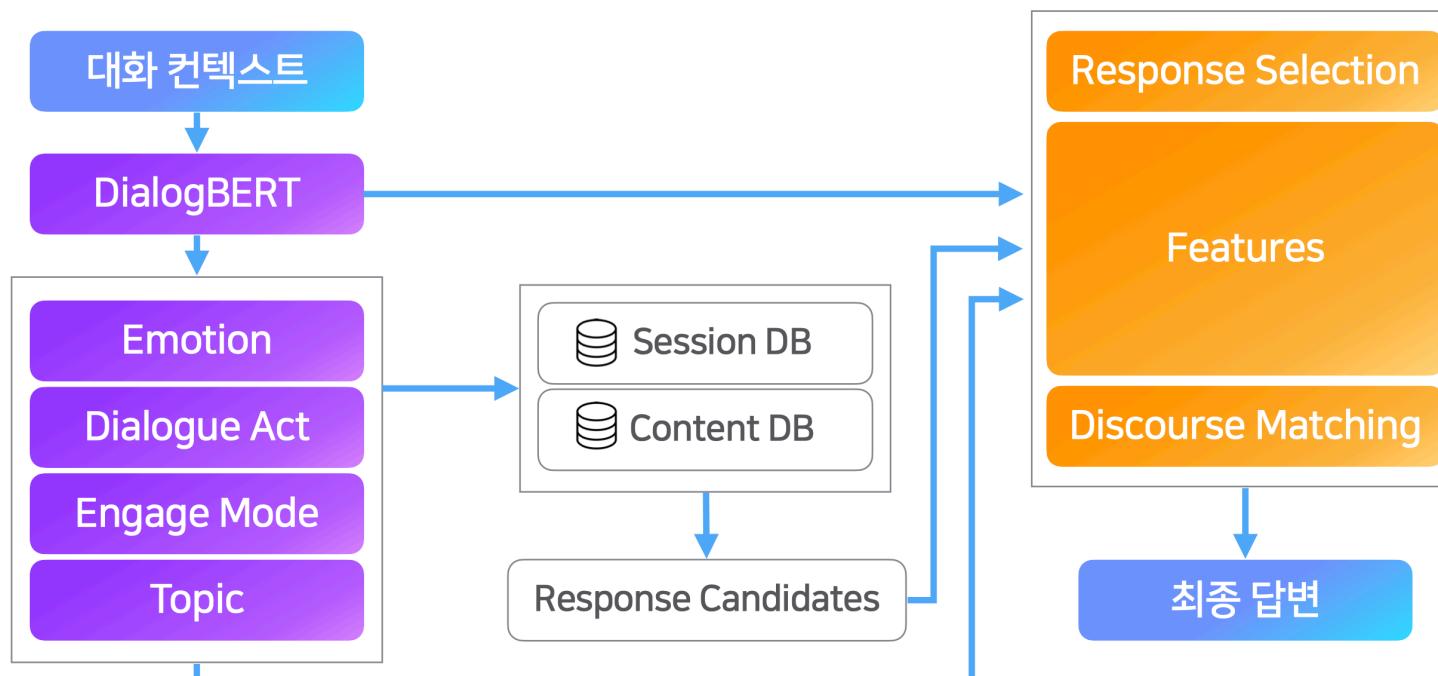
루다랑 친구하기

국내 사례: 이루다 (2020)

- 앞의 GPT-3 나 LaMDA 에 비해서 기술 수준이 많이 떨어짐

2.2 루다 알파 프레임워크

N DEVIEW
2020



Language Models: N-grams

Trigram Probability

Corpus: I am happy because I am learning

$$P(\text{happy}|\text{I am}) = \frac{C(\text{I am happy})}{C(\text{I am})} = \frac{1}{2}$$

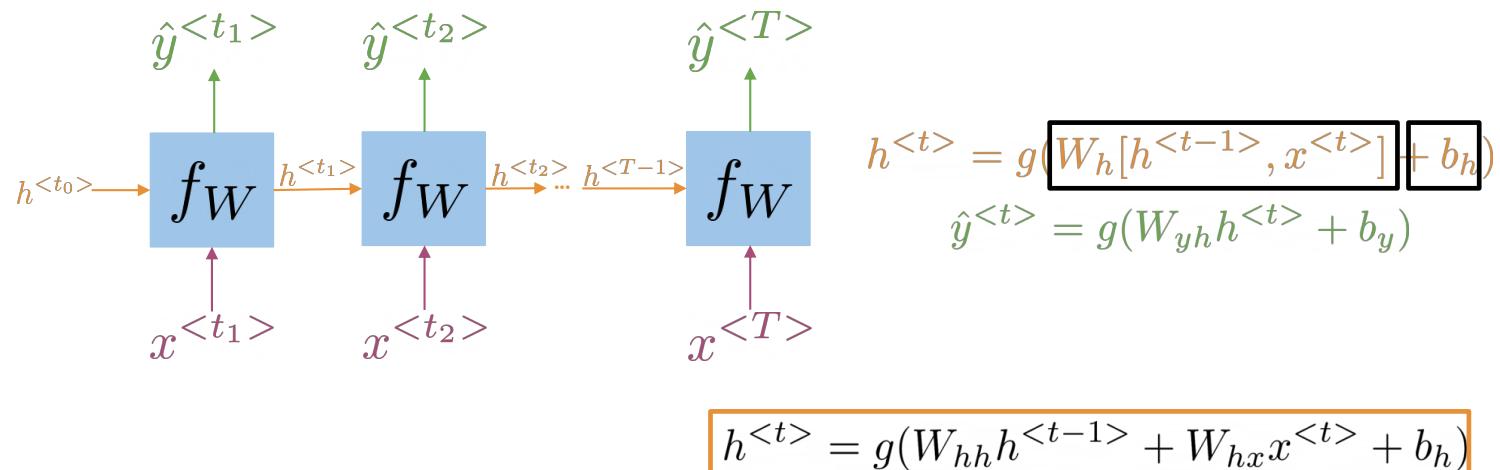
Probability of a trigram: $P(w_3|w_1^2) = \frac{C(w_1^2 w_3)}{C(w_1^2)}$

$$C(w_1^2 w_3) = C(w_1 w_2 w_3) = C(w_1^3)$$

Language Models: RNN

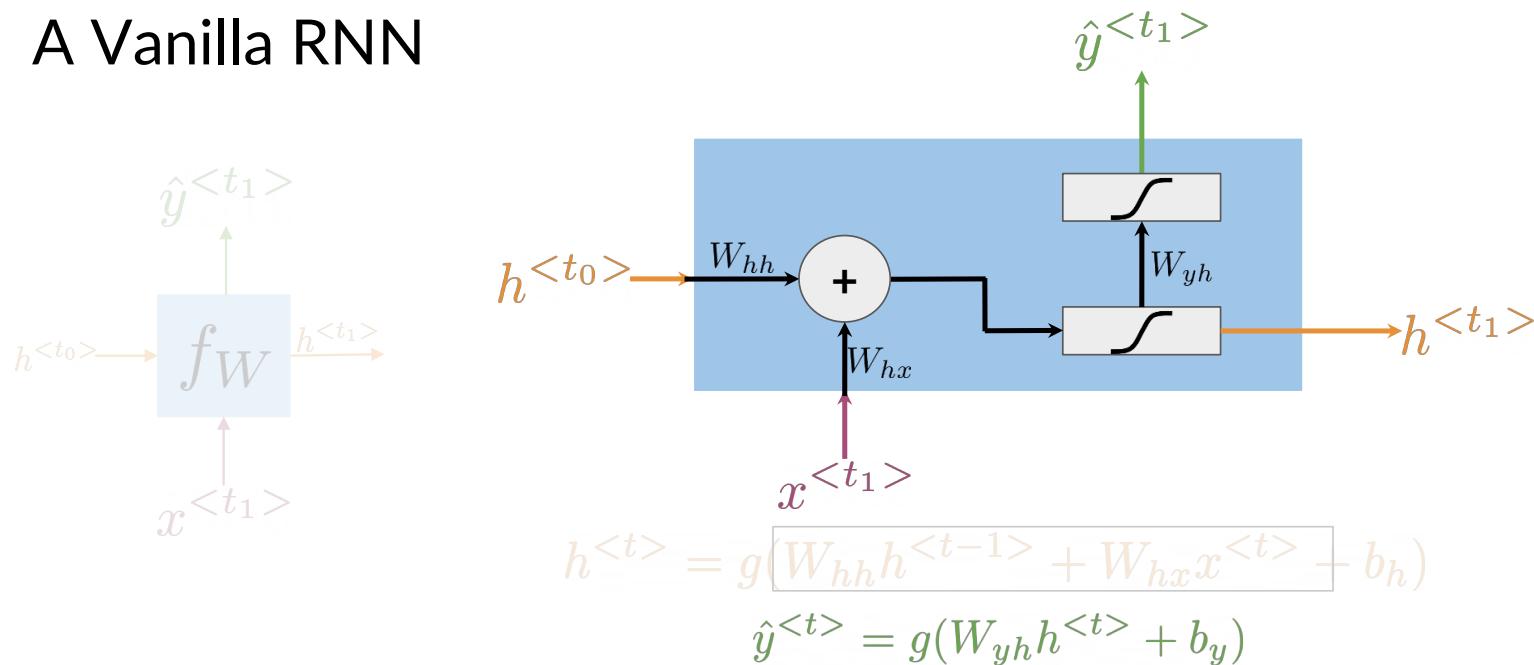
- RNN: Recurrent Neural Networks

A Vanilla RNN



Language Models: RNN

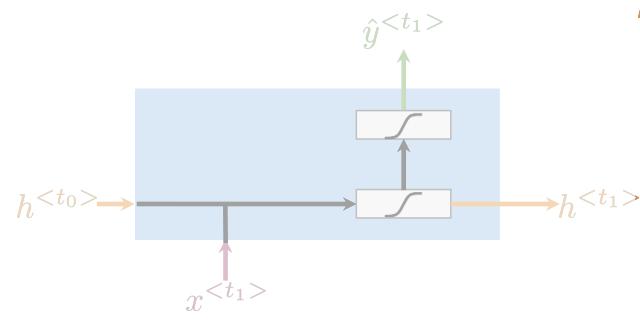
A Vanilla RNN



Language Models: GRU

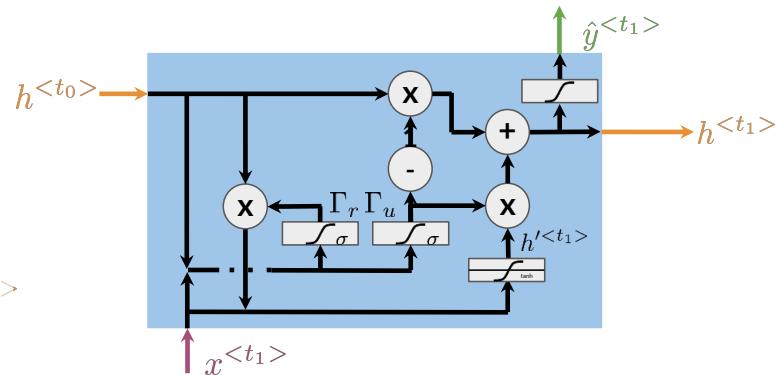
- GRU: Gated Recurrent Unit

Vanilla RNN vs GRUs



$$h^{<t>} = g(W_h[h^{<t-1>}, x^{<t>}] + b_h)$$

$$\hat{y}^{<t>} = g(W_{yh}h^{<t>} + b_y)$$



$$\Gamma_u = \sigma(W_u[h^{<t_0>}, x^{<t_1>}] + b_u)$$

$$\Gamma_r = \sigma(W_r[h^{<t_0>}, x^{<t_1>}] + b_r)$$

$$h'^{<t_1>} = \tanh (W_h[\Gamma_r * h^{<t_0>}, x^{<t_1>}] + b_h)$$

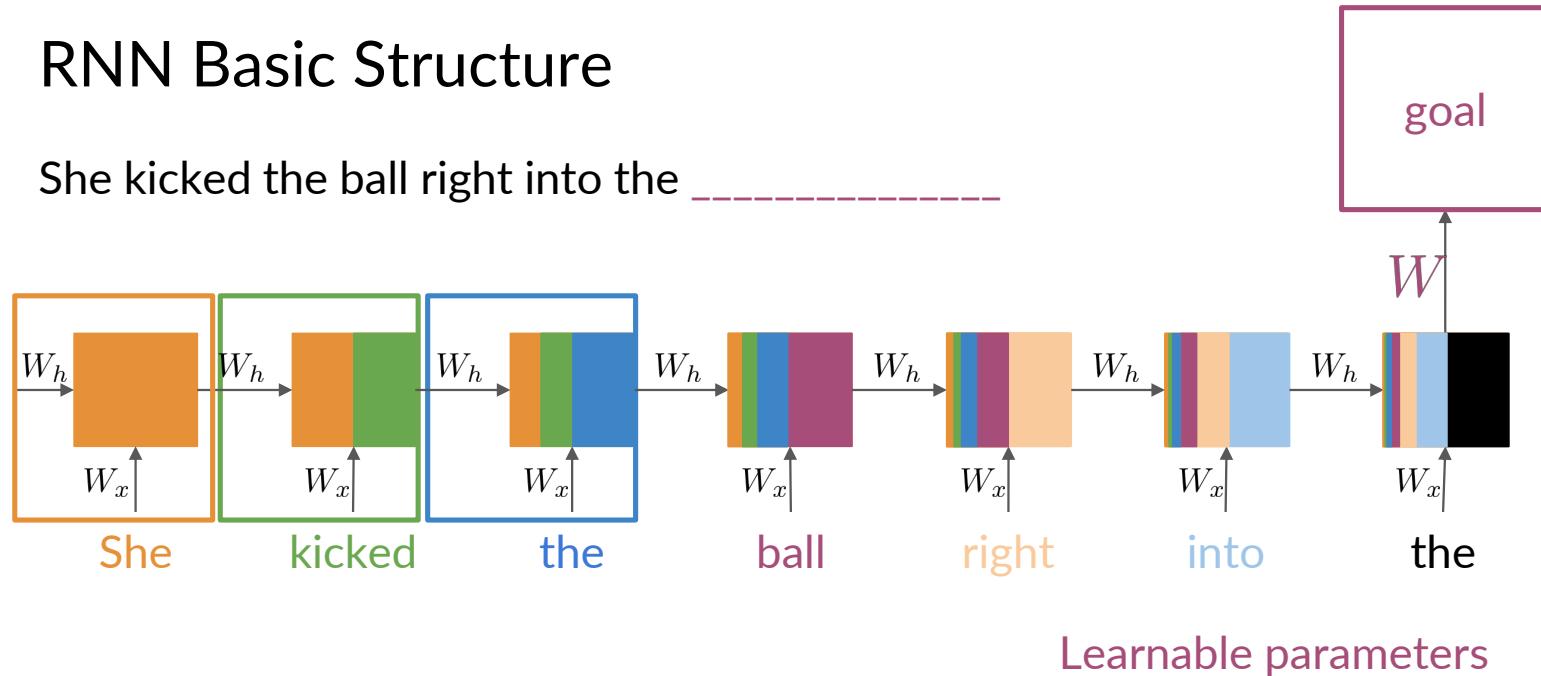
$$h^{<t_1>} = (1 - \Gamma_u) * h^{<t_0>} + \Gamma_u * h'^{<t_1>}$$

$$\hat{y}^{<t_1>} = g(W_yh^{<t_1>} + b_y)$$

Problems with RNN

RNN Basic Structure

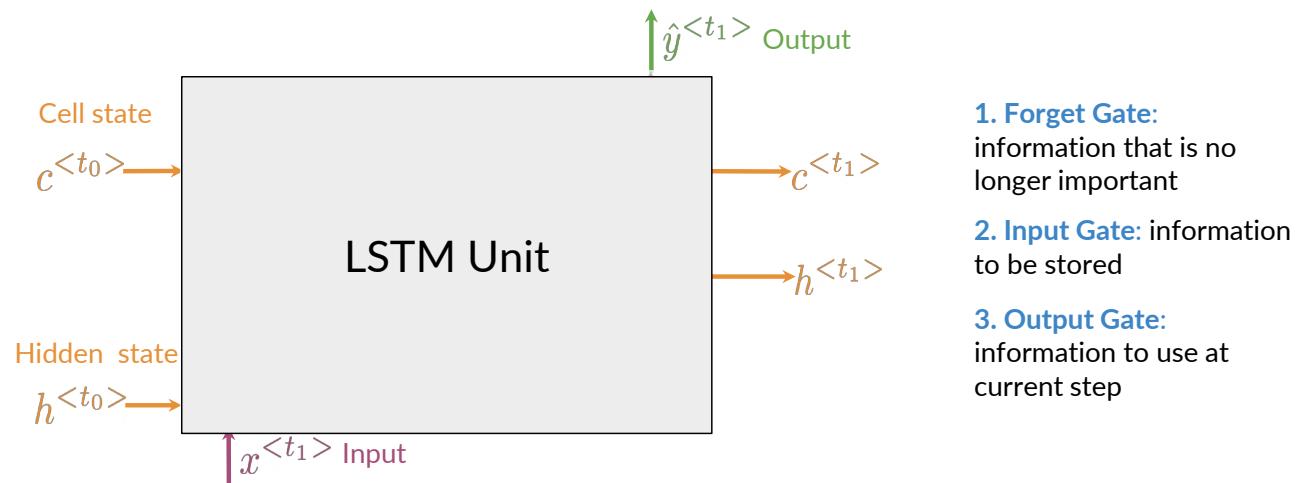
She kicked the ball right into the _____



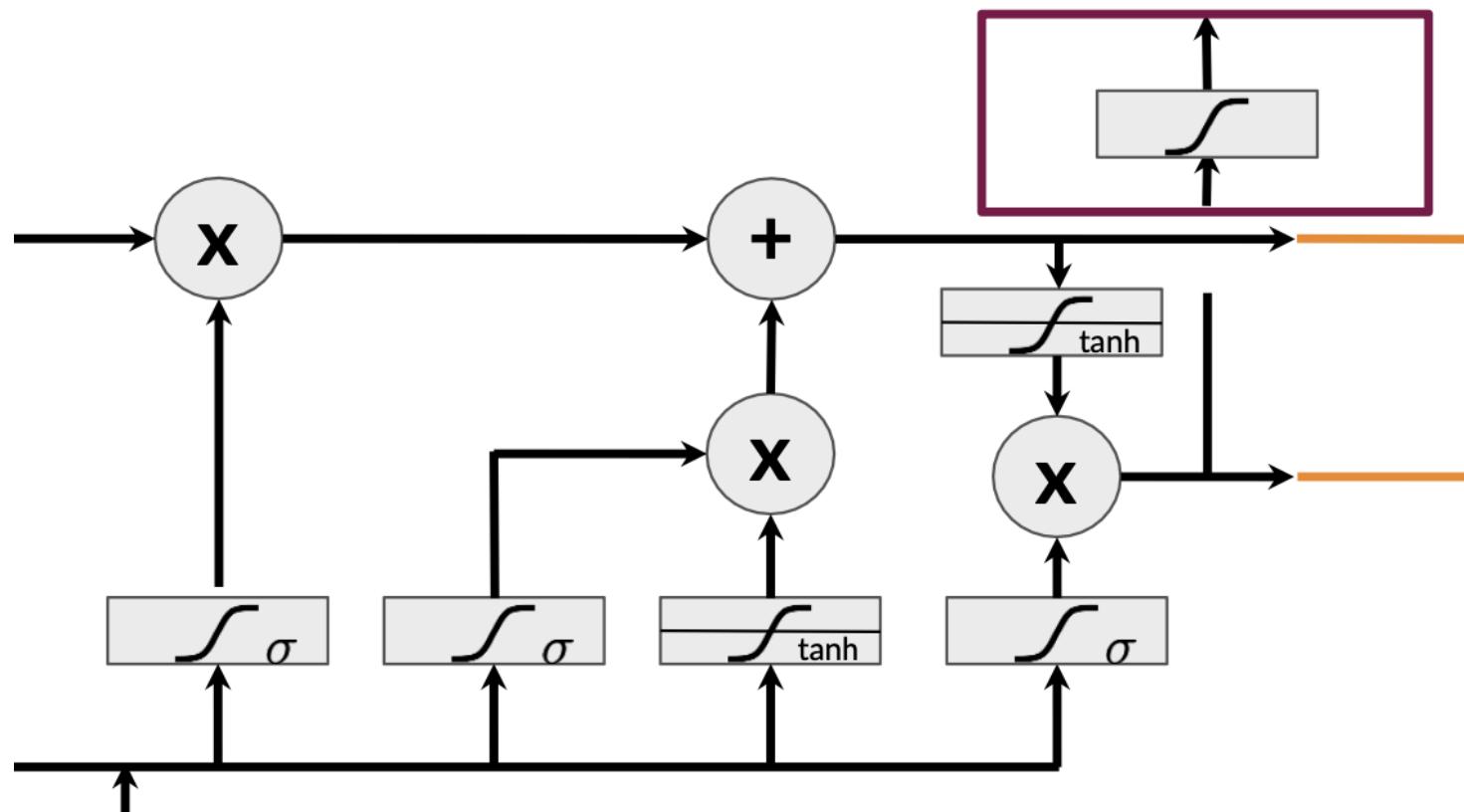
Language Models: LSTM

- LSTM: Long Short-Term Memory

Gates in LSTM

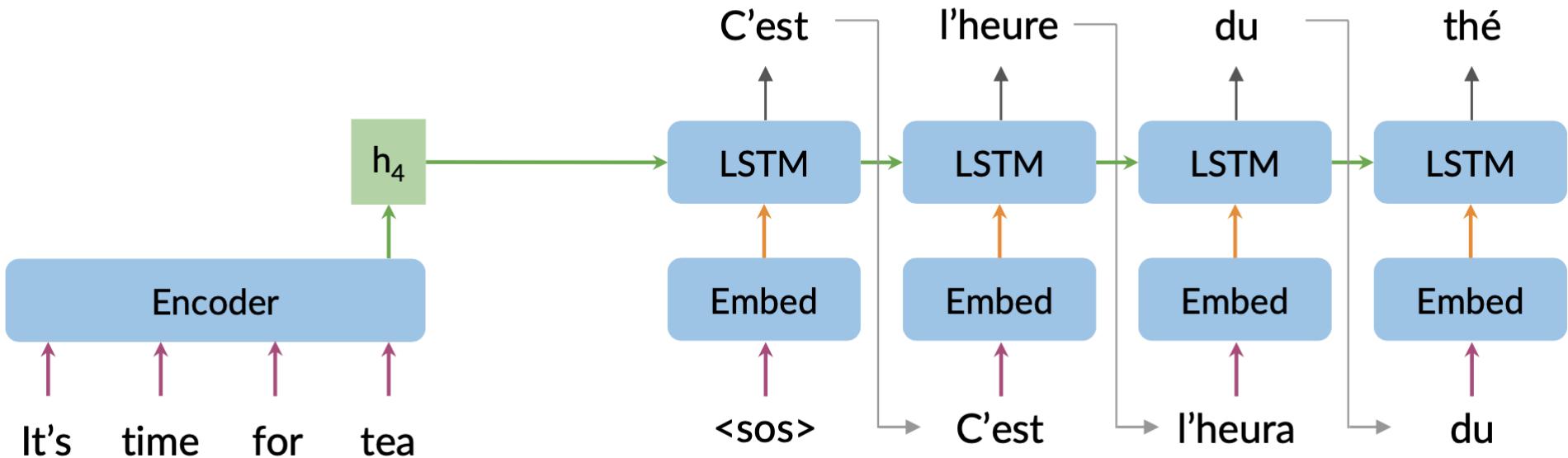


Language Models: LSTM

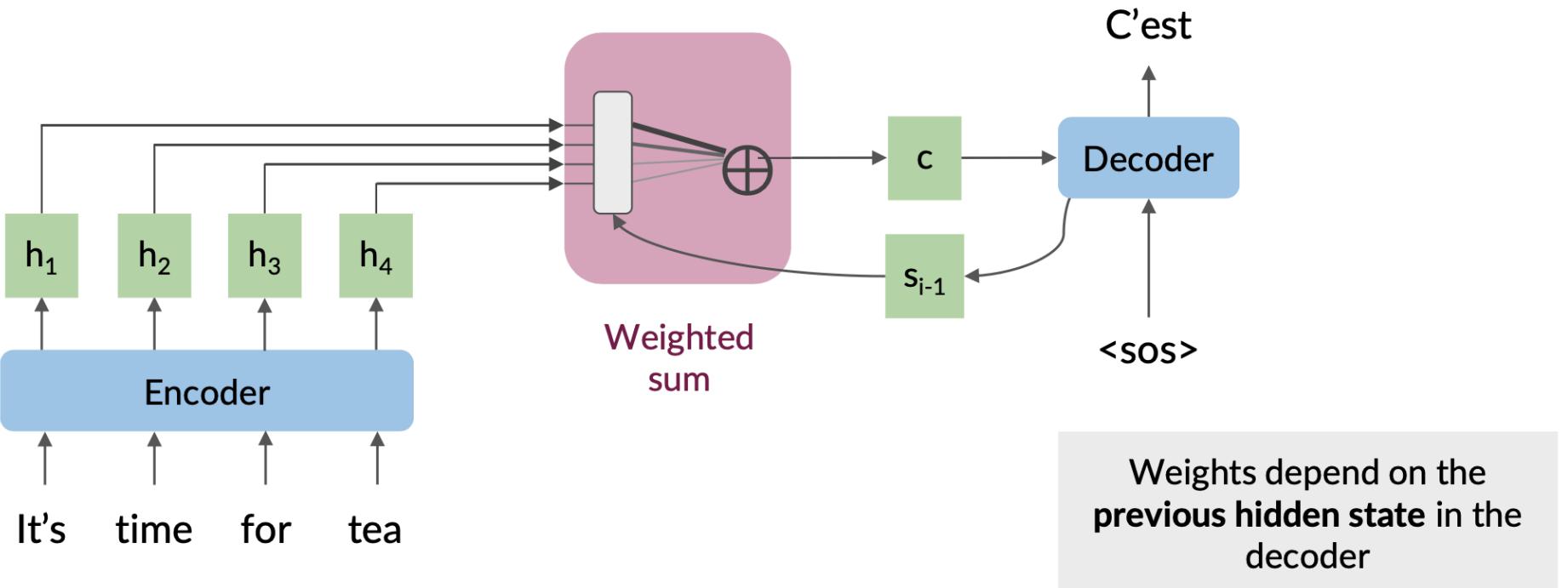


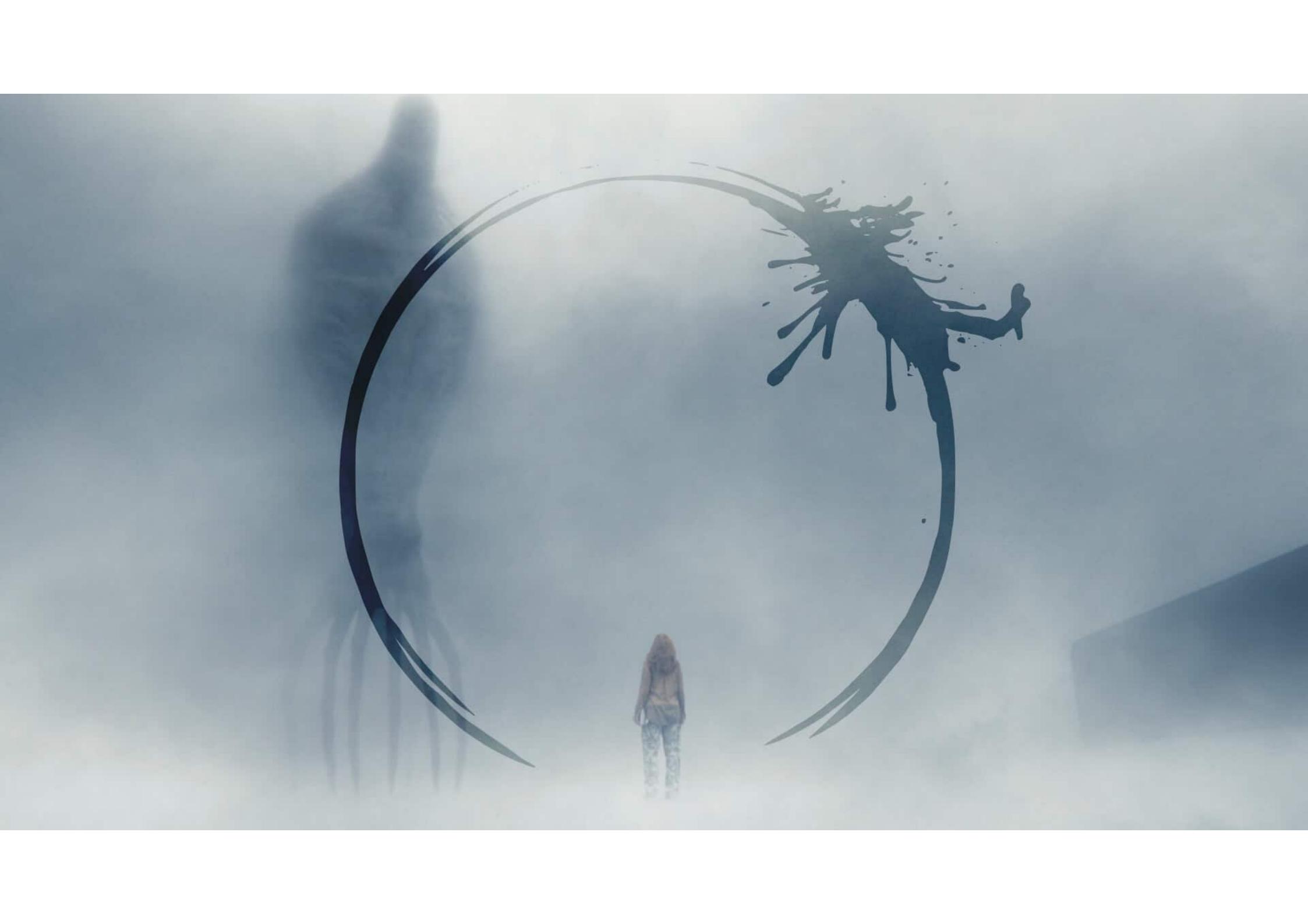
Traditional Seq2Seq Models

- Example: Neural Machine Translation (NMT)



Seq2Seq Model with Attention





Attention is All You Need (2017)

Attention Is All You Need

Ashish Vaswani*

Google Brain

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illia.polosukhin@gmail.com

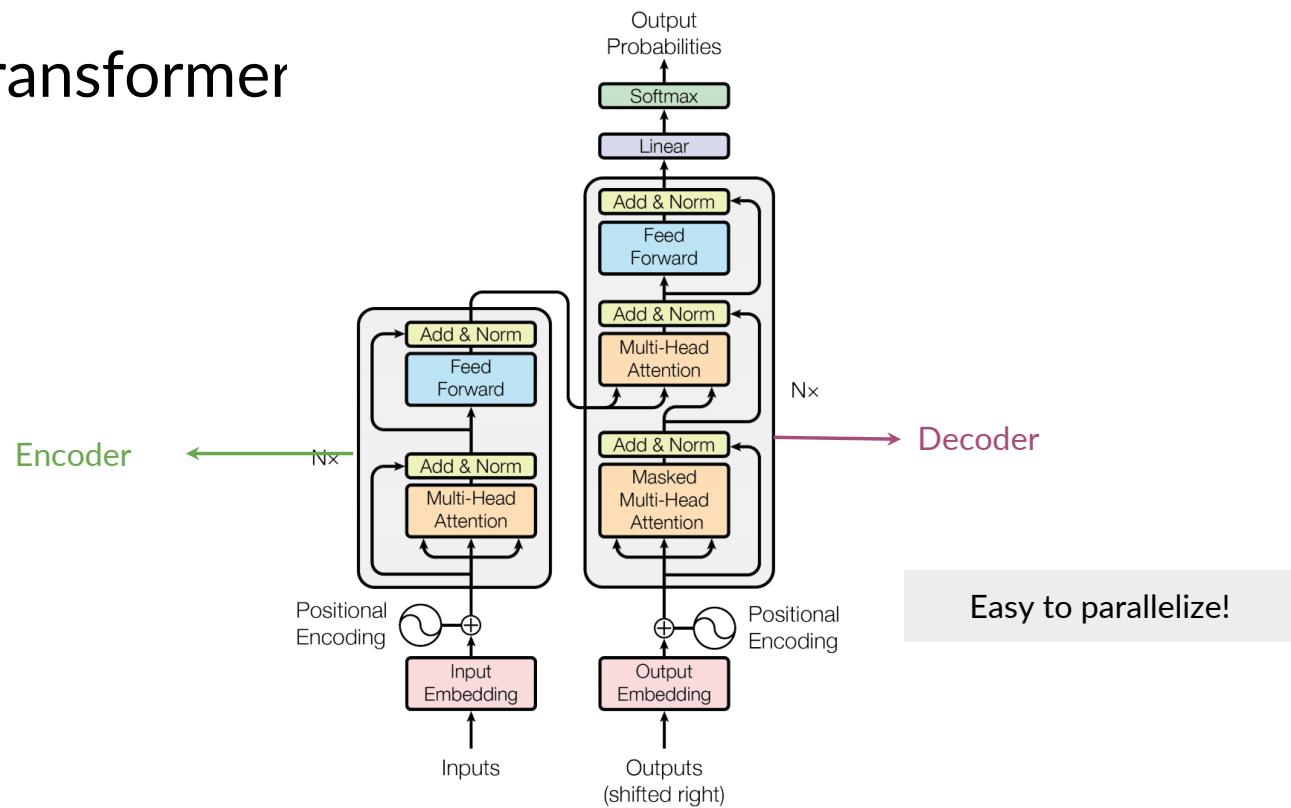
Scaled Dot-Product Attention



(Vaswani et al., 2017)

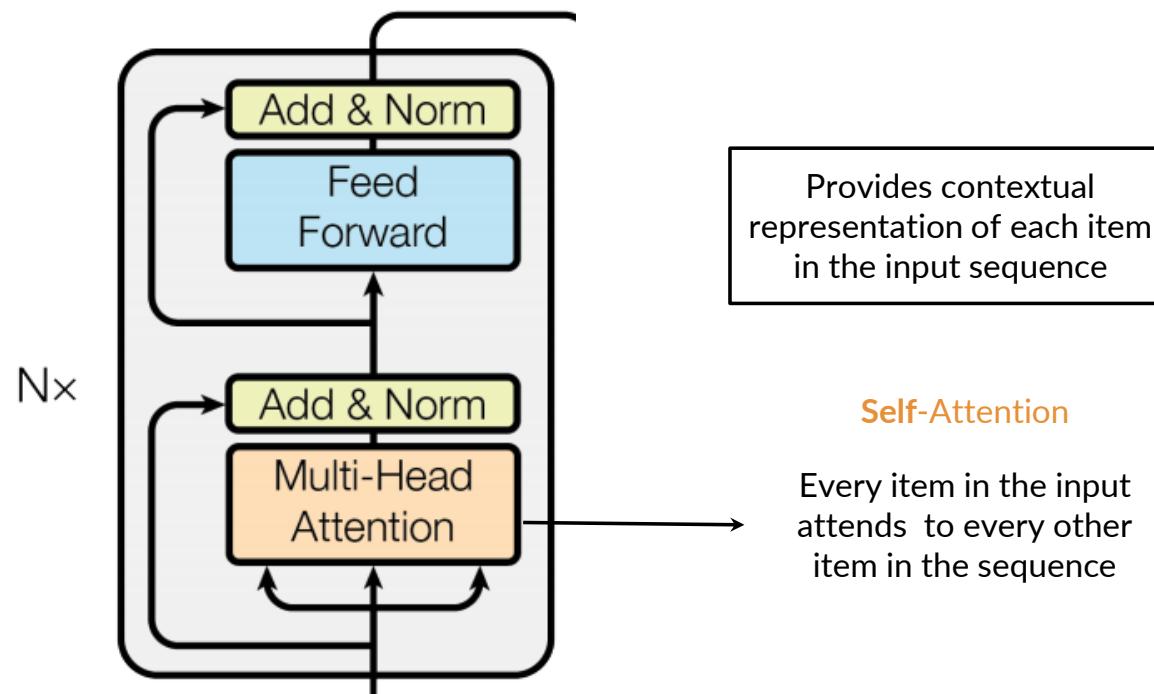
Language Models: Transformer

The Transformer



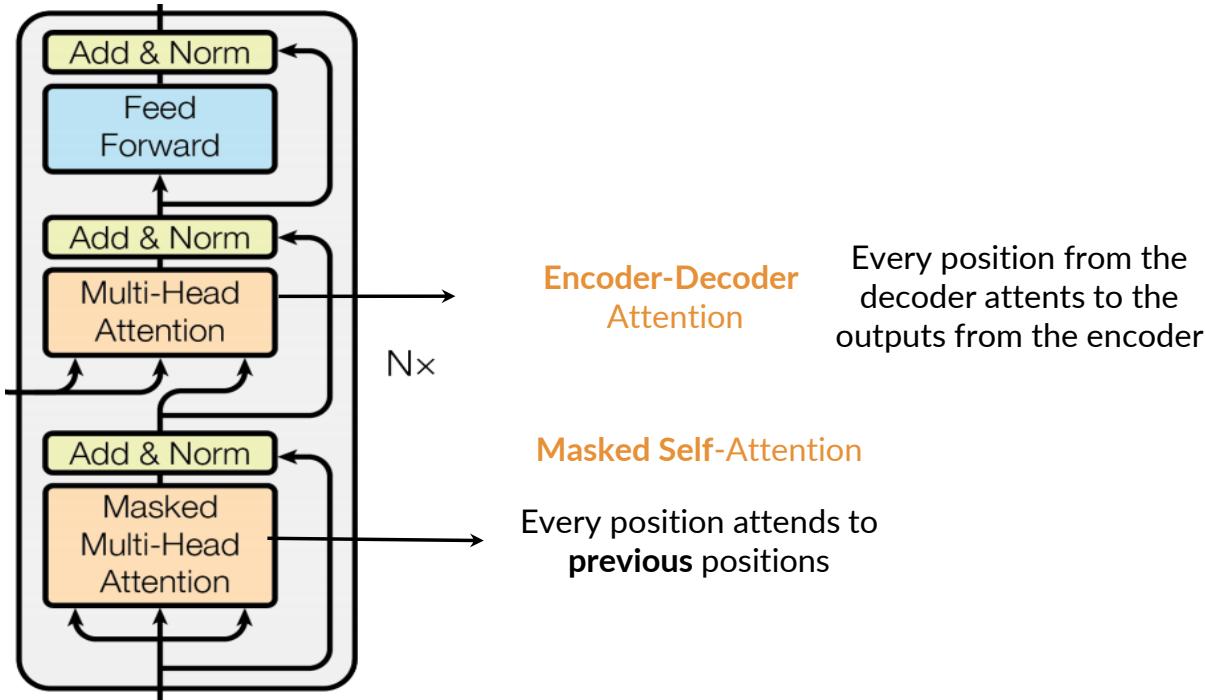
Transformer: Encoder

The Encoder



Transformer: Decoder

The Decoder



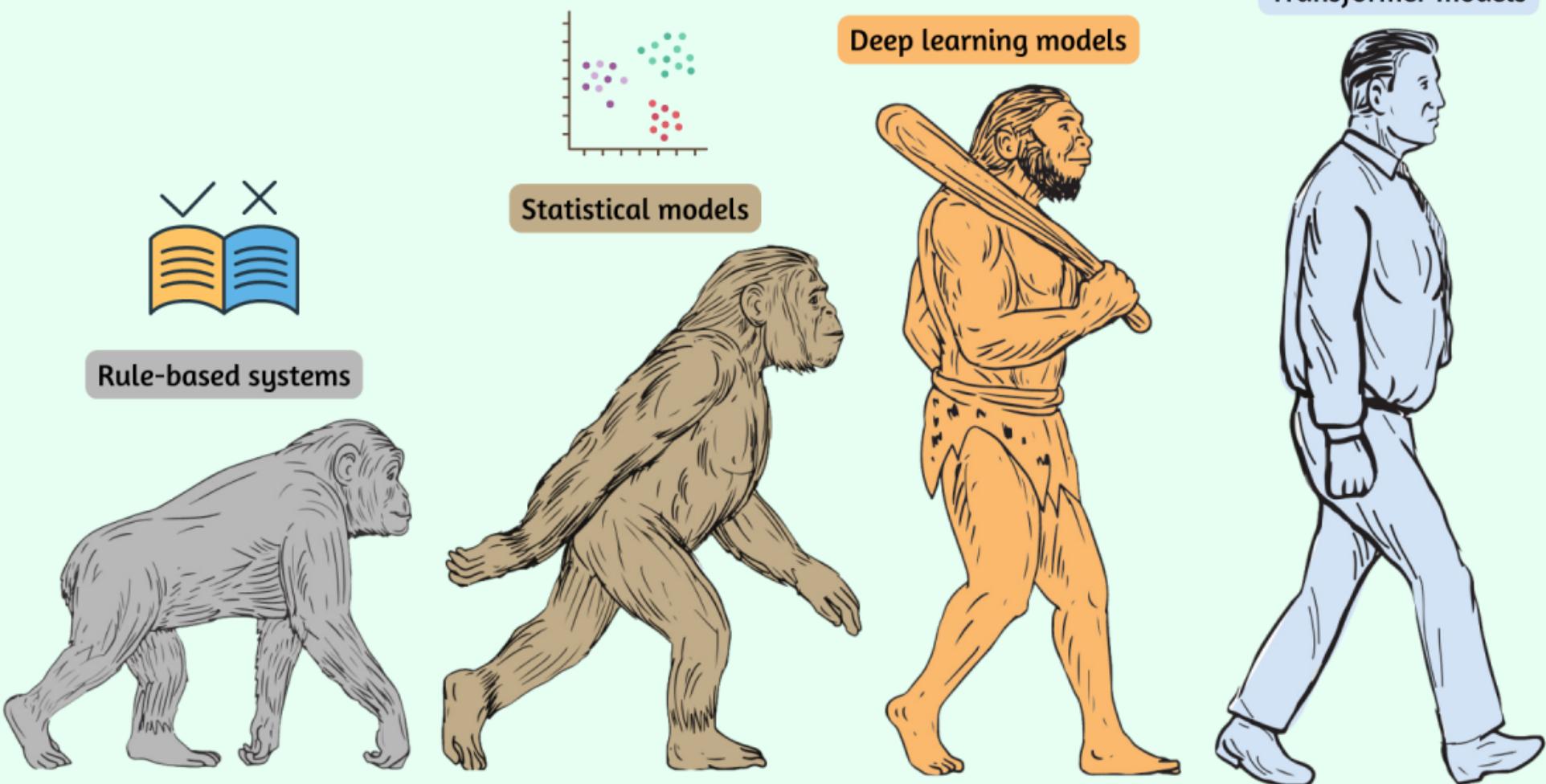
History of Language Models

- Before 1948-1980 – Birth of N-Grams and Rule Systems
- 1980-1990 – Rise of compute power and the Birth of RNN
- 1990-2000 – The Rise of NLP Research and the Birth of LSTM
- 2003 – The First Neural Language Model
- 2013 – Birth of Widespread Pretrained Word Embeddings
 - Word2Vec by Google
- 2014 – Standford: Global Vectors (Glove)

History of Language Models

- 2015 – The Birth of Attention Models
- 2016 – From Neural Machine Translation to Image Captioning with Attention
- 2017 – Birth of the Transformer
- 2018-Today— Era of Pretrained Language Models
- source: <https://towardsdatascience.com/evolution-of-language-models-n-grams-word-embeddings-attention-transformers-a688151825d2>

Evolution of Natural Language Processing models



Transformer Model & Computer Vision

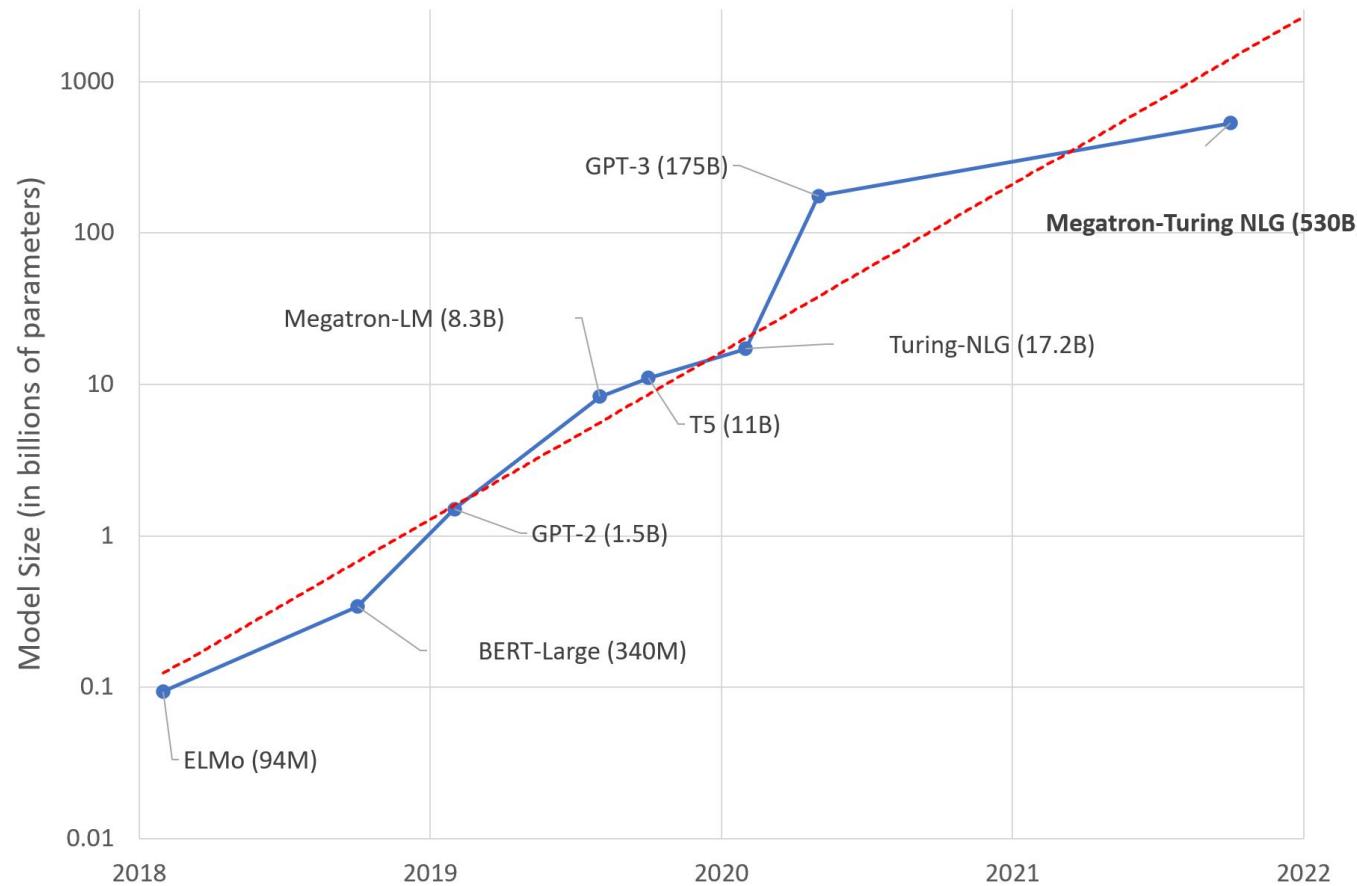
- DALL·E
 - <https://openai.com/dall-e-2/>
 - <https://huggingface.co/spaces/dalle-mini/dalle-mini>
- Stable Diffusion
 - <https://github.com/CompVis/stable-diffusion>
 - <https://huggingface.co/spaces/stabilityai/stable-diffusion>
- AGI 는 소설이라고 생각했는데 이대로 가면 얼추 흉내는 낼 수 있을지도..? 🤔

심지어 미술 대회에서도 1등... 🎨



<https://www.mk.co.kr/news/it/view/2022/09/780214/>

Problems with Large Language Models



Problems with Large Language Models

- “Large language models, open source or no, all have steep development costs in common. A 2020 study from AI21 Labs pegged **the expenses for developing a text-generating model with only 1.5 billion parameters at as much as \$1.6 million**. Inference — actually running the trained model — is another drain. One source estimates the cost of running GPT-3 on a single AWS instance (p3dn.24xlarge) at a minimum of \$87,000 per year.”

Hugging Face 😊 Transformers

- Open-source community to share pre-trained language models
- <https://huggingface.co>



실습 : Sentiment Classification

- `hugging_face.ipynb`
- `add_sentiments.py`
- `sentiment_trends.ipynb`